



# **2015 World Archery Coaching Seminar**

***Fuengirola, Spain***

***30<sup>th</sup> September – 4<sup>th</sup> October 2015***

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**Physiotherapist Triathlon, Canoeing & Kayaking Spanish Federations**

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The background of the slide features a dark blue gradient. On the left side, there are several concentric white circles representing target rings. On the right side, there is a white silhouette of an archer in a full draw, holding a bow and arrow. The archer is positioned in the foreground, with the target rings visible behind them.

- Initial considerations: physical training in archery
  - The importance of the physical training
  - Archer's differentiating physical abilities
  - Methods to develop physical abilities
- 
- Planning and design of the training
  - Technical training vs. physical training
  - Energy expense, supplementary exercise and hydration
  - Injuries provoked by the training and prevention

*Part 1*  
*Physical Training. Considerations, abilities and methods*

*Experiences*

*Kids & Improvements*



# Initial considerations: physical training in archery







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# Initial considerations: physical training in archery

Mujeres				
Sujeto	VO2 máx	Hr. máx.	% graso	% <u>musc</u>
1	38	183	21,8	40,2
2	39,5	181	34,3	31,6
3	46,2	191	24,4	40,6
4	36,36	193	23,6	39
5	35	187	28	35,2
6	43,4	193	29	35
<b>Media</b>	<b>39,7</b>	<b>188,0</b>	<b>26,9</b>	<b>36,9</b>

Hombres				
Sujeto	VO2 máx	Hr. máx.	% graso	% <u>musc</u>
1	50,91	190	17,8	43
2	40	170	15,1	45,3
3	54,9	187	18,2	41,1
4	45,9	185	17,45	44
5	53,9	189	13,7	45,9
6	52,5	182	13,6	48,4
<b>Media</b>	<b>49,7</b>	<b>183,8</b>	<b>16,0</b>	<b>44,6</b>

- Physiological values less significant
- Similar to other international archers
- Difficult to find homogeneity anthropometric

\*Source: National Team

Initial considerations: physical training in archery

*Transition from the club to elite:*

Football: 8-10 years old of training in clubs

Triathlon: 6-8 years old of training in clubs

Kayaking: 6-8 years old of training in clubs

Archery: 2–4 years old of training in clubs





# INITIAL CONSIDERATIONS PHYSICAL TRAINING IN ARCHERY



- Quick access to the performance despite scarce physical training.
- Girls carry out lower level of physical training but they have more probabilities to achieve high performance.
- Traditional idea: when practising precision sports it is not needed the development physical abilities.
- Limited research on the physical conditions required by the archers.
- Influence of the Physical work out on scores (?)



# INITIAL CONSIDERATIONS PHYSICAL TRAINING IN ARCHERY



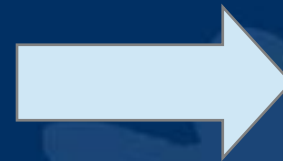
- Better promotion and easy access to the sport (clubs and technical assistance)
- Improvement of initiatives on techniques training
- Identification of archery with performance and enjoyment
- Involvement in the syllabus of Sports sciences
- Discrimination of archers' specific physical necessities and advanced planning for their performance.

# Initial considerations: physical training in archery

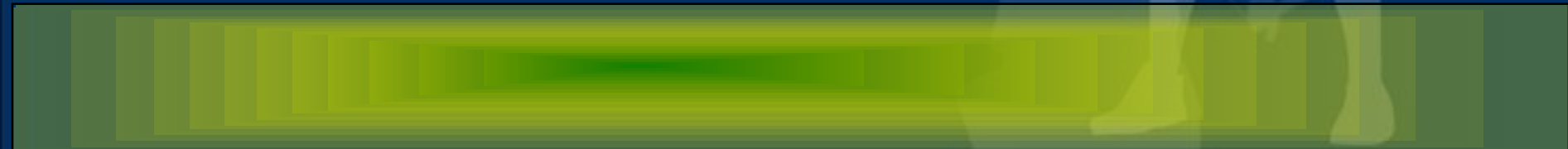
***Physical training***



***Prevention***



***Performance***



# Initial considerations: physical training in archery



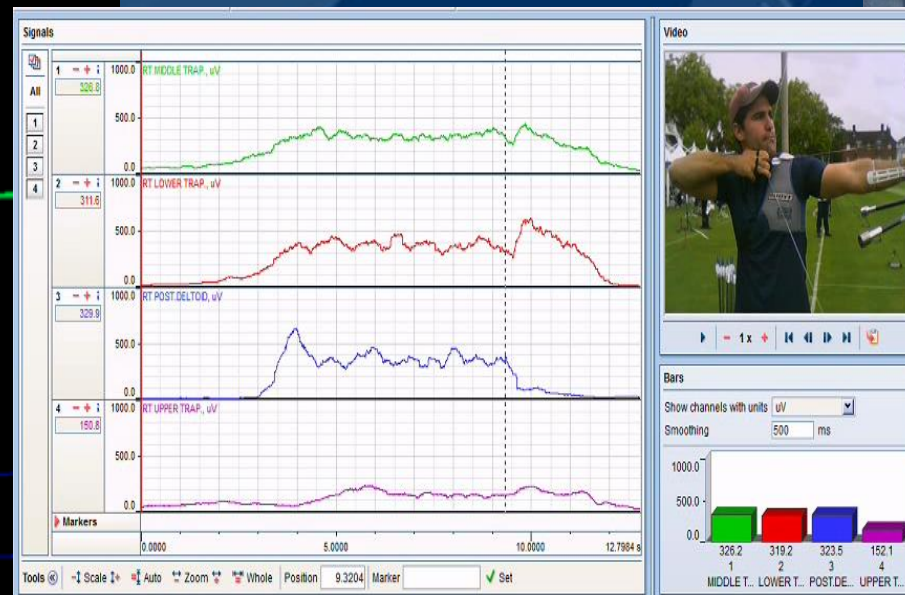
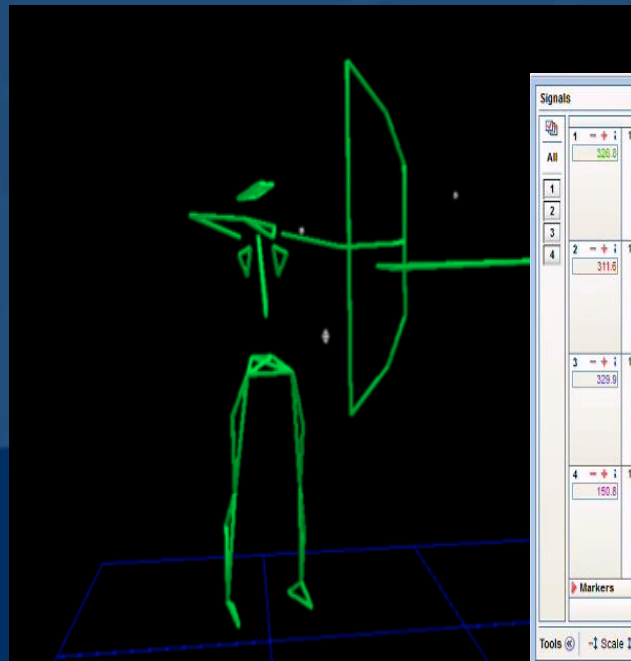
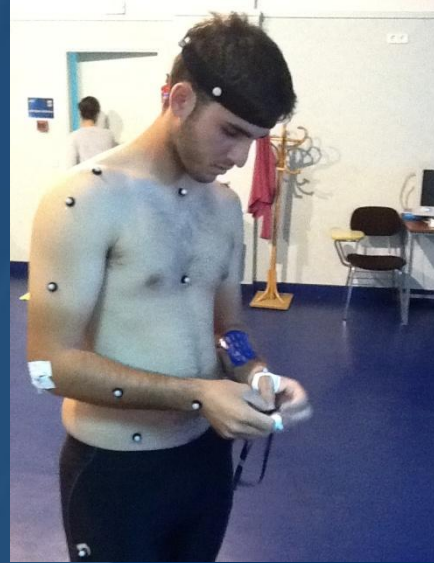


# Initial considerations: physical training in archery





# Initial considerations: physical training in archery



WHY??

LOOKING FOR SUCCESS  
PAST vs PRESENT  
TRAINING GOALS





# The importance of the physical training

## Why should we carry out a programme of physical training?



8.500 Kg a day

11.500 kg a day







41 steps vs. 121 arrows....



# The importance of the physical training

## Some other reasons...

- Muscle performance depends on the maturing of the nervous system. Since the myelination of the nerve fibres is not completed till sexual maturity, puberty establishes the physiological limits within the muscle performance. (13-15 years old). 
- For long time strengthen training for kids has been considered as controversial because of the possible influence in their growth. 
- In addition there were doubts if the strengthen training could influence the muscles of preadolescents due to their lack of androgens 
- Nowadays it is known that the risk of injury is low and that physical training may prevent injuries. However, it is recommended to be cautious when carrying out strength exercises with adolescents. 



# The importance of the physical training

- During the 1980s some researches stated that children who followed a structured training gained significantly their muscle strength (more than 40% ) after 9 weeks of training without bones or muscles injuries.
- children are not likely to develop the size of their muscle fibres, so the determining factors are the following:
  - The improvement of the motor coordination,
  - The increase of the activities related to motor units, and
  - Other neurological adaptations that are not defined. They are known as neural profits.



*Journal of Sports Sciences*, 2004, 22, 383–390

Taylor & Francis  
healthsciences

## **BASES Position Statement on Guidelines for Resistance Exercise in Young People**



The British Association of  
Sport and Exercise Sciences  
Endorsed Course

## **Resistance Training for Children and Youth: A Position Stand from the Australian Strength and Conditioning Association (ASCA) 2007**



## POSITION STAND / PRISE DE POSITION

# Canadian Society for Exercise Physiology position paper: resistance training in children and adolescents

David G. Behm, Avery D. Faigenbaum, Baraket Falk, and Panagiota Klentrou

Appl. Physiol. Nutr. Metab. 33: 545–546 (2008)

## INTRODUCTION / INTRODUCTION

**Resistance exercise and strong healthy children:  
safe when done right!**

Stuart M. Phillips



American Academy  
of Pediatrics



DEDICATED TO THE HEALTH OF ALL CHILDREN™

**Strength Training by Children and Adolescents**  
Council on Sports Medicine and Fitness  
*Pediatrics* 2008;121;835  
DOI: 10.1542/peds.2007-3790

<sup>the</sup>Journal of Strength and Conditioning Research™

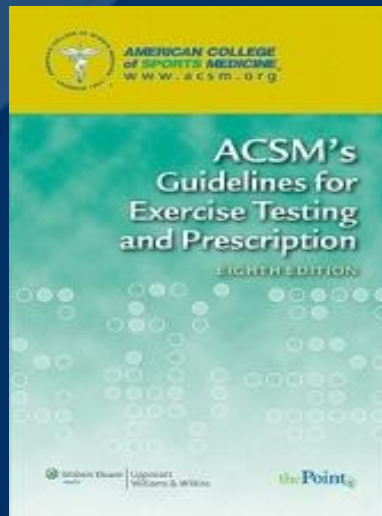
## **YOUTH RESISTANCE TRAINING: UPDATED POSITION STATEMENT PAPER FROM THE NATIONAL STRENGTH AND CONDITIONING ASSOCIATION**

**AVERY D. FAIGENBAUM,<sup>1</sup> WILLIAM J. KRAEMER,<sup>2</sup> CAMERON J. R. BLIMKIE,<sup>3</sup> IAN JEFFREYS,<sup>4</sup> LYLE J. MICHELI,<sup>5</sup> MIKE NITKA,<sup>6</sup> AND THOMAS W. ROWLAND<sup>7</sup>**

<sup>1</sup>Department of Health and Exercise Science, The College of New Jersey, Ewing, New Jersey 08628; <sup>2</sup>Department of Kinesiology, University of Connecticut, Storrs, Connecticut; <sup>3</sup>Department of Kinesiology, McMaster University, Hamilton, Ontario, Canada; <sup>4</sup>Department of Science and Sport, University of Glamorgan, Pontypridd, Wales, United Kingdom; <sup>5</sup>Division of Sports Medicine, Children's Hospital, Boston, Massachusetts; <sup>6</sup>Health and Physical Education Department, Muskego High School, Muskego, Wisconsin; and <sup>7</sup>Department of Pediatrics, Baystate Medical Center, Springfield, Massachusetts



ACSM-2010: 'kids and teenagers can take part in activities and training where strength is required if they receive proper preparation and supervision. In general terms the principles of physical training for adults are applicable to younger athletes. Between 8 and 15 repetitions of an specific exercise can be suitable for an appropriate work out. Before rising the weight make sure the exercise is being carried out properly.'



# Resistance training among young athletes: safety, efficacy and injury prevention effects

A D Faigenbaum,<sup>1</sup> G D Myer<sup>2,3,4</sup>

*Br J Sports Med* 2010;**44**:56–63. doi:10.1136/bjsm.2009.068098

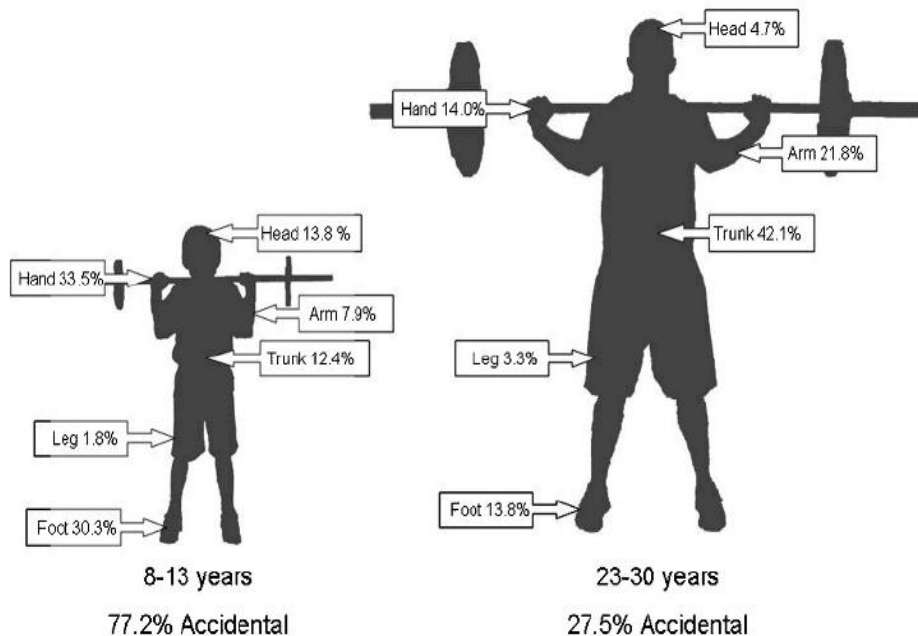
## **ABSTRACT**

A literature review was employed to evaluate the current epidemiology of injury related to the safety and efficacy of youth resistance training. Several case study reports and retrospective questionnaires regarding resistance exercise and the competitive sports of weightlifting and powerlifting reveal that injuries have occurred in young lifters, although a majority can be classified as accidental. Lack of qualified instruction that underlies poor exercise technique and inappropriate training loads could explain, at least partly, some of the reported injuries. Current research indicates that resistance training can be a safe, effective and worthwhile activity for children and adolescents provided that qualified professionals supervise all training sessions and provide age-appropriate instruction on proper lifting procedures and safe training guidelines. Regular participation in a multifaceted resistance training programme that begins during the preseason and includes instruction on movement biomechanics may reduce the risk of sports-related injuries in young athletes. Strategies for enhancing the safety of youth resistance training are discussed.

# The importance of the physical training

- Nowadays experts recommend programmes for advanced technical training including technical exercises, weightlifting and plyometric as part of programmes designed to increase performance and avoid injuries.
- Specialized physical training methods include a progressive use of weights, movements, speed and types of training, including machines, free weights, elastic bands, medicine balls and plyometric exercises.
- The risk of injuries due to repetitive exercises must be taken into account when training young athletes.

**Figure 3** Percentage of injuries of the oldest and youngest age categories. Note that the small prevalence of leg injuries in the 8–13 years age categories provides invalidated results and should be interpreted with caution. Reprinted from Myer et al.<sup>24</sup> Reproduced by permission of the National Strength and Conditioning Association, Colorado Springs, Colorado, USA.





# The importance of the physical training

- In USA sports with higher risk of injury are: American football (28%), fighting(16%), and gymnastics (13%).
- Apart from qualified professionals during the supervision and instruction of trainings, the following 10 items are suggested:

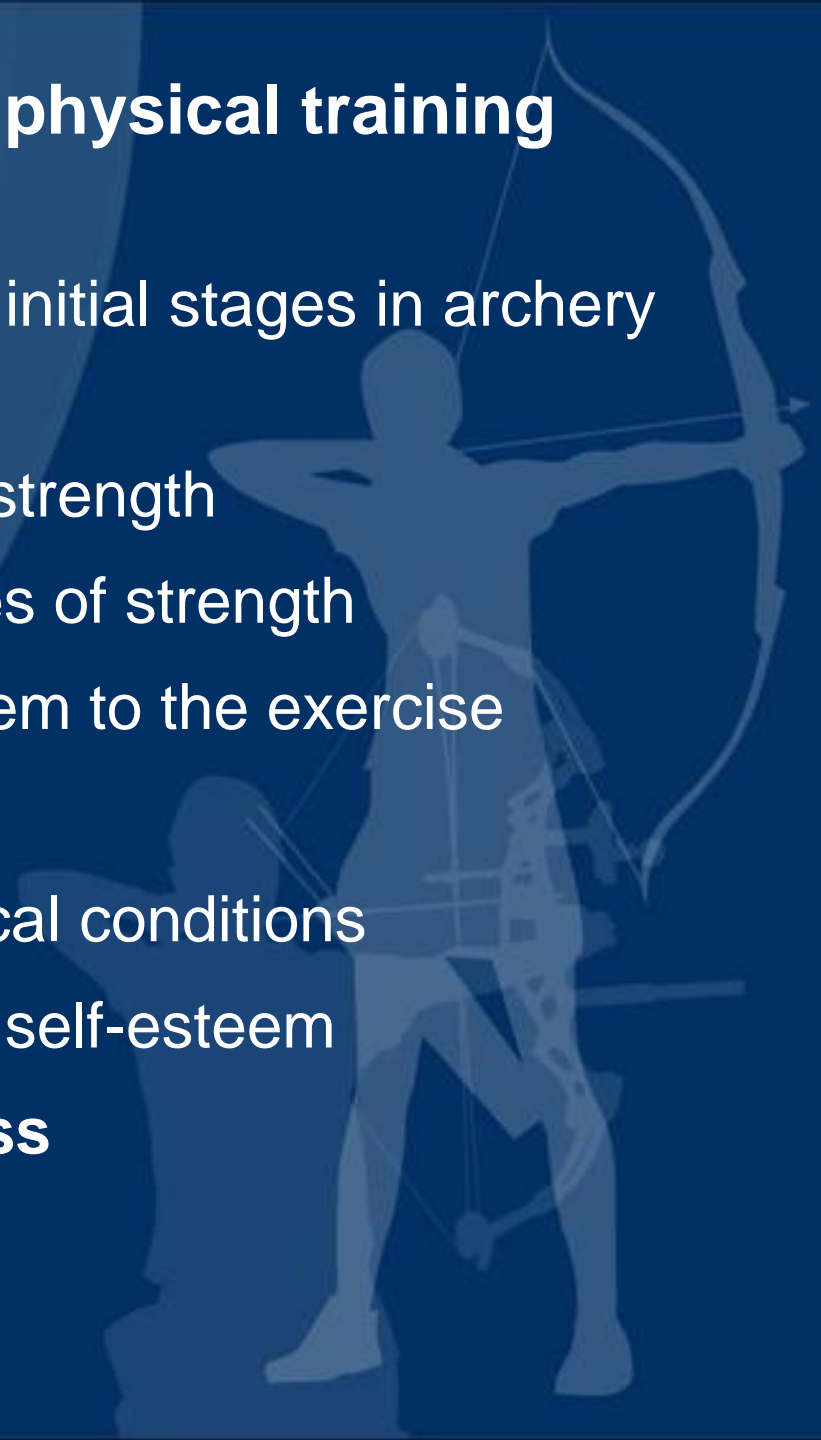


- ▶ All youth should have the emotional maturity to accept and follow coaching instructions.
- ▶ All youth should wear comfortable attire that does not restrict movement patterns and athletic footwear that provides good traction and support.
- ▶ Resistance training sessions should begin with dynamic warm-up activities.
- ▶ Resistance training sessions should include exercises for all of the major muscle groups including the hips, abdomen and lower back.
- ▶ The focus of youth resistance training programmes should be on learning proper exercise technique and not on the amount of weight lifted.
- ▶ Qualified professionals who have an understanding of youth resistance training and paediatric fitness should provide supervision and instruction.
- ▶ Qualified professionals should ensure the training area is safe, adequately ventilated and free of any potential hazard.
- ▶ Qualified professionals should monitor each participant's ability to tolerate the exercise stress and should modify the training programme when appropriate.
- ▶ Qualified professionals should systematically vary the training programme over time in order to minimise the risk of injury or overtraining.
- ▶ Lifestyle factors that influence training adaptations such as proper nutrition, sufficient hydration and adequate sleep should be addressed in youth sport programmes.

# The importance of the physical training

Therefore, physical training since initial stages in archery contributes to:

- Improve nerve factors of strength
- Improve the different types of strength
- Adapt the locomotor system to the exercise
- Avoid injuries
- Weight control and physical conditions
- Gain self-confidence and self-esteem
- Reduce anxiety and **stress**



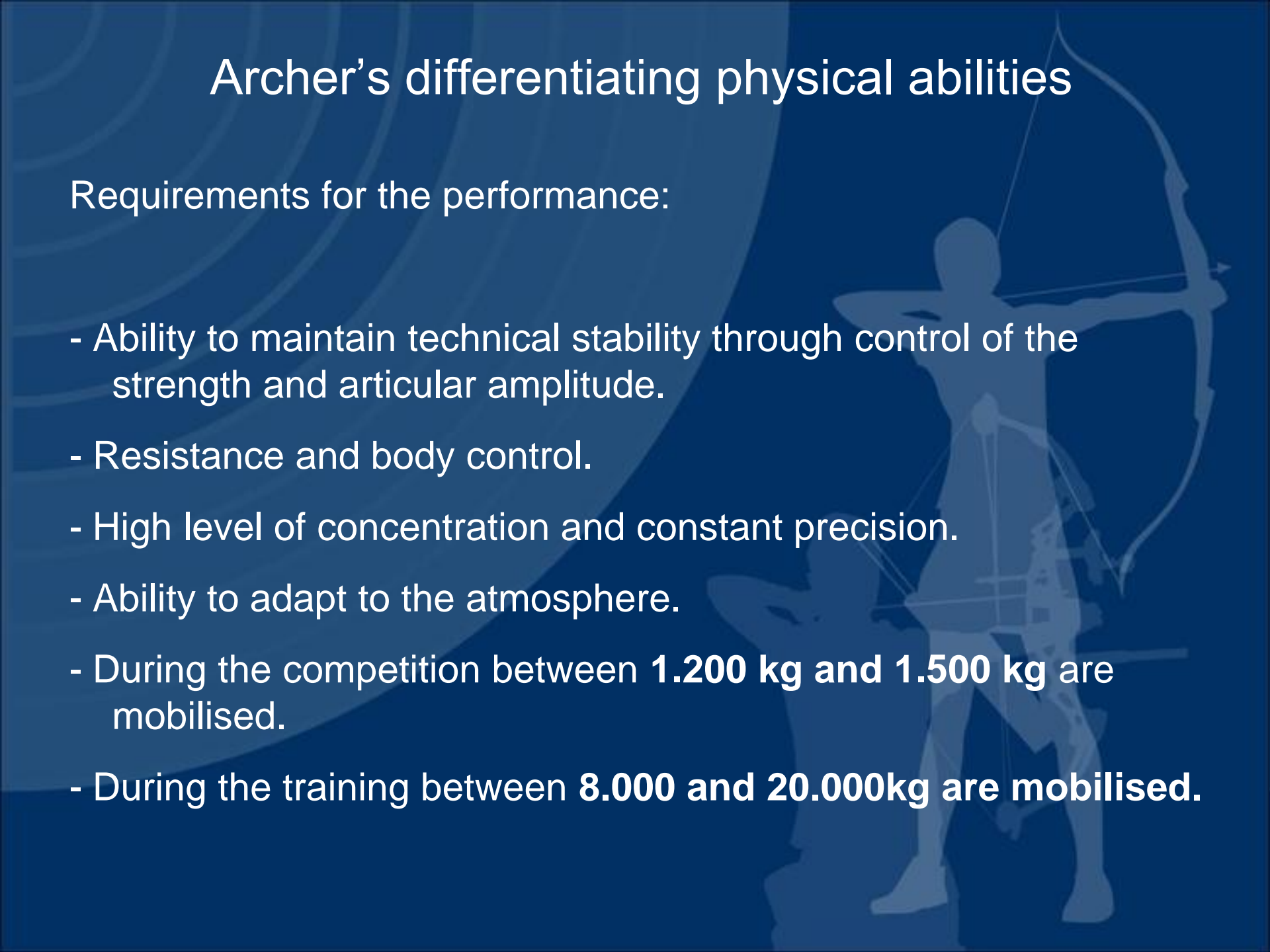
WHATT??

NEEDS



# Archer's differentiating physical abilities

Requirements for the performance:

- Ability to maintain technical stability through control of the strength and articular amplitude.
  - Resistance and body control.
  - High level of concentration and constant precision.
  - Ability to adapt to the atmosphere.
  - During the competition between **1.200 kg and 1.500 kg** are mobilised.
  - During the training between **8.000 and 20.000kg** are mobilised.
- 
- The background of the slide features a dark blue gradient with a large, faint silhouette of an archer in the center-right, holding a bow and arrow. To the left, there are several concentric, light-colored circles representing a target. The overall aesthetic is professional and focused on the sport of archery.



# All this... but how?



## \*Physical Fitness

- Aerobic endurance
- Anaerobic endurance
- Flexibility
- General strength
- Special strength
- General balance
- General coordination
- Body control
- etc.

## \*Shooting Skills

- Evaluation
- Pre-setting
- Adjustment
- String clearance
- Draw & hands synch
- Shooting body balance
- etc.

## \*Scientific Support Programme

- Nutritional support
- Psychological support
- Technological support
- etc.

\*Talented Athlete

## \*Technologically upto date equipment

- Selection
- Tuning
- Sight adjustment
- Arrows selection
- Back-up preparation
- etc.

## \*Good Planning of the Year

- Time for preparation
- Time for peaking
- Distribution of competitions

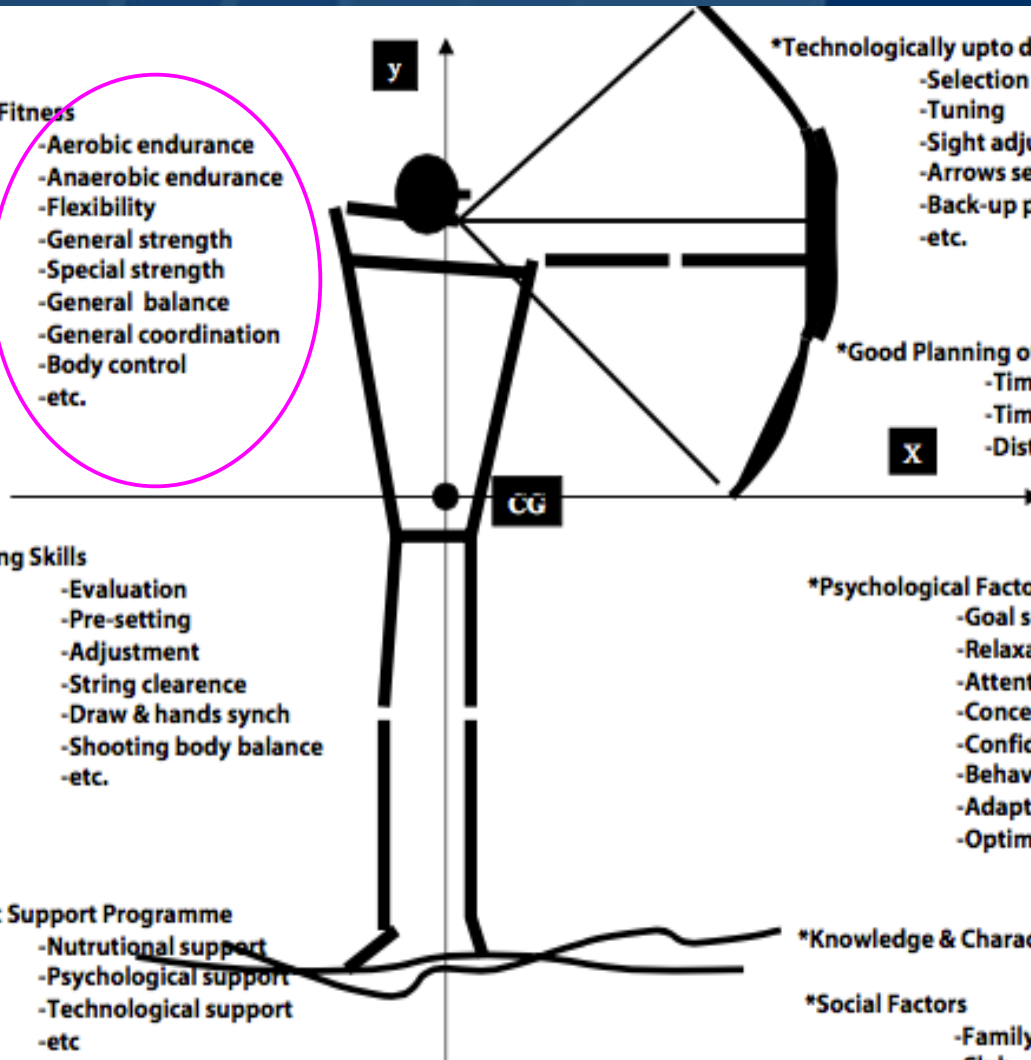
## \*Psychological Factors

- Goal setting
- Relaxation
- Attention
- Concentration
- Confidence/Positive attitude
- Behaviour/Attitude
- Adaptation and orientation
- Optimal performance state

## \*Knowledge & Character of the Coach

## \*Social Factors

- Family
- Partner(s)
- Club
- Job, school
- etc.



# Archer's differentiating physical abilities

## *Abilities to develop:*

Aerobic resistance

Reaction rate

Extreme strength

Flexibility

Body control

Strength - Resistance

Specific strength or useful



# Archer's physical training

## **Aerobic resistance**

Most of definitions state it makes reference to the athlete's physiological ability to resist tiredness (Bompa 1983; Ozolín 1983; Platonov 1988; Weineck 1988; Neuman 1990; Zintl 1991).

To keep on during all the season

To improve the cardiovascular system ( $\leq 30'$ )

To provide an organic base

Means of developing routines, control and relaxation

To improve recovery efforts

To facilitate technical stability

To control body composition

Running, swimming, kayaking, rowing, team sports, etc.

# Archer's physical training

## Aerobic resistance

- Total duration must be more than 30'.
- 3 sessions/sem.

1<sup>st</sup> Part of the season: swimming, kayaking, rowing, elliptical, team sports.

2<sup>nd</sup> Part of the season: race, bike, crossing, team sports.

- Moderate intensity (55-70% HR. max)
- Continuous methods: stable condition

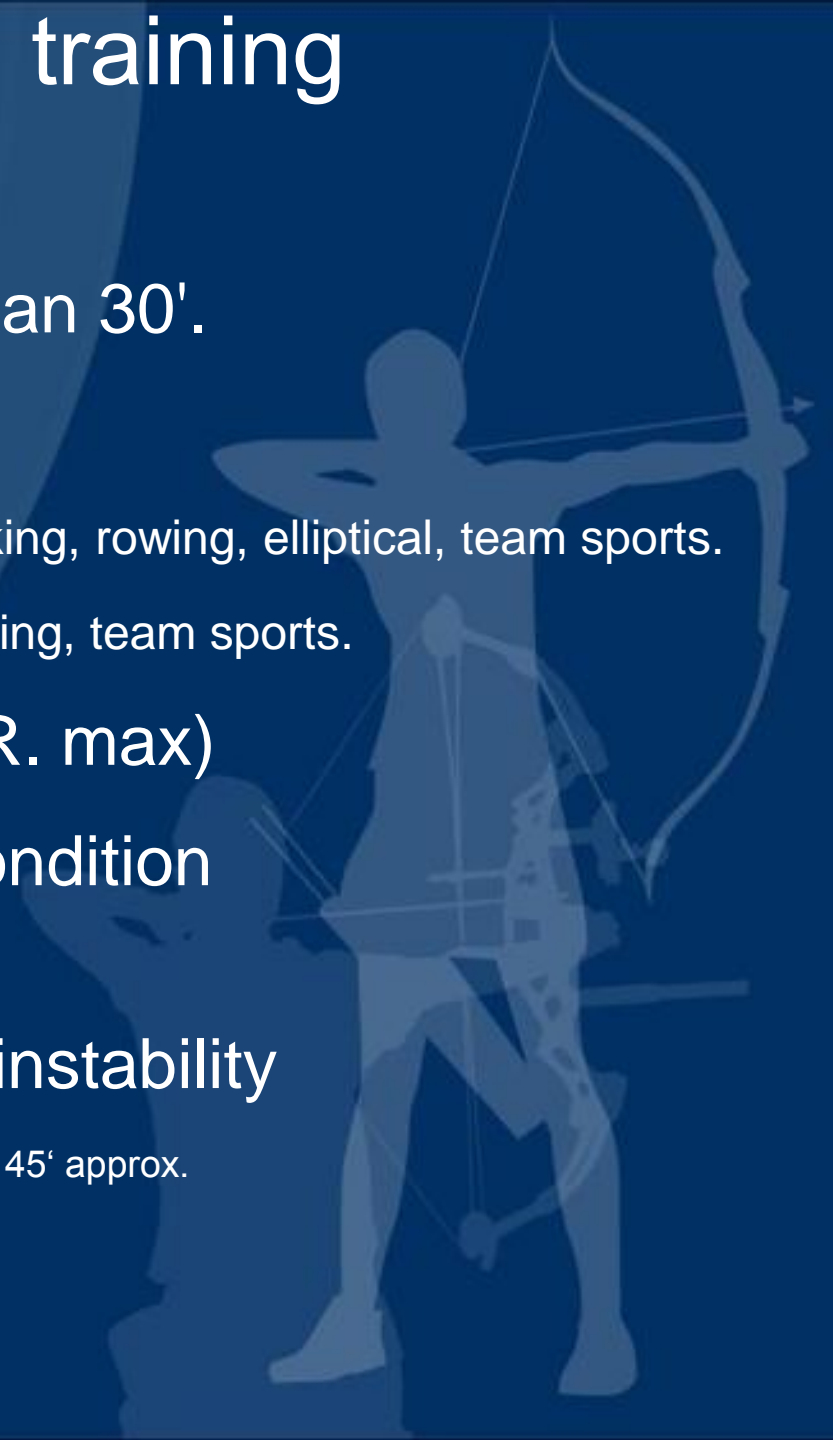
Continuous running, swimming, cycling, etc.

- Intervallic methods: phases of instability

Fartlek, exercises of changing rhythm (4-5') in total it makes 45' approx.

- Aerobics circuits

Station (20") + race + station (20") + race





# Archer's physical training



## **Flexibility:**

Range of motion that reaches a certain articular segment. It is determined by the elasticity of the muscle and articular range. .

To keep all the season with the warming up at the beginning and the end of the training.

Impact on technical aspects.

It is very important to work out pectoral girdle and shoulder blade.

No proven injury prevention

Training permits technical rehabilitation more easily.

Wide range of methods that can be combined. The most frequent and efficient ones are: Passive (3 x 15")

# Archer's physical training

## Maximum dynamic force and FMR:

In short, force consist of pushing and pulling of something  
(McGinnes, 1999)

Ability to mobilise the largest possible load  
in a particular movement (once)

Many working methods

It brings stability to the technical and  
anatomical basis

In training the F.M.R (%RM) is used.

To make progress with the training in order  
to get total force.

Número máximo de repeticiones	% de la carga máxima levantada una sola vez
1 RM	100
2 RM	94
3 RM	91
4 RM	88
5 RM	86
6 RM	83
7 RM	81
8 RM	79
9 RM	77
10 RM	74
11 RM	71
12 RM	68
13 RM	65
14 RM	63
15 RM	60

*\*Within the group of values FDMR we find one particular that is what corresponds to the force applied when the athlete performs its specific movement of competition. This value is known as useful force (J.J. González-Badillo y E. Gorostiaga, 1993, 1995). Improving the value of force must be the main objective of training and the most engaged with the performance.*

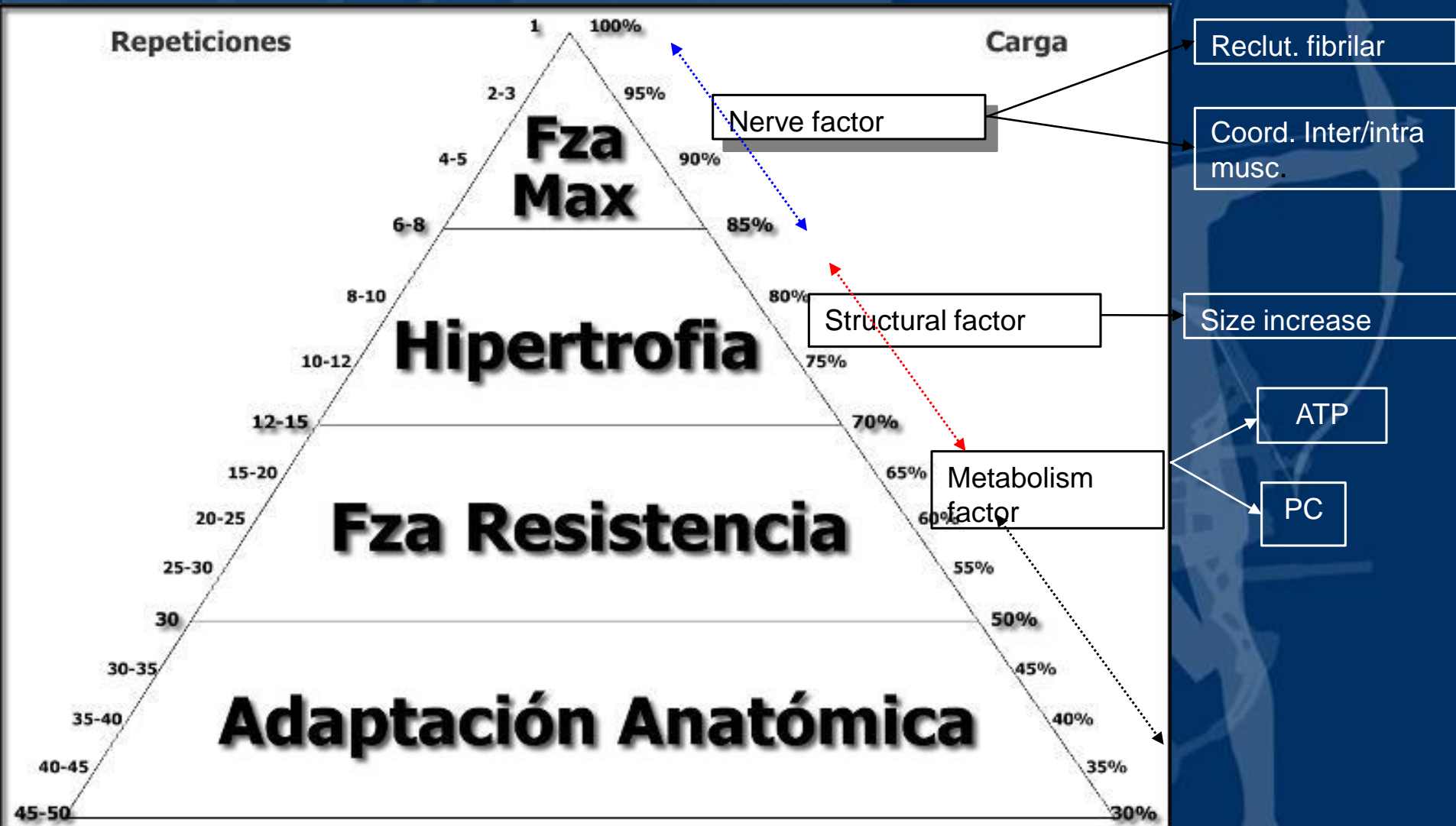
# Archer's physical training

- Training cycles of 8 -12 weeks (3 and 5 days/week.)
- At the gym. Better free weights.
- Select and alternate groups of muscles.
  - Tues-Thurs: Back, shoulder, forearm. 3 exercises per group
  - Wed-Fri: chest, triceps leg.
- The method depends on the needs of strength and the archer's level of experience.
- High load percentages generate more effective profits.

Método	% RM	Rep/Series	Recup.	Veloc. Ejec.	Caract. Esfuerzo
Unidad Entto. % bajos II	40-60	10-12r x 3-4s	3-5'	máxima	No alcanza agotamiento
Unidad Entto. % bajos I	60-75	8-12r x 3-4s	3'-5'	media/alta	No alcanza agotamiento
Unidad Entto. % Medios I	80-85	5-7r x 5s	3'-5'	alta/máxima	Máximo
Unidad Entto. % Máximos II	90	3-4r x 4-5s	3'-5'	alta/máxima	Máximo
Unidad Entto. % bajos I	60-75	8-12r x 3-4s	3'-5'	media/alta	No alcanza agotamiento
Unidad Entto. % bajos II	40-60	10-12r x 3-4s	3-5'	máxima	No alcanza agotamiento



# Archer's physical training



# Archer's physical training



## **Body control (Isometric force):**

*Athlete's ability to maintain or correct your body alignment minimizing the effect of fatigue*

It is required when focusing (girdle)

Fundamental work out of trunk and legs (support)

It is essential to provide feedback (mirror, video, etc.)

Positions that require active work maintained.

Much attention in the performance by the archer

Include suspension and traction

# Archer's physical training

*"Principle of the size" it requires high loads to improve isometric force*

To keep 6-8 seconds to recruit muscle fibres 100%

To respect positions imposed by the techniques of archery

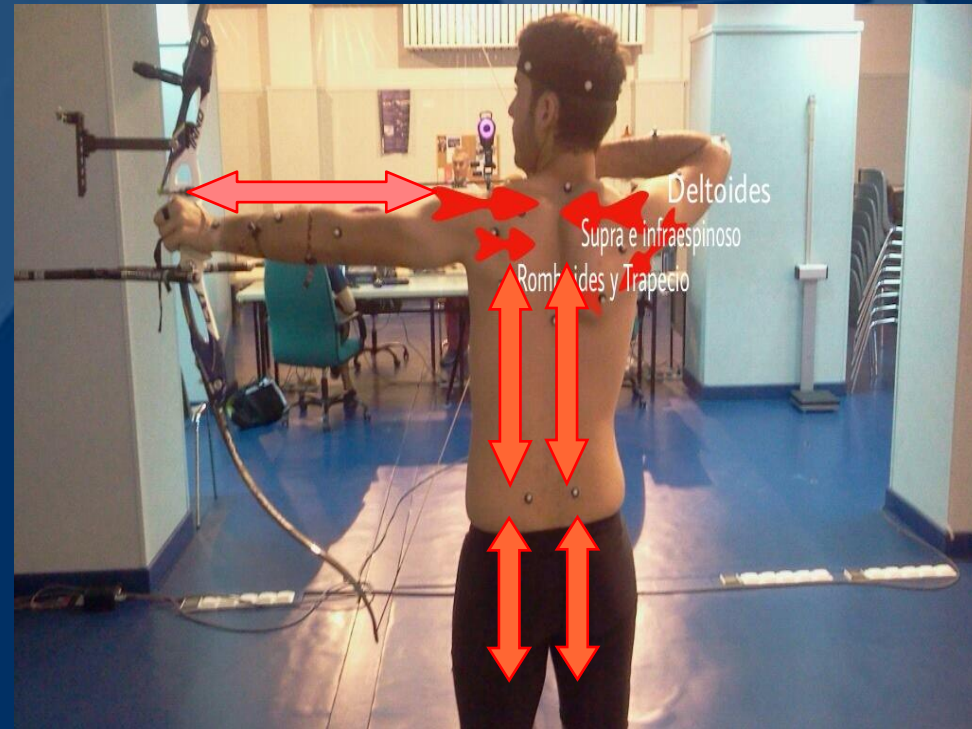
Activation speed progressively increased

Organization of the session

1<sup>st</sup> part: Core labour and supports

2<sup>nd</sup> part: push and hold exercises

3<sup>rd</sup> part: arch openings held











# Archer's physical training

## Reaction rate:

Ability to react as quickly as possible to a stimulus.

Immediate response to the clicker.

Few tasks\*. No connection between scores and response time.

Moderate correlation between response to the clicker and the precision.

Improvements conditioned by nervous factors.

Influence on touch and sound stimuli.

Low trainability and little transfer.

\*Ertan, H; Acikada, C. The effect of clicker reaction time on scoring point and relationship among visual, auditory and tactile reaction times among Turkish national archery teams. *Hacettepe Journal of Sports Sciences*, 7(3):12-20

\*\*Tinazci, C. The analysis of shooting dynamics in archery. Hacettepe Univ. Unpublished doctoral thesis.

# Archer's physical training

- Finger extensors
- Immediate response to tactile and sonic stimuli
- Search for shooting positions in the execution
- 4 x 10 starts, pronation/supination
- Include exercise circuits





# Archer's physical training

## Strength - resistance

The ability to maintain peak of strength and its production for a certain time. The degree of resistance to the force will be defined by the force losses suffered by the athlete involuntarily during a race or a workout.

It should be done on the specific movement or part of it.

The load must not affect the quality of the movement

The best method of training is to shoot many arrows (organizing the number of arrows / series)

It improves the energy metabolism and mechanical compliance



# Archer's physical training



If we shoot with tires, brakes or we increase the bow resistance, we are NOT training force resistance, but improving specific strength.

When the new resistance becomes habitual use, we shall use higher resistance.

Developing the strength with some joint angles, positions and similar dynamic tools used in competition, we maximize the outcomes of the training.

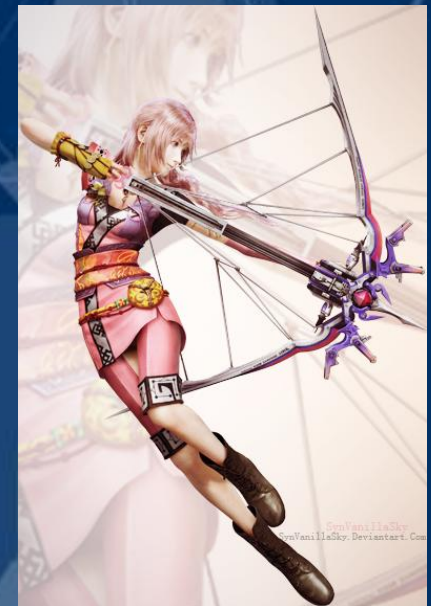
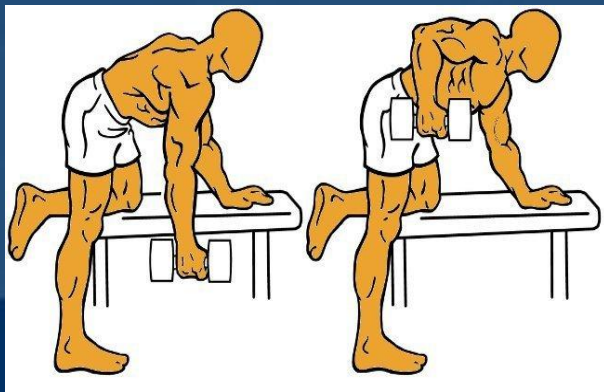
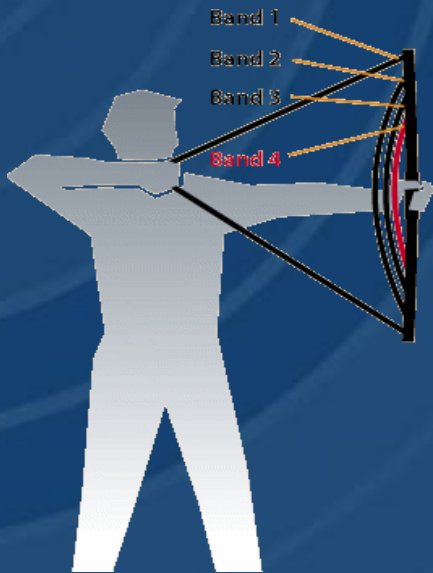
## Considerations:

Loading must not be so high that substantially change the structure of the technique.

The intensity (velocity) in these cases must always be high.

The number of recommended repetitions: 15-20

Recovery must last enough to allow each series to be made with a similar intensity (velocity), without great loss of speed.



# Archer's physical training

Other important aspects of physical training:

Convey the concept of 'nature of the effort' to the archer.

$$C d E = \frac{\text{Repeticiones realizadas}}{\text{Repeticiones realizables}}$$

**Recovery** and **execution speed** are important references for training intensity.

At the stage of general physical training it is recommended to work as fast as possible since it affects the neural activity (stimulus frequency, recruitment, and synchronization)

At the most specific stage the execution speed of the movements is critical because of the high transfer.

The best nerve adaptations are at **90% (3 s. x 3.rep.)**

Eccentric workout (**+20% load**).



*Part 2.*  
*Planning and design of the training*



HOW??

ANATOMY & BIOMECHANICAL  
SEASON PLANNING  
EXERCISES





# Planning and design of the training

- The movement of the fling is a complex pattern
- The archer should know the groups of muscles and its level of participation in the movement in order to understand the action sequence
- Muscle simultaneous participation includes static and dynamic actions to be taken into account in training.
- Stable technical changes are complicated if they are carried out later.

“In conclusion, it was established that archers develop a specific muscular strategy, aiming behavior and postural sway to better shoot an arrow. When we analyzed the archers both as a group and individual, there were many variables that affected performance simultaneously”  
*Shooting dynamics in archery: A multidimensional analysis from drawing to releasing in male archers.* Cevdet Tinazci . 2010

*The current literature review reaches a common conclusion that high level archers use their back and shoulder girdle muscles more than arm and forearm muscles in drawing the string. That strategy may have two advantages; (1) reaching to exhaustion may be delayed because of using stronger muscle groups [7] and (2) having lower contraction levels of forearm muscles may not cause lateral deflection of the bowstring [8]. The both advantages of the mentioned strategy help increasing the scores on the target. (Hertan H.)*



# Planning and design of the training

## Muscles involved in archery

- Knee and hip extensors.

- Large areas and trunk flexion

Statically and bilaterally balanced

- Trapezius++, rhomboids++, S.I.R++

- deltoids+++, Triceps ++, Biceps +, Pectoral+

- Forearm flexion /extension of the fingers

Dynamic sequential contraction

- Deltoids +++, pectoral +++, SIR ++

- Triceps +++)

- Wrist extensors +, fingers flexors

Static contraction (Isometric)

L  
E  
G  
S  
.  
T  
  
S  
T  
R  
I  
N  
G  
  
B  
O  
W

\* Nishizono & Cols. An electromyographically analysis of purposive muscle activity and appearance of muscle silent period in archery shooting.1984 .*Jap J. Of Phys Fit and Sport*.33. 17-26.

# Planning and design of the training

- Design of the exercises depending on the effect:

**Located:** Slight transfer. Train isolated muscles. Complementary role. Function to prevent injuries and compensate. Farthest from the competition phase goal: improving the maximum force to develop simultaneous and subsequently specific manifestations.

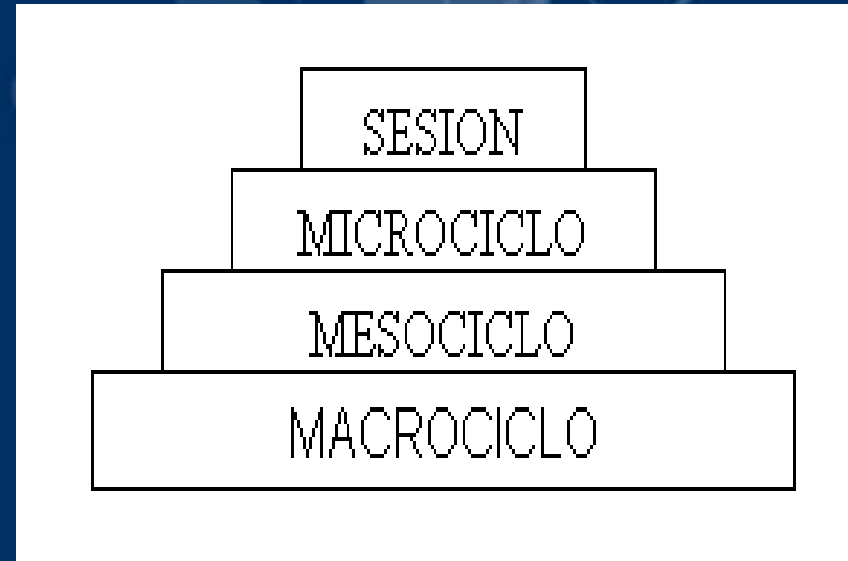
**Generalized:** *involving large groups of muscles in a coordinated manner. Application or transfer to most specific movement competition. They can be found in any phase of the training cycle.*

**Specific:** reproduce movements of competition, under the same conditions or in very similar situations. Maximum transfer to the competition itself. They can be considered as training exercises by adding additional resistance force.



# Planning and desing of the training

- Session: Minimum training unit. (1, 2 or 3 a day)
- Microcycle: one set of 8-10 days of training: set, load, activate, impact, competition, etc.
- Mesocycle: a set of microcycles that generates adaptive effects. 3-4 weeks of training.
- Macrocycle: mesocycles block which seeks for the achievement of objectives through adaptive methods.
- season: set time or full training cycle.
- Variability of contents in each session, e.g.: 4 out of 10

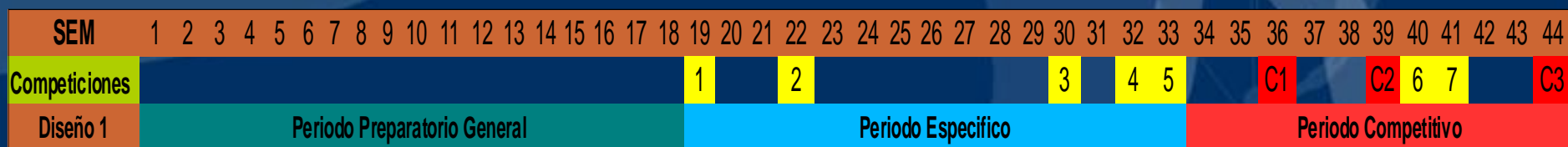
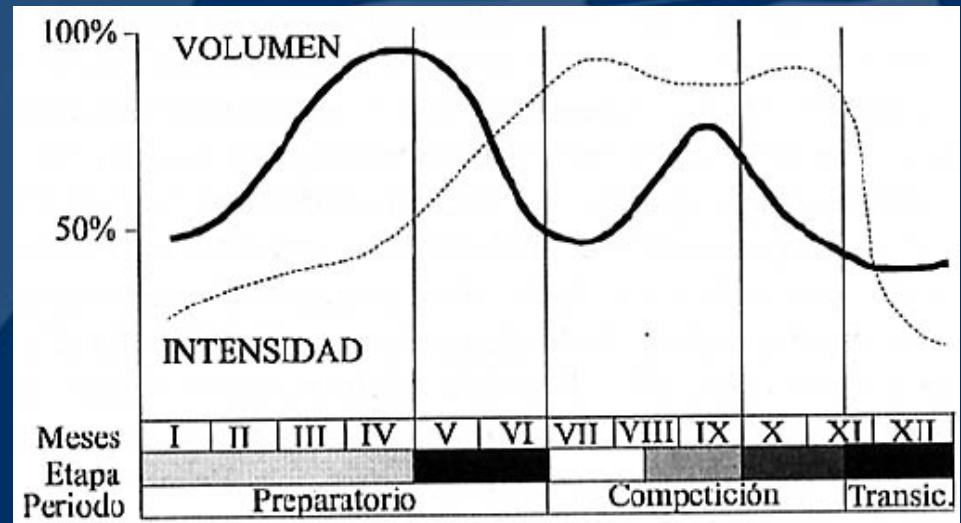


# Planning and design of the training

## Planning methods:

### Traditional:

- Divided in three phases
- Limited
- Monotonous





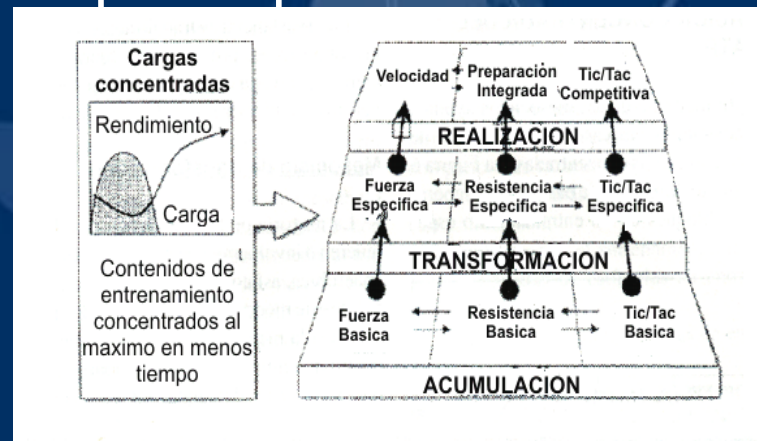


# Planning and design of the training

Planning methods:

## Mixed:

- Suitable when the competition is focus on a specific season
- It allows to build a solid base and adapt the peaks of the structured training.
- Appropriated for archery
- It incorporates the concept of ATR



Competiciones

Diseño 2

Periodo Preparatorio General

Periodo Especifico

A

T

R

A

T

R

1

2

C1

C2

C3



MES	septiembre					octubre					noviembre				diciembre					enero				febrero				marzo					abril					mayo				junio					julio					agosto								
Nº SEMANA MES	1	2	3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3
Nº MICROCIclo	1	2	3	4	5	6	7	8	9*	10	11	12	13	14	15	16	17	18	19	20*	21	22	23	24	25	26	27	28	29*	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45															
Nº FLECHAS	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###	###											
MESOCICLOS	Introducctorio									P1. Capacidades especificas base									P2. Capacidades especificas desarrollo									A		T		R		T		R		A			T		R																	
TIPO MICROCIclo	C	C	C	C	C	A	C	C	C	R	C	C	C	C	I	A	C	C	C	C	C	C	C	C	C	C	C	C	C	I	A	WC1	A	WC2	R	EUR	R	A	WC3	C	C	C	C	I	R	A														
% GENERAL	9%	9%	9%	9%	8%	8%	8%	8%	8%	8%	7%	7%	7%	7%	7%	7%	6%	6%	6%	6%	6%	6%	5%	4%	4%	3%	3%	3%	3%	2%	2%	2%	6%	6%	6%	5%	3%	2%	2%	2%	2%	2%	6%	5%	4%	2%	2%	2%	1%											
% ESPECIFICO	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%	5%	6%	6%	7%	7%	7%	7%	8%	8%	8%	4%	4%	4%	5%	7%	8%	8%	8%	8%	8%	4%	5%	6%	8%	8%	8%	9%											
100%	[Stacked bar chart showing cumulative percentage of training load over 45 weeks]																																																											
80%	[Stacked bar chart showing cumulative percentage of training load over 45 weeks]																																																											
60%	[Stacked bar chart showing cumulative percentage of training load over 45 weeks]																																																											
40%	[Stacked bar chart showing cumulative percentage of training load over 45 weeks]																																																											
20%	[Stacked bar chart showing cumulative percentage of training load over 45 weeks]																																																											
Nº MICROCIclo	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45															
Carga Física	2	3	3	3	3	2	3	3	3	1	4	4	3	3	5	2	3	3	3	4	3	5	2	3	3	3	4	3	4	1	2	4	3	3	5	2	3	1	1	2	3	3	3	4	4	1														

OLYMPIC GAMES



# Planning and design of the training

Planning methods:

## Contemporaneous:

- Greatest adaptation to competition
- Ideal for sports with many competitions (league)
- High performance
- Trendy approach in Sports

Competiciones				1	2			3	5	C1	C2			C3
Diseño 3	Periodo Preparatorio General	A	T	R	A	T	R	T	R	A	T	R		

FASE	PRETEMPORADA. Prep fis de base								ATR 1												ATR 2					ATR 3			ATR 4																													
MES	septiembre					octubre					noviembre				diciembre				enero				febrero				marzo					abril					mayo				junio					julio					agosto							
Nº SEMA	1	2	3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2
Nº MICRO	1	2	3	4	5	6	7	8	9*	10	11	12	13	14	15	16	17	18	19	20*	21	22	23	24	25	26	27	28	29*	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	1	2											
Nº FLECH																																																										
MESOCIC	Introdutorio								A				T				R				A					T				R			T			R					A		T				R											
TIPO MIC	C	C	C	C	A	C	C	C	C	R	A	C	C	C	C	C	A	C	C	C	C	R	A	C	C	R	A	C					C	R	C	I	R	WC1	A	WC2	A	EUR	C	R	WC3	R	C	C	C	C	I	A	R					
% GENE																																																										
% ESPEC																																																										
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MICROCICL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45													

OLYMPIC GAMES

# Planning and design of the training

## Weight settings:

- Choose a method that fits over the competition schedule.
- Assign an objective and value to the training intensity in each microcycle (intensity from 0 to 5)

Recovery: 0-1: indispensable. After competition or between macrocycles.

Setting: 1-2: low intensity. Transition between periods and prior to competition.

Weight: 2-4: real training. The more common. Requirement.

Impact: 5: high weights. Don't abuse. Frequent at the final stage of weight.

- Consider the technique aspects as priority
- Do not mix up peak of form with peak of weight





# Physical and technical training

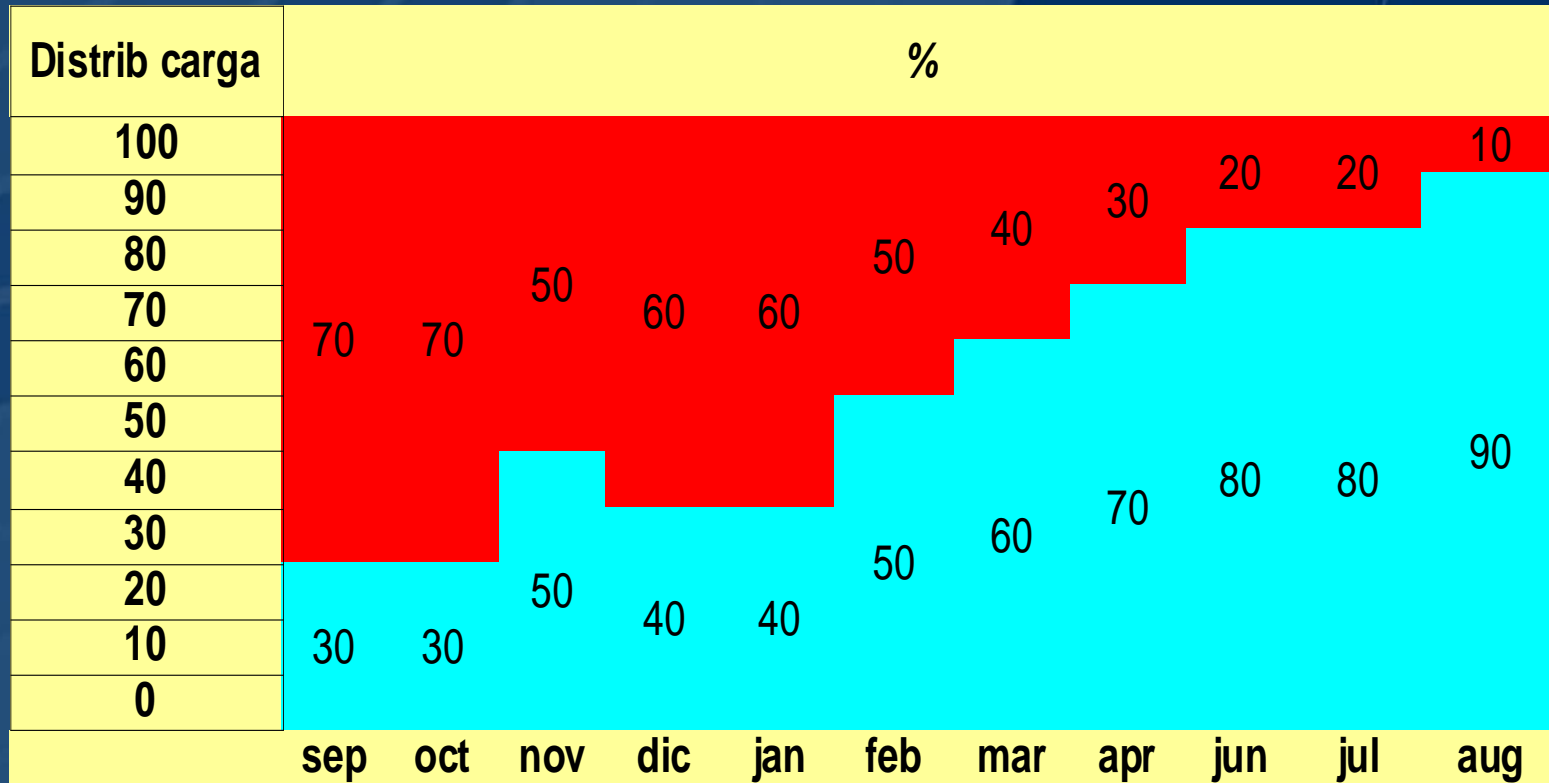


- Technical weight rating (0-5)
- Technical workout involves physical exercises (Force + resistance)
- As a general rule: if the technical exercise is high the physical workout is low.
- As the season progresses, technical and physical training integrated
- First, technical exercises; then, the physical ones.
- Ask the athlete

Basic physical abilities

Specific physical ab.

Competition physical ab.



TECNICO

FISICO

# Weekly planning model – General physical training

week tipe 1							
	MON	TUE	WED	THU	FRI	SAT	SUN
Morning	Aerobic 25'	Aerobic 25'	Aerobic 25'	Aerobic 25'	Aerobic 25'	Self training	REST
	Tech.	Tech.	Tech.	Tech.	Tech.		
Afternoon	Tech.	Tech.	Rest	Tech.	Tech.	REST	
	Natural Circuit	Gym General Strength		Natural Circuit	Gym General Strength		

# Weekly planning model – General physical training

## Natural Circuit

- 60' exercises combined with running
- 30" workout or 10 rep
- 8 – 10 sessions
- Continuous exercises
- Development of strength and resistance
- Combine big groups of muscles.
- Add progressively other materials (sticks, balls, ropes...)

## Gym general strength

- Located exercises
- Suitable weight at higher speed
- 3 exercises (shoulders, dorsal, triceps, pectoral, biceps, abdomen 12-15 rep.)
- Correct execution.
- Preventive / Training

lunes		martes		miércoles	jueves		viernes	
DIA 1		DIA 2			DIA 1		DIA 2	
Dorsal	Remo Tumb	Pecho	press banca		Dorsal	Remo Tumb	Pecho	press banca
	Manc. 1 mn		press manc			Manc. 1 mn		press manc
	Remo sent		fondos br			Remo sent		fondos br
Tríceps	Jalón	Hombro	Elev front		Tríceps	Jalón	Hombro	Elev front
	Press franc		Elev lat			Press franc		Elev lat
	Push ups		Remo cuello			Push ups		Remo cuello
Antebrazo/br	Curl	Pierna	½ sent		Antebrazo/br	Curl	Pierna	½ sent
	Apertura dedos		cargada F			Apertura dedos		cargada F
	Pron/supin		Impuls			Pron/supin		Impuls



# Weekly planning model – General physical training



# Weekly planning model – General physical training



# Weekly planning model – Specific physical training

week tipe 2							
	MON	TUE	WED	THU	FRI	SAT	SUN
Morning		Aerobic 25'	Aerobic 25'	Aerobic 25'	Aerobic 25'		REST
	Tech.	Tech.	Tech.	Tech.	Tech.	Self training	
Afternoon						Gym 2	
	Tech.	Tech.	Rest	Tech.	Tech.	REST	
	TRX Circuit + Gym 1	Gym 2		Gym 1	Indoor Circuit		

# Weekly planning model – General physical training

## TRX circuit

- Traction
- Extensions
- Pushing
- Keep tension
- Dynamic + static workout
- 3-5 s. x 15-20 rep or 20"

## Gym 2

- 3-4 s. x 3-4 rep 85-90% 1RM
- 3 ex. dorsal + 3 ex. Shoulder + 3 ex. Triceps
- 3 x 5 slopes

## Gym 1

- 3-4 s. X 3-4 rep. 85-90% 1RM
- 2 ex chest + 2 ex biceps
- 200 abdominals.
- Flexibility

## Indoor circuit

- 8-10 stations x 3-4 laps
- 20" force exercises
- Combine groups of muscles
- Body control ++
- Specific exercises (include technical movement)









# Weekly planning model – Competitive physical training

week tipe 3							
	MON	TUE	WED	THU	FRI	SAT	SUN
Morning	Tech.	Aerobic 25'	Aerobic 25'	Aerobic 25'	Aerobic 25'	Self training	REST
		Tech.	Tech.	Tech.	Tech.		
Afternoon	Tech.	Tech.	Rest	Tech.	Tech.	REST	REST
	FIELD CIRCUIT	GYM 3		FIELD CIRCUIT	GYM 4		

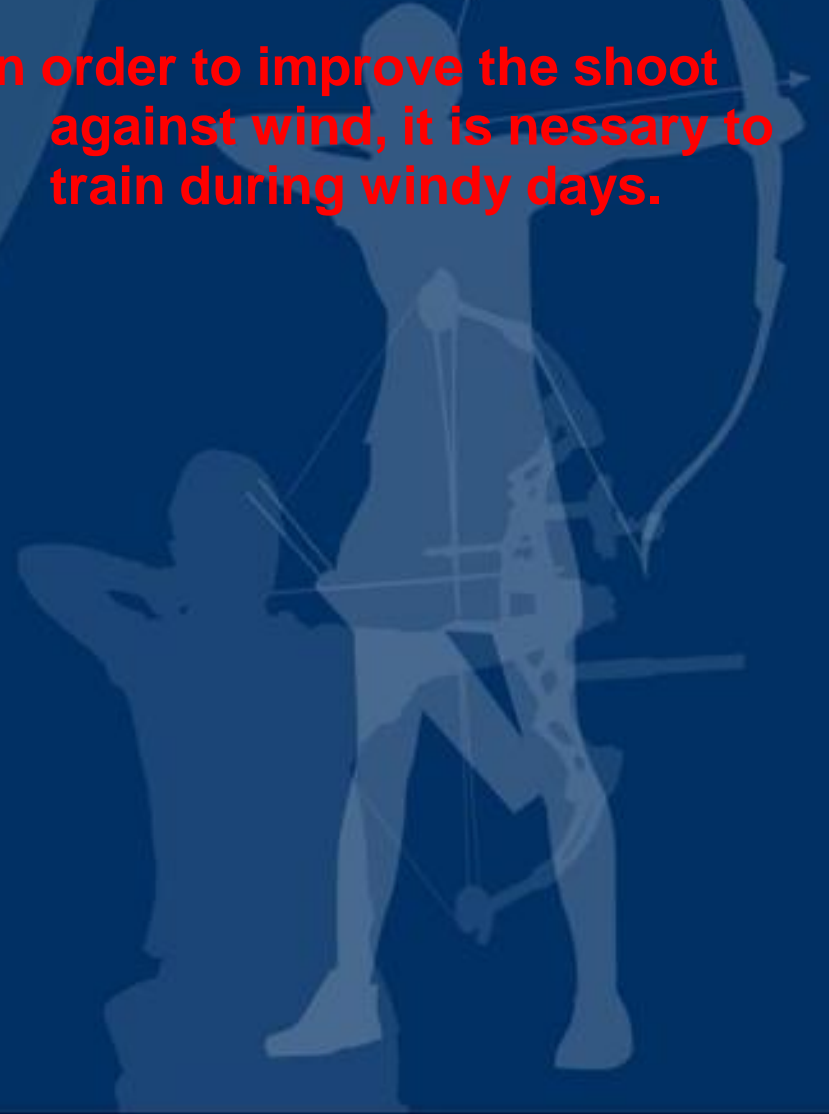
# Weekly planning model – Competitive physical training

Gym 3

Field Circuit

**In order to improve the shoot against wind, it is necessary to train during windy days.**

Gym 4





## **PART 3**

**Energy expense, supplementary exercise and  
hydration**

**Diet & calories**

**Supplements**

**Health indicators**



# Energy expense

Energy comes from aerobic metabolism and muscles reserves of ATP and PC.

It is very important to maintain adequate supply of energy

NEGATIVE SPLIT????



Prior to the competition nutritional status can affect these skills, HdC content, protein and fat diet has significant effects on cognitive functions by influencing fatigue, attention, reaction time and alertness.

(Lloyd, Green y Rogers; 1994. Mood and cognitive performance effects of isocaloric lunches differing in fat and carbohydrate content. *Physiol Behav.* 1994. Jul; 56(1): 51-57. Benton, Ruffin y Lassel; 2003).

The delivery rate of dietary carbohydrates affects cognitive performance in both rats and humans. *Psychopharmacology (Berl)*. 2003 Feb;166(1):86-90

# Energy expense

Estimated expense by heart rate monitor:

**Technical + Physical training session 950 Cal/day and 1.400 Cal./day**

**Competition (Round) 400 Cal. and 800 Cal.**

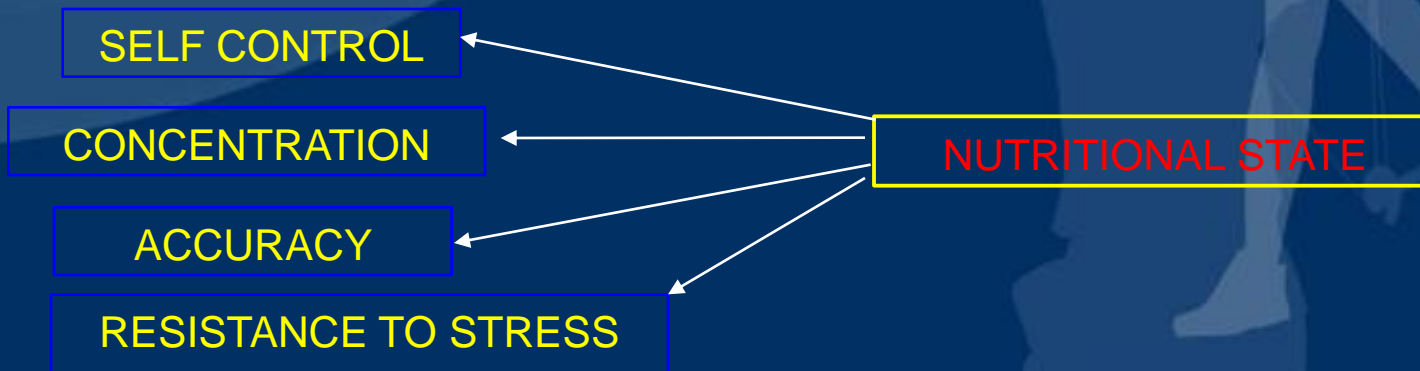
The basal metabolic rate must be added to these amounts.

(H) TMB =  $(10 \times \text{weight in kg}) + (6,25 \times \text{height in cm}) - (5 \times \text{age in years}) + 5$

(M) TMB =  $(10 \times \text{weight in kg}) + (6,25 \times \text{height in cm}) - (5 \times \text{age in years}) - 161$

Harris-Benedict revised by Mifflin y St Jeor in 1990

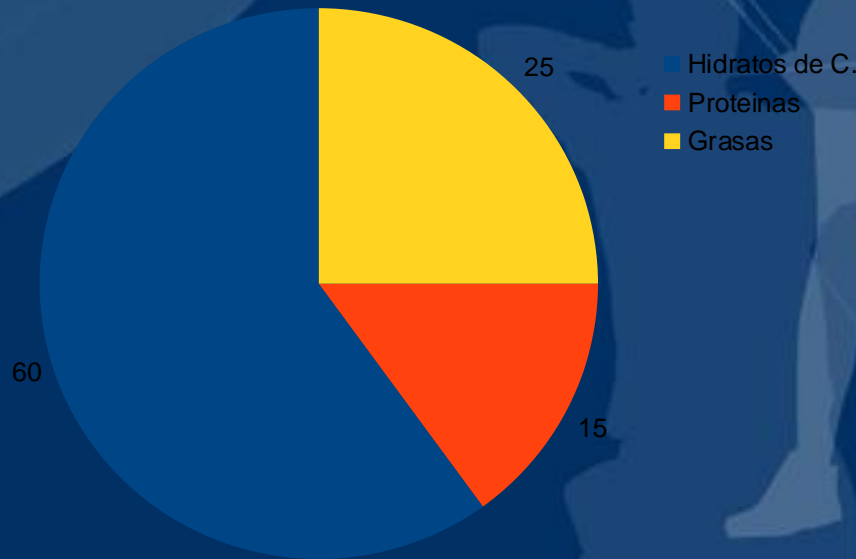
**Total=1.500/2.000 Cal/d. Women and 2.500/3.100 Cal/d. men**



# Energy expense

## *Archer's dietary needs*

- Carbohydrates during training and competition: 60-65% of the total energy
- Proteins should be between 15-20%
- Fat: 20-25%. Don't restrict except in case of overweight. It is very important for the intensity and duration of the competition.



# Energy expense

- Extra carbohydrate and fat may influence negatively the perceptual and cognitive abilities.
- During competition avoid fatty foods (fried, battered, sauces) because of its long stay in the stomach.
- Candies and sweets. High glycaemic index. After the initial peak may lead to hypoglycaemia.
- Provide low glycaemic meals.
- Maintain the levels of L-tryptophan and brain serotonin.

Hidratos de carbono sin sabor a azúcar		Hidratos de carbono con sabor a azúcar	
Categorías de alimentos	Índices glucémicos	Categorías de alimentos	Índices glucémicos
<b>Pastas</b>		<b>Azúcares</b>	
- Fettuccinis	62	- Glucosa (tableta)	102
- Macarrones	64	- Glucosa (polvo)	97
- Raviolis con carne	39	- Fructosa	30
- Espaguetis (enriquecidos con proteínas y hervidos 7 min)	37	- Sacarosa (azúcar de mesa o sucrosa)	65
- Espaguetis blancos (clásicos, hervidos 8 min)	51	- Lactosa (azúcar de la leche)	48
- Pastas integrales	47	- Miel	73
- Fideos	55		
<b>Cereales en grano</b>		<b>Frutas</b>	
(no hay que confundir con los preparados para el desayuno como, por ejemplo, el muesli)		- Manzana	36
- Trigo partido (cocido 20 min)	46	- Zumo de frutas	40
- Cuscús (sémola de trigo duro)	61	- Albaricoque	31
- Maíz	68	- Plátano	53
- Arroz blanco	55	- Uva (con piel)	25
- Arroz integral	50	- Zumo de uva	48
		- Kiwi	52
		- Mango	55
		- Naranja	43
<b>Pastelería</b>		<b>Cereales para el desayuno (marca de referencia Kellogg's)</b>	
- Croissant	67	- All Bran (28% de son)	30
- Tarta de fruta casera	59	- Corn Flakes	77
- Quiche de queso	55	- Crispies	87
- Pan integral al 80%	70	- Muesli (valor medio de 4 marcas)	66
- Baguette	85	- Arroz Krispies	82
		- Special K (enriquecido con proteínas al 15%)	54



# Energy expense

- Minimally processed food.
- Facilitate recovery through diet, supplementation and adequate rest.
- Check the level of sweating and the colour of the urine.
- Base the diet on carbohydrates with low glycaemic index, oily fish, lean meat, eggs and milk.
- The day before the competition, compensate with glycogen.
- Cola drinks, coffee or tea can increase nervousness.\*

Proceso de recuperación	Tiempo mínimo de recuperación	Tiempo máximo de recuperación
- Restauración de las reservas intramusculares (ATP + CP)	- 2 minutos	5 minutos
- Restauración del glucógeno intramuscular	- 10 horas (después de un ejercicio continuo concéntrico)	46 horas
	- 5 horas después de un ejercicio intermitente	24 horas
	- 48 horas después de un ejercicio con un régimen de contracción muscular excéntrica	72 horas
- Restauración de las reservas de glucógeno hepático	- Desconocido	12-24 horas
- Disminución de la concentración sanguínea y muscular de ácido láctico	- Para la concentración sanguínea: 30 minutos con un ejercicio de recuperación activa al 50-60% del $\dot{V}O_2$ máx.	1 hora
	- Para la concentración intramuscular: 1 hora con recuperación pasiva	2 horas
- Restauración de las reservas de oxígeno	- 10-15 segundos	1 minuto



# Energy expense

- Control of diet parameters
- Anaemia (girls)
- Testosterone / Cortisol
- Body composition
- Glycaemia
- Blood pressure
- Multivitamins
- Frequent analysis



# Example of the dietary schedule

día	Comida	Menú	% HdC	% Grasas	% Proteínas	Kcalorías	total Kcal/día (aprx)
Viaje	Desayuno	leche con cereales ó 2-3 tostadas	75	10	15	400	2050
	Almuerzo	1 barrita + 1 zumo	60	15	5	200	
	Comida	Pasta boloñesa+ ensalada + pastelito + pan	60	20	20	750	
	Merienda	Sandwich de jamón y queso + zumo	65	20	15	200	
	cena	Pollo + arroz con verdura + macedonia	50	25	25	500	
Concentración 1	Desayuno	leche con cereales ó 2-3 tostadas/croasan	70	20	10	450	2200
	Almuerzo	sandwich pavo/jamón – isostar	65	10	25	250	
	Comida	Filete ternera+arroz+pan+fruta	60	15	25	800	
	Merienda	Pastelito+ fruta- isostar	80	15	5	200	
	cena	Pescado+ensalada+pan+yogur	55	15	35	500	
Concentración 2	Desayuno	leche con cereales ó 2-3 tostadas+yogur	70	10	20	450	2600
	Almuerzo	Sandwich de jamón y queso + fruta-isosar	65	20	15	300	
	Comida	Pasta+pechuga pollo plancha+ pan +fruta	65	10	25	1000	
	Merienda	2 barritas + fruta- isostar	80	15	5	350	
	cena	tortilla francesa+arroz+yogur	55	15	30	500	
Round	Desayuno	leche con cereales ó 2-3 tostadas+yogur	70	10	20	450	2800
	Almuerzo	Sandwich de jamón y queso + fruta-isosar	65	20	15	300	
	Comida	Pasta+pechuga pollo plancha+ pan +yogur+ fruta	65	10	25	1100	
	Merienda	2 barritas + fruta- isostar	80	15	5	350	
	cena	Pescado+arroz+pan+fruta+yogur	60	10	30	600	
Eliminatorias	Desayuno	leche con cereales ó 2-3 tostadas+yogur	70	10	20	450	2700
	Almuerzo	Sandwich de jamón y queso + fruta-isosar	65	20	15	300	
	Comida	Filete ternera+arroz+pan+yogur+fruta	60	15	25	1000	
	Merienda	2 barritas + fruta- isostar	80	15	5	350	
	cena	tortilla francesa+arroz+fruta+yogur	55	15	30	600	
	Desayuno	leche con cereales ó 2-3 tostadas+yogur	70	10	20	450	

Día	Hora	Día 20 de junio
Desayuno	06:45	leche con cereales ó 2 tostadas y yogur
9:00-13:00		<b>ENTRENAMIENTOS OFICIALES</b>
Almuerzo	10:30	1 barrita + 1 zumo+bebida isotónica durante entrenamientos ofic.
9:00-13:00		<b>ENTRENAMIENTOS OFICIALES</b>
Comida	13:00	Pasta/pollo/fruta ó arroz/carne/fruta
15:00-17:00		<b>ENTRENAMIENTOS OFICIALES</b>
Merienda	16:00	pastelito+zumo+ bebida isotónica durante entrenamientos ofic.
Cena	20:00	Pescado/pollo/arroz/fruta

Día	Hora	Día 21 de junio
Desayuno	6:45 Chicos 7:30 Chicas	leche con cereales ó 2 tostadas y yogur
9:00-11:00		<b>Competición round chicos</b>
Almuerzo	Chicos NO	Suplementación durante el round Isostar Long Energy Endurance
	Chicas: 11:00	sandwich pavo
Comida	Chicas: 13:00	Pasta/pollo/fruta
	Chicos: 12:00	
16:30-18:30		<b>Competición round chicas</b>
Merienda	Chicas NO	Suplementación durante el round Isostar Long Energy Endurance
	Chicos: 16:00	sandwich pavo
Cena	20:00	Pescado/pollo/arroz/fruta

Día	Hora	Día 22 de junio
Desayuno	6:45 Chicos 7:30 Chicas	leche con cereales ó 2 tostadas y yogur
9:00-11:00		<b>Competición Eliminatorias chicos</b>
Almuerzo	Chicos NO	Suplementación eliminatória Isostar Long Energy Endurance+barrita
	Chicas: 11:00	sandwich pavo
Comida	Chicas: 13:00	Pasta/pollo/fruta
	Chicos: 12:00	
16:30-18:30		<b>Competición Eliminatorias chicas</b>
Merienda	Chicas NO	Suplementación eliminatória Isostar Long Energy Endurance+barrita
	Chicos: 16:00	sandwich pavo
Cena	20:00	Pescado/pollo/arroz/fruta

Día	Hora	Día 23 de junio
Desayuno	6:45 Chicos 7:30 Chicas	leche con cereales ó 2 tostadas y yogur
9:00-11:00		<b>Competición Eliminatorias Equipos Chicos</b>
Almuerzo	Chicos NO	Suplementación Isostar Long Energy Endurance +barrita
	Chicas: 11:00	sandwich pavo
Comida	Chicas: 13:00	Pasta/pollo/fruta
	Chicos: 12:00	
16:30-18:30		<b>Competición Eliminatorias Equipos chicas</b>
Merienda	Chicas NO	Suplementación Isostar Long Energy Endurance +barrita
	Chicos: 16:00	sandwich pavo
Cena	20:00	Pescado/pollo/arroz/fruta

Día	Hora	Día 24 de junio
Desayuno	6:45 Chicos	leche con cereales ó 2 tostadas y yogur
10:00-13:30		<b>Competición SEMIS Chicos/Chicas</b>
Almuerzo	Chicos NO	Suplementación Isostar Long Energy Endurance+barrita
	Chicas NO	
Comida	13:30	Pasta/pollo/fruta
16:00-19:30		<b>Competición FINALES Chicos/Chicas</b>
Merienda	Chicas NO	Suplementación Isostar Long Energy Endurance+barrita
	Chicas NO	
Cena	20:30	Pescado/pizza/pollo/arroz/fruta



# Supplementation

## Training:

- Pure glutamine: 3-4 gr./day after training
- Active supradyn with breakfast
- September-March: Vitamin C 1gr./day
- Isostar or water during the sessions (specially spring and summer)
- 90-100 Cal. Every 2 hours if the training lasts more than 4hours

## Competition:

- Creatine monohydrate: maintenance dose 2gr/day
- Long Energy Endurance (Isostar).
- Interesting to check the following link: [www.wada-ama.org](http://www.wada-ama.org)
- Carry out a proper warming up in order to activate metabolism, prevent swelling sensations derived from glycogen

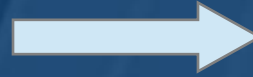
# Supplementation

- Other products potentially relevant for the performance because of their effects on accuracy, alertness, attention, decision making, memory, visual acuity, balance, agility, and reaction time:

Producto	eficaz	dosis	mecanismo acc	referencias
Cafeína	SI	5 – 6 mg/kg	inhibición de los sitios receptores de adenosina	Foskett (2009); Duncan(2012); Stuart (2005); Duvnjak-Zaknich et al. (2011)
BCAA	??	5-10 gr/L	impactan la síntesis de serotonina	Hassmen (1994); Blomstrand (1997); Chevront (2004)
HdC	SI	Solución 5-10% +electrolitos	mantenimiento de la concentración de glucosa sanguínea	Welsh (2002); Winnick (2005); Collardeau (2001)
Flavonoles de cacao	??	500-900 mg	aumento de la perfusión cerebral inducida por la vasodilatación dependiente de óxido nítrico	Scholey (2010); Field (2011); Francis, (2006); Fisher., (2006)
Ginkgo biloba	NO	X	X	Gorby et al., 2010; Laws et al., 2012
Panax ginseng	??/NO	200-600 mg	modulan la actividad del eje hipotalámico-pituitario-adrenal	Geng et al., 2010; Gorby et al., 2010
Guaraná	??	75-300 mg	presencia de cafeína en las semillas de guaraná	Kennedy et al. (2004); Haskell (2007)
L-teanina	??	50-200 mg	función cerebral influyendo en las concentraciones de los neurotransmisores dopamina, serotonina y ácido $\gamma$ -aminobutírico	Bryan, 2008
Tirosina	NO	100-300 mg/kg	mejora la habilidad de las neuronas para liberar neurotransmisores, evitando así los déficits cognitivos	Lieberman, (2003); Watson (2012)

# Hydration

DEHYDRATION

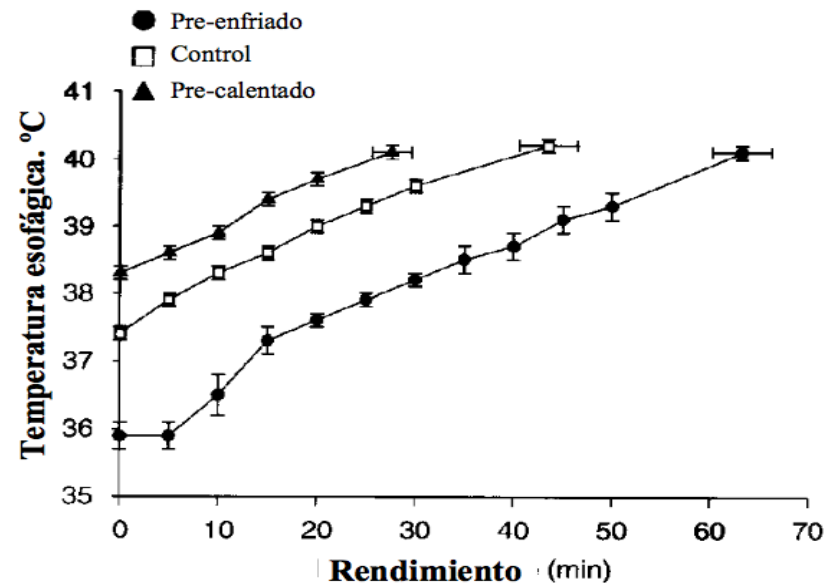


Affects:

- Brain
- Muscles
- Circulatory system

- Numerous recommendations
- Check the level of sweating and the colour of the urine to prevent and avoid dehydration.
- Know the environmental and physical characteristics of the place where the competition will take place (humidity, wind, altitude...)

400-500 ml/h competition  
Fresh water (15°-20°)

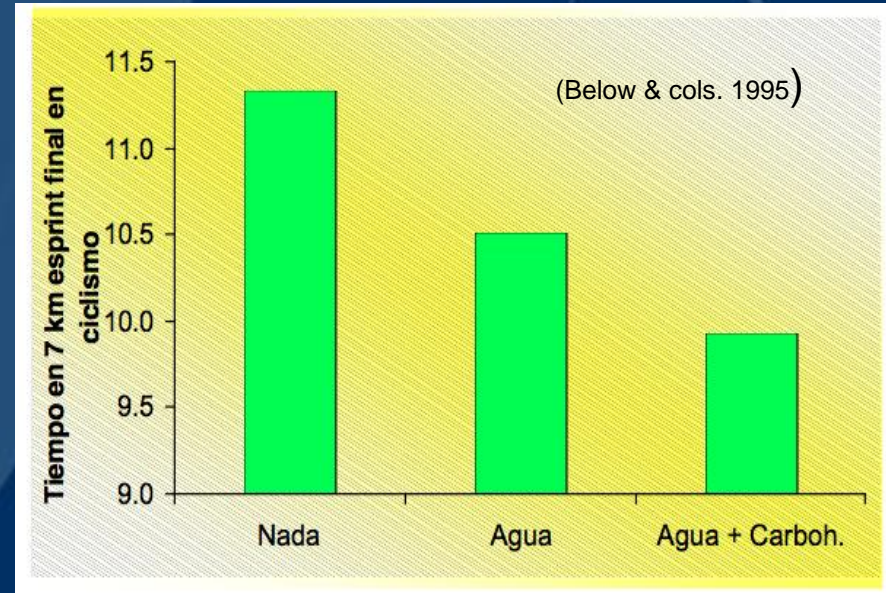


# Hydration

- The cardiovascular system is very sensitive to dehydration.
- For every litre of sweat , the internal temperature increases 0'3°.



- The perception of fatigue increases.
- It incorporates electrolytes (Na,K)  
Avoid Caffeine (?)



## AVERAGE NUTRITIONAL VALUES:

Serving = 79 g (makes up 500ml of drink).  
Flavour: orange.

	Unit	Content per 100g	% R.D.A.* per 100g	Content per serving	% R.D.A.* per serving
Caloric value	kCal	385		304	
Caloric value	kJ	1638		1294	
Carbohydrates	g	95,5		75,4	
- of which Sugars	g	30		23,7	
- of which Organic acids	g	1,1		0,9	
Sodium	g	0,25		0,2	
Vitamin E	mg	8,4	84 %	6,6	66 %
Vitamin C	mg	48	80 %	38	63 %
Vitamin B1	mg	0,95	68 %	0,75	54 %

\* R.D.A.: Recommended Daily Allowance

# Injuries and prevention

## *Prevention = Performance*

Incidence areas of injuries that limit training (in %):

Región	%
<b>hombro</b>	<b>56</b>
<b>dedos</b>	<b>20</b>
<b>lumbares</b>	<b>10</b>
<b>tobillo</b>	<b>5</b>
<b>antebrazo</b>	<b>4</b>
<b>codo</b>	<b>2</b>
<b>muñeca</b>	<b>1</b>
<b>Cuello</b>	<b>1</b>
<b>rodilla</b>	<b>1</b>

\* Source: National team, 2010-2013



# Injuries and prevention

- Women are more prone to injury.
- Recurve body parts are usually more injured than compound ones. (\*)
- Tendinopathy biceps brachial and rotator cuff involve more frequent injuries (due compression)
- 2 out of 5 archers are injured during their career.
- Related to technique rather than to physical preparation
- A suitable enforcement is a preventive factor.
- 7/1 relationship br. rope/ br. arc

# Injuries and prevention

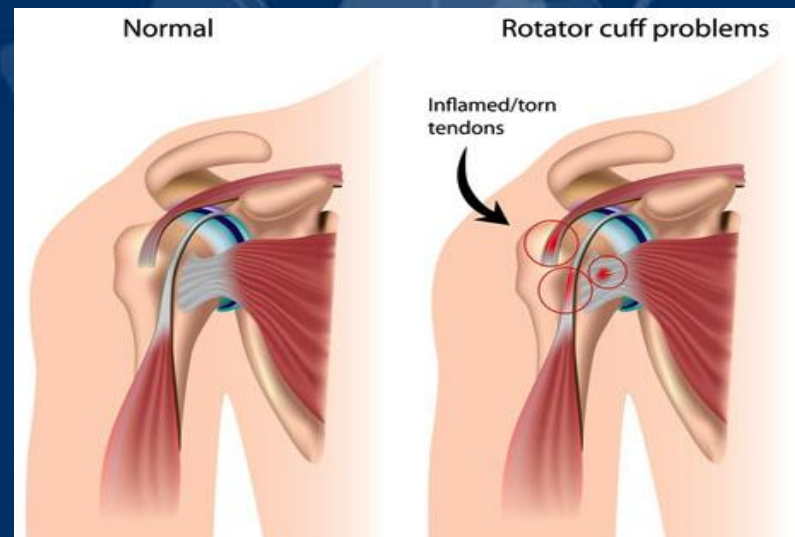
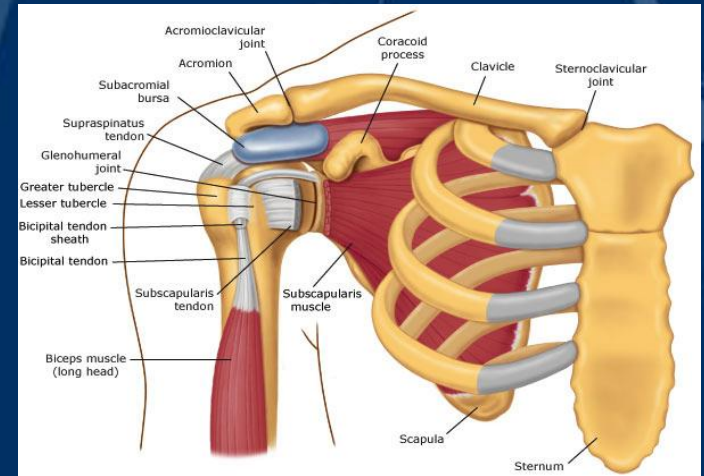
The tendon joint under pressure provokes ischemia and oxygen deficits in the tendon

Excessive stress on the biceps is associated with AC-compression.

Changes in muscle balance of the rotators.

Set down the arrows involves extra stress due the overweight.

Fatigue and micro-breakages lead to repair nodules that thicken the tendon.



# Injuries and prevention

Prevention → Reduce stress on critical areas



Muscular elasticity. Rise the head, humeral (biceps/triceps) and muscle toning. (Chest and dorsal)



Requires dorsal musculature  
Bigger  
Stronger  
Higher probabilities of synergies  
More tolerance to fatigue



Free weight

Suspensions

Tractions

Compressions

Specific exercises for neuro-muscular coordination

# Injuries and prevention



- To solve possible problem related to the technical training
- Good physical condition is the basic principle of prevention
- To fix any pain the archer may have
- Early rehabilitation instead of rest. Use of accessories when training.
- Immobilization results in a loss, sometimes irreversible in the mass of collagen (depending on duration and age).
- Early mobilization favours remodelling and repair.
- To apply cold stuff after training (it doesn't limit hyperaemia or the oxygen saturation, but facilitates venous return).
- Work in overweight eccentric normalizes the structure of the tendon.

*Thank you!!*

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