

## Modern Aspects of Talent Selection – A Process from Youth to Adult Sports

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### **ABSTRACT**

*Modern aspects of Talent selection – a process from youth to adult sports means: Get sports ahead. It includes research, consulting and sports project management.*

*It means: Active Sourcing, Data-Driven-Recruiting, On-Boarding-Processes and personal advice in different sports kind.*

- Requirement analysis
- Sports- and competitive analysis
- Data-Driven Recruiting
- Talent Pool and network
- Fit –Add Analyses

*To find the right candidate in different sports kinds means if he had the right power, endurance, resilience, willed strength for a top performer – for this you need a specially ask technology and different steps for an individualtalent finding.*

*With an international net work and scientifically methods you will find personnel of for your sports kinds.*

*The coach today must be also very automotive with connection to Life Science, Engineering or Digital Business, a little bit finance-specialist, IT-Manager or Marketing-Profile!*

*Search for young professionals, potential carrier and specialists or young experts – for this you need a right feeling and lots experiences.*

*These performance carrier have an over average high implementation tempo, an extraordinarily will to have success and unprecedented performance level!*

*And you need a team for sports training, sports medicine, and sports psychology experts of Kinanthropometry and Nutrition.*

*There are so many aspects for the right talent selection in youth sports:*

1. Sports Nutrition, Periodic of Training and Sports Performance in Youth Sports
2. Sensitive periods of brain during growth and development of children
3. The type of sport
4. Different periodic of training
5. The amount of training you do
6. The amount of time you spend doing the activity or exercise
7. Which age
8. What influences the energy consumption of the young sports men?  
*Possible influences factors for the energy consumption are: Anthropometrical Parameter (Age, Gender, Weight, Muscle Mass, Height), Diseases, Injuries, Sports kinds, Trainings terms, Training volumes, Training intensity, Trainings frequency, Trainings fitness, Profession/school level), Climate influences, which kind of food and specific dynamically force, food induce thermo genesis.*
9. Which biological age
10. Which growth dynamic and
11. How to realise the high loading during childhood.

**Targeted talent management and the systematic selection and promotion of performance-focused means highly motivated junior executives.**

*But it is also a long-term performance development with very different steps and success.*

*For example during early childhood you have every time beside of the young sportsmen the parents which influence the development of the young talents!*

*Every time you have in the background the critical phases of the youth development like puberty. This time is very important for the future stability of the adult sportsmen.*

*We have brought together tradition, talent and expertise in the selection of our exclusive Premier Cru line of Sportsmen.*

*The overall scenario of human resources development spans systematic selection in the recruitment process, talent development along differentiated career!*

*Keywords: Biological age, Energy Consumption, Functional Anthropology, Growth Dynamic, Sports Nutrition, Talent Selection, Identification and Management, Training and Loading, Youth and Children Sports.*

Modern aspects of Talent selection – a process from youth to adult sports means: Get sports ahead. It includes research, consulting and sports project management.

It means: Active Sourcing, Data-Driven-Recruiting, On-Boarding-Processes and personal advice in different sports kind.

### **Growth as a mirror of health**

James Tanner [1986] wrote these important words which since then have become fundamental to the understanding and the concept of auxology. But measuring growth and development is not only important for health issues - anthropometry belongs to the basic tools of routine screening programs in Public Health - it is similarly essential for **sports of youth in most of sports kinds**, as well as for security purposes, for the usability of industrial products for sports, it has become routine for car and clothing industries, for furniture, housing, and actually all aspects of modern environment.

You have to see the **GROWTH REFERENCES AND GROWTH CHARTS**

The commonly used **Tanner-Whitehouse growth** (Tanner et al. 1965) describes the development of height and weight references for British children. They consist of tables of mean values, standard deviations and percentiles.

And they provide **percent** of the cross sectional and individual-type, both instantaneous and whole-year charts, with a particular focus on pubertal growth, and how to present it on the chart. The charts show the effect of tempo on growth velocity: peak height velocity of early maturing adolescents is usually higher than peak height velocity in late mature-the curve of the average peak height velocity is flatter than individual pubertal height velocity.

These aspects reflect in all parts of children and youth training and for the right talent selection in youth sports!

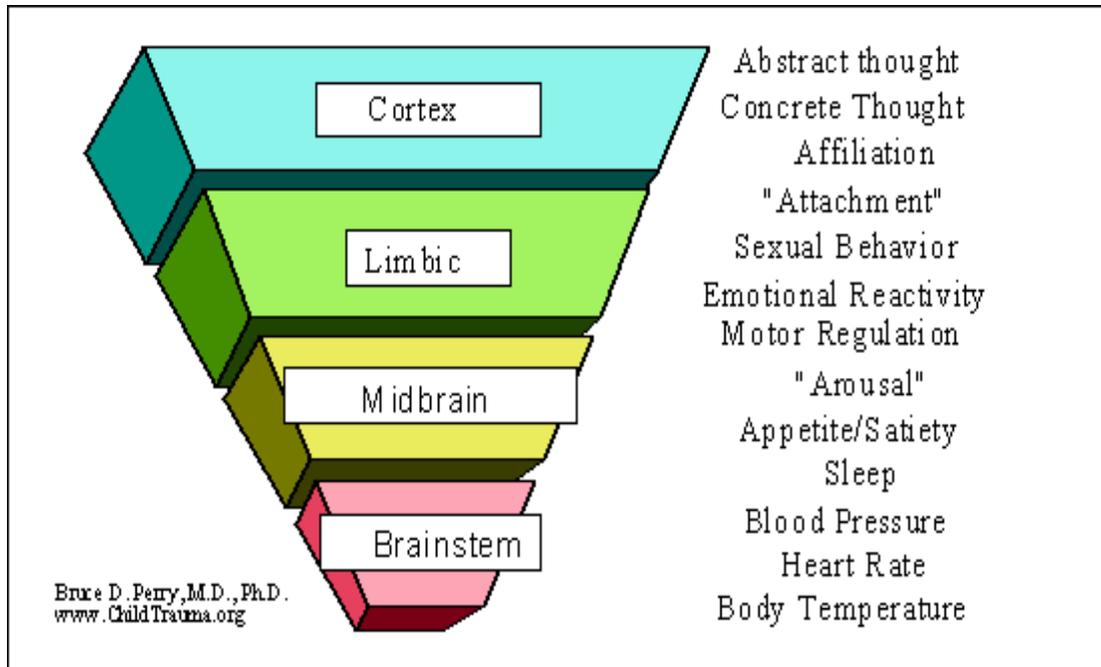
### **1. Sports Nutrition, Periodic of Training and Sports Performance in Youth Sports**

Sports and nutrition form the whole body of the children, beginning with the brain development and the growth process of the somatic parameters.

The main fundamental for young sportsmen, training and nutrition including drinking are the sensitive periods of brain development during growth from birth up to childhood to adult

person what is described in children's mental health and the neurosciences (Perry 2015) (Figure 1).

**Figure 1: Sensitive periods of brain during growth and development of children**



Nonetheless, the number of synapses remains at this peak, over-abundant level in all areas of the cerebral cortex throughout middle childhood (4-8 years of age). That means for sports children: beginning to find first talents according coordination and to develop the right form of nutrition during these times and it is finalised with the end of growth and development of the young sports children during the age of 18 years.

In relation to hard sports overloading and strain is reported about catch-up-growth (Ashworth and Millward 1985).

Nutrition is during this process one aspect which influences the growth process.

That means that you have every time to analyse following two aspects:

- Compact nutrition → eating
- Fluid nutrition → drinking

In Germany we call: "Essen und Trinken halten den Körper zusammen" That means: "Eating and drinking keep the body together".

What influences the energy consumption of the young sports men? Possible influences factors for the energy consumption are:

Anthropometrical Parameter (Age, Gender, Biological Age, Weight, Muscle Mass, Fat Mass, Bone Mass, Height)

Diseases,

Injuries,

Sports kinds,

Periodic of training,

Trainings terms,

Training volumes,

Training intensity,

Trainings frequency,

Trainings fitness,  
Profession or school level,  
Climate influences.

The kind of food and specific dynamically force, food induce thermo genesis (Malina 1987, Herm 1975, 1988, Konopka 2006, Weineck 2009).

But the biggest problem is that there are so many possibilities for right nutrition – also in sports for children!

In practical work we have different possibilities for using food.

You can recognise for example

- Ten foods for children usefully for brain and exercising
- Calories, Carbohydrates, Fluids, Iron, Vitamins, other Minerals, Protein

If you have a look to the ten foods for children which are usefully for brain and exercising than there is the example of following overview:

- **1. Eggs**
- **2. Greek Yogurt**
- **3. Greens**
- **4. Purple Cauliflower**
- **5. Fish**
- **6. "Clean" Meat**
- **7. Nuts and Seeds**
- **8. Oatmeal**
- **9. Apples and Plums**
- **10. Turmeric**

There are also so many questions with lots of question marks as it were there the right Nutrition? Some questions are for example which influences have :

- Energy gels?
- Energy bars?
- Drinks?
- Shakes?
- Minerals?

And there are also following other questions possible:

- Nutrition advisor?
- Nutrition before sports?
- Nutrition during sports?
- Nutrition after sports?

In our experiences are following recommendation possible and however, the amount of each food group you need will depend on:

- The type of sport,
- The amount of training you do,
- The amount of time you spend doing the activity or exercise,
- Which age?

During start and time of coaching and training the children and youth sportsmen need to learn:

- How long before exercising is best for you to eat?
- How much food is the right amount for you?

It is very difficult if there are in nutrition sciences so many dietary supplements possible how the following one example shows:

- **Top Substance of content**
- **Amino Acids**
- **Avena Sativa**
- **BCAAs**
- **Beta Alanin**

- **Chitosan**
- **Casein**
- **Chondroitin**
- **Chrome**
- **CLA**
- **Creatin**
- **Ecdysteron**
- **Egg Protein**
- **GABA**
- **Ginseng**
- **Glucomannan**
- **Glucosamine**
- **Green tea**
- **Guarana**
- **HCA**
- **HMB**
- **Coffein**
- **Carbohydrate**
- **Collagen**
- **Cre-Alcalyn**
- **L-Arginin**
- **L-Carnitin**
- **L-Glutamines**
- **L-Tryptophan**
- **L-Tyrosine**
- **Maca**
- **Phaseolin**
- **Phosphatidyserin**
- **Protein**
- **Pyruvat**
- **Soya Protein**
- **Stevia**
- **Synephrin**
- **Whey Protein**

The both marked parts **Creatin** and **L-Carnitin** are described here as an example short and give the difficult aspect for using the right food.

We can recognise some important aspects between the big different views of content how the following example for the L-Carnitin or Creatinine, shows in the following overview:

***One example with L –Carnitin:***

- L - Carnitin e.g. shall increase fat burning. But it is not Fat burner!
- This substance produced the own body and make sure, that fats go into the Mitochondria, the power stations of the cells, where they burning.
- True to the motto, “more is better” shall L - Carnitin also help, worrisome fat to lose.
- What is with Antioxidant?
- During physical training develop and increase so called free radicals, which can damage the somatic cells. If Antioxidant like Vitamins A, C and E the free radicals can catch so they promote very often as dietary supplement.
- So the German Society for Nutrition (DGE) thinks nothings from such dry chemicals and pills.
- With healthy and balanced nutrition the body get all things what he need.

- Generally is effective for sports men to use adequate nutrition: a slow fat, varied and balanced diet with a high part of complex carbohydrates and reach vegetables and fruits.
- If there is not jet a deficiency than there is no effect if you use more L-Carnitin.
- That there develop a deficiency it is very extreme implausible. At most vegans, which every animal food refuse have according experts the problem to use too less L-Carnitin.

***And the other aspect for Creatinine:***

- Alone for very less substances exists clearly evidence for an increasing of sports performance.
- For example for Creatinine.
- Elasticity and fast power sports men allow these substances effectively an intensive quantity of training with increasing of sports performance.
- Creatinine is in the human body together with a group of phosphates in complex with Creatinine phosphate. This chemical combination is a very important source of energy and allows a short time intensive muscle work.
- But side effects like increasing of body mass are not eliminated.
- There are no longitudinal studies about this.

So we have to differentiate the nutrition for adult sportsmen and sports children Table 1.

**Table 1:Right Nutrition for Top Training Goals for adult sportsmen and sports children(Herm 1988)**

**Right Nutrition for Top Training Goals for adult sportsmen and sports childr**

<u>Adult sportsmen</u>	<u>Sports Children</u>
Muscles build up	Not before puberty
Catabolism of fat	If there are problems
Endurance development	Yes
Better regeneration	Yes
To reach the right Muscles definition	Muscle feeling and coord
Better fitness	Yes
Strength development	Not before puberty possi
Weight increasing	According the sports kin
Better health and active life	Yes
Health stabilisation	Yes
Optimisation of mental effort	Yes
Better sexual activity	No
Higher energy level	According the loading
Prevent injury	Yes

***Please realise:***

- Low in fat, varied and balanced diet with high part of complex carbohydrates and rich vegetables and fruits is also ok.

Important is to see the Nutrition and Food chain with:

- **Protein - Eiweiß**
- **Carbohydrate - Kohlenhydrate**
- **Fat - Fett**
- **Vitamins - Vitamine**
- **Mineral nutrients - Mineralstoffe**

- **Fibres - Ballaststoffe**
- **Sugar and Salt - Zucker und Salz**
- **Hydration - Flüssigkeitszufuhr**

Optimal training means that you cannot substitute or compensate bad and insufficient training for any mysterious magic elixirs and

***Nutrition is in some sports kinds more important than in others.***

For example in weight class sports kinds (Judo, Wrestling, Boxing and so on) or in sports kinds like Gymnastics (where the own body must moving).

In other we need a high built up for muscles like throwing etc. or for regeneration phases during or after training.

If for example a cyclist is suddenly without energy it will be for the competition or training important and very often critically.

But Nutrition has not in all sports kinds such a priority.

For sports kids it is quite difficult to calculate the energy requirements if you have to consider the age, the biological development, the sports kinds and so on.

Here are demonstrated some example for **Calorie Consumption in Sports** for adult person and if and which of it can be used to calculate as model for sports children is quite difficult to estimate:

- *How much is the mean Calorie Consumption e.g. of a 75 kg heavily soccer during 90 minutes of a soccer game? How much is that for child soccer?*
- In average you have energy consumption during soccer training of 12 kcal/kg body weight per hour.
- So the calculation would be: ***Calorie Consumption per 90 min game = 12 kcal x 75 kg x 1,5 h = 1350 kcal***
- That means that the soccer needs 1350 kcal energy if he 90 minutes kick.
- *And how much energy needs the soccer during one trainings day? We need also a differentiation for children.*
- *If he is an office worker or a scholar (8 hours) than he has a PAL number (PAL means: Physical Activity Level) for example of 1.4-1.5.*
- Than we hypothesise that he sleeps 8 hours with a PAL of 0.9.
- And during the time left of six a half hours he has done normal daily things like walking (PAL 1.6)
- Than you can calculate following:
- ***Energy consumption sleeping = 75 kg x 1 kcal/h x 8 h x 0,9 = 540 kcal Energy consumption during working = 75 kg x 1 kcal/h x 8 h x 1,5 = 900 kcal Energy consumption for the rest of the day = 75 kg x 1 kcal/h x 6,5 h x 1,6 = 780 kcal loss of digestion = 75kg x 1 kcal/h x 24 h (= GU) x 10 % = 180 kcal specific –dynamical effect = 75kg x 1 kcal/h x 24 h (= basal metabolic rate) x 10 % = 180 kcal.***
- ***If you calculate all data, that you have a daily total metabolic rate of 3930 kcal.***
- It is an important and respectable quantity of energy.
- And it must use lots of food to reach this amount.
- If you keep some certain fundamentals it is to realise.

As example for children and youth estimation of Basal Metabolic Rate (BMR) for different age groups was found:

**Age group Formula**

**3 to 10 years**

$$\text{BMR} = 0.085 \times \text{KG [kg]} + 2.033$$

**11 to 18 years**

$$\text{BMR} = 0.056 \times \text{KG [kg]} + 2.898$$

And as guidance level and references for Energy Input is described:

Age	Male	female
15 upto under 19 years	3100 kcal	2500 kcal

A main point for training and nutrition is the right drinking. But there are also so many possibilities. That's ways here one simple aspect for *Composition of sports drinks*: Most important is water and you can add following contents

- Carbohydrates (e.g. as sugar, glucose, fruit sugar, maltodextrin or fruit syrup)  
Total 60–80 g/litre and please look attention to a
- Good taste and give attention to a
- pinch salt

***For which training do you need a sport drink?***

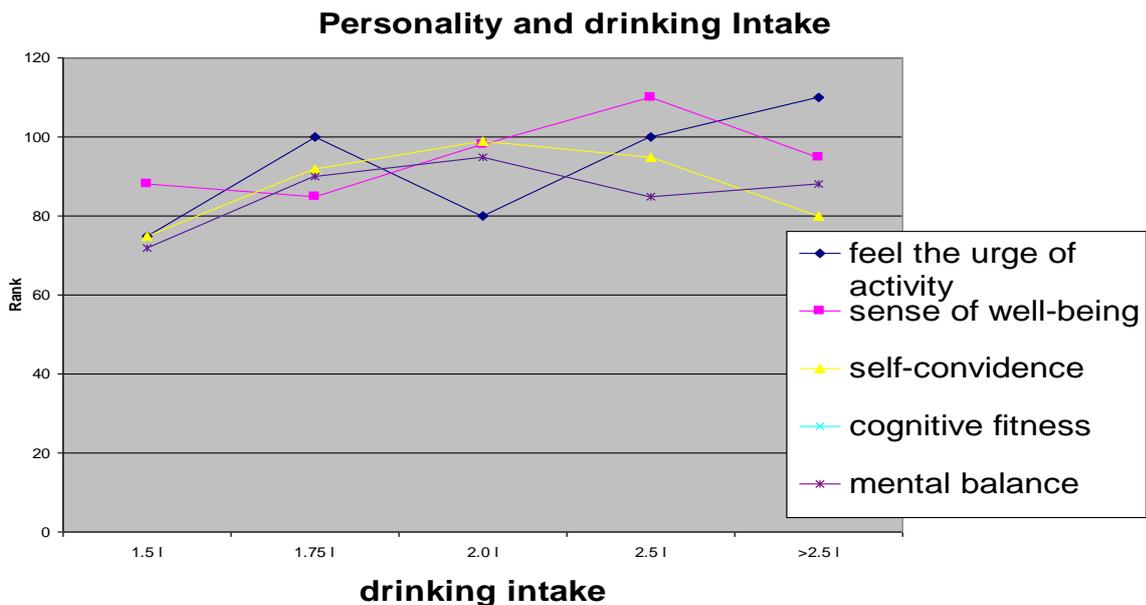
For intensive and long training

- for competitions longer than 60 minutes
- during multiple starts per day
- if there is for want of energy

Here is shown an example of self report of personality (blue) and acuteness of (red or green) as a function of the daily drinking intake of the last time during the first analysis (baseline) in Figure 2.

According the Institute for Sports Nutrition (2012) (iS Sporternährung) we can demonstrate following characteristics of drinking of sports persons.

**Figure 2: Self report about personality drinking intake of sports persons**



For young sports persons you must develop the qualified form of drinks before, during and after sports training. To find the right recipe is described with following three very fast drinking recipes with different content:

- Recipe 1, recipe 2, recipe 3
- 1 Liter Tea
- 1 Liter Water
- 1 Liter Fruit Syrup
- 60 g Sugar  
50 g Maltodextrin  
with different content
- 0–30 g  
60 g  
0–20 g

The right guide is:

- ***Do not use energy drinks!***
- ***Mineral Water is better!***

***So we have to establish Aims of investigations in youth sports for nutrition and growth and development***

There are some questions open and to solve:

Is nutrition an essential component of carrier as athletes? No, definitely not.

Fast-food is that you use lots of unhealthily calories but less high quality foods and nutrients.

We need relevant documents and guidelines with individual measures and projects for Nutrition e.g. section or professional group

***Look that there are not a hint of content of doping/drug in food or drinks!***

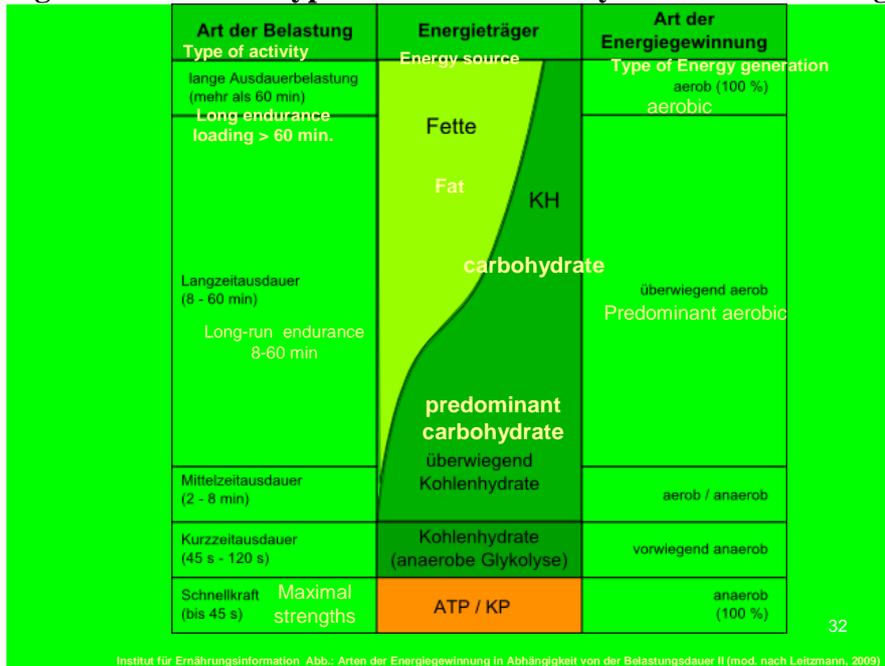
We need relevant documents and guidelines with individual measures and projects for Nutrition e.g. section or professional group like at the Athletic Coaching Camp in Sodepur Kolkata.

There the coaches, parents and children find the best form for a healthy, high-performance and effective form also of drinking in relation to training, coaching, nutrition under and in consideration of all circumstances.

This is very important that all parts beside the sports kids have possibilities to participate under the guidance of the coaching team and persons looking after someone else for the right nutrition.

Furthermore we have to recognize the right relations between type of activity, energy source of the sports children and the type of energy generation of the growing children like demonstrated in figure 3.

**Figure 3: Type of activity and energy generation**



The following examples of Sports Kinds, Requirement and Target show the complexity to decide the procedure for the right nutrition for sports children and a high level training with intensively loading (Table 2).

**Table 2: Examples of Sports Kinds, Requirement and Target**

- Endurance**
- Long time of loading
  - Continuous Loading
  - Endurance ability
  - Marathon, Triathlon
  - Distance event

- Strength Sports**
- Development of maximal power like Weightlifting
  - Increased muscle mass - springiness and coordination
  - Power lifting
  - Bodybuilding

- Endurance with high strength input / Combination of strength, endurance-Continuous endurance**
- Canoeing
  - Cycling
  - Cross-Country-Skiing

- Springiness sports kinds / Combination of strength and speed as well as maximal strength and strength endurance**
- Coordination
  - Push and Throw
  - Jumping
  - Short Sprinting
  - Gymnastics

- Game Sports**
- Interval long term loading
  - Speediness,

- Elasticity
- Coordination
- Soccer, Handball, Tennis

#### **Martial arts**

- Maximal strength,
- Endurance
- Flexibility
- Interval long term loading
- Wrestling,
- Judo
- Karate
- Boxing

#### **None classified sports kinds**

- Less distinctive profile (Coordination, Motoric)
- Archery
- Sailing
- Motorsports
- Horseback, Raiding

## ***2. Methods of investigation of young sportsmen for growth and development and nutrition in different sports kinds***

Our own investigations shows selected analysis of growth and development during one year, measured all 28 days young sportsmen with age between 12 to 18 years. Athletes, Handball Player, Weight Lifter and non Athletes where investigated. Every investigation was morning between 9 and 11 am o clock.

The nutrition status, training loading and performance and somatic development were analysed during the year's period.

Determined were growth characteristics of the biological age, the growth velocity and the growth dynamic of height, weight, muscle mass, bone mass, fat mass with estimation of growth types.

The degree of biological maturity of a child's organism in relation to calendar age is determines with **Biological Age**.

Biological Age is a biological tempo and was described as a process of physiological, biochemical, mental and anatomical aging. Included are genetically and environmental as well as life style influences.

So the tempo at which the biological age of an individual proceeds can differ from calendar age.

Very important is the biological age during growth and development between ages of eight up to eighteen years of mankind.

But the Biological Age is also over the period of adulthood one criteria to estimate the life situation up to the death. For adult peoples Biological Age don't has a relation to growth if the normal human finish his somatic growth of height up to an age of 21 years.

But the Biological Age play a very big role for adult persons for describing of life situation, especially health and life quality. Described is a biological age difference in adulthood's life of more than 20 years. That means that a 60 year old person can be have a biological age of 40 or 80 years.

In Sports for Children an interesting and essential fundamental is the Biological Age (Grimm 1966, Wutscherk 1974, Herm 1975). Very oft biological age is a stronger predictor of

participation in Physical Activity than chronological age. The effects of biological age in sports kinds are different and variable.

So was located for example in normal population age groups between 8 and 18 years an age different in years about more than 5 years between late developed (retarded) child and early developed (accelerated) child. The most children are normal developed, but for all age groups is characterised also the harmonic, proportional and disharmonic, disproportional growth and development as well as phases of high growth stretching of lineation or growth faltering of the body. It's accentuated a periodic of sporadic temporary increments in growth velocity as "Growth Spurts" which are ubiquitous phenomena in growth, and are traditionally looked upon as spurts in amplitude. But in sports kind's biological age is in the average position is some times disarranged to retarded biological age for example in Gymnastics or to accelerated children in power and springiness sports kinds. So the "Biological Age" for coaching plays a very important role in lots of sports kinds since years. It is a basic fundamental for talent selection and development of young sports men.

Considering the complementary concept of amplitude and tempo in growth, growth spurts may also be looked upon as spurts in tempo, for example as temporary changes in progress of maturation. Accentuated is the dynamical and stabile type of growth (Herm 1988).

**The biological age is refers to an individual's age as determined by biological maturation and exogenous influences, which may differ from chronological age** (Tittel and Herm, 1992).

Another problem since years for talent selection is that investigated athletes, aged 12 to 15, training in different teams, found that about 40% of the sample was comprised of early matured, significantly more than their distribution in the general population, while only one fifth of the boys and girls were late matured. There was concluded that despite knowing that the adult performances of late matured children surpass those of early matured. It is very, very important for trainings conception if many coaches were not taking into account the biological age of the athletes and were simply selecting taller, heavier athletes at every age level. Our subliminal programming to select for superior physical abilities at every age can be hard to overcome in lots of sports kinds. So the selection makes **all the differences** in one calendar age group if secondary the Biological Age also the older children will be selected (Herm 1975).

Late developed children may be discouraged if they perceive themselves to be less talented than their early maturing peers, while early developed may themselves drop out if they become discouraged in later adolescence as their early advantage in terms of strength and stamina disappears once maturity levels have evened out and their performances subsequently plateau or decline.

The complex stage of individual growth and development is characterising with Biological Age. As an Index it can define its morphological and physiological traits.

For sport participating children is biological development one main point for long term performance development.

Biological Age in sports was the first time since the fifties one important aspect (Grimm 1966)!

Also in other areas the Biological age is an indispensable index of somatic development in a number of fields of study, e.g. in Forensic Medicine, in Sports Medicine and in Physical Education, etc.

It determines the state of a child's development in respect to a definite age standard and classifies its position in the so-called 'zones of growth velocity'. We can differentiate Biological Age of young children in

1. Early development or Acceleration,
2. Normal or average development,
3. Late development or Retardation.

Biological age may be differing significantly from chronological age if it exhibits disproportions from normal growth in various periods of development (Fig. 6, Young Sportsman with different Biological age). According these investigations you can recognize an age different in years about more than 5 years between late developed child and early developed child.

With development of Sports Medicine (identification, therapy and treatment the risk of injury) and Methods of Functional Anthropology (early warning and diagnosis the risk of injury) also the problem of Biological Age was developed as one main point in youth sports (Herm 1988). The discussion on methods of biological age determination and results in sports has shown the actuality of the problem in former and at present time (Herm 2007, Kaur 2010, Rudolph (2011). "It is commonly agreed that biological age has to be considered from several points of view and that also results should be practically applied at this time demanding intensive training of children" (Novotny 1979).

In Functional Anthropology and Sports Medicine beside Methods of Somatometry, Methods of Body Composition determination and Methods of dynamometry and methodical variant are methods of biological age determinations definitely is main point in teaching and research work.

Grimm (1966) described the Biology of Constitution of children and youth also for sports.

He created the individual biological performance age not alone for adult as well as for children and youth. He has given also the message to see every time the social influences like culture and society. More than hundred years ago already Cramton (1908) wrote: "All observations, records, and investigations of children, whether pedagogical or medical, social or ethical, must regard physiological age as primary and fundamental basis".

According Hermanussen (2013) Biological Age refers to the state of maturation or degree of physical development of human organism. The Biological Age can differ in tempo of an individual proceed and the progress in calendar age. You can find this depends on sex, type of body shape, genetics, ethnicity and environmental aspects. During childhood and puberty girls grow up and develop faster than boys. Girls are two years earlier developed than boys. You can find also different Growth Types in sports like dynamical or stable type (Herm 1988, 2007).

The body or somatic type influenced also the progress of biological age. Pycnomorphy/Endomorphy of both sexes of children tend to develops faster and achieve puberty and maximum height up to 2 years earlier than leptomorphy/ectomorphy. Investigations in India Kaur (2010) shows differences in biological age between ethnicities, they are caused both by environmental (socioeconomic) and genetic factors. You can find secular trends, trends in amplitude and tempos according the recent improvements in living conditions have a led to increase in the rate at which children and adolescents mature.

It is reported about synchronic and synchronic development under consideration of biological age. It is important to see to the Biological Age when identifying the position of particular child development.

There are differences in growth and development by sports children and non sports children. By non sports children is described a reduced physical activity as a global development. Physical activity affects the external skeletal robustness which decreased in German and international children of other countries (Rietsch, Godina, and Scheffler, 2013).

We need biological age also for Final Height Prediction. So you have another final height according the Biological Age by Girls and Boys. And it is for the different sports kinds do you have to estimate the final stature and for this you have usefully also to observe the biological age! Investigations in different sports kinds illustrated and demonstrated the increasing the stature by adult high level sports men in different sports kinds according the talents selection and looking for higher people and according the secular acceleration of the mankind over the period of the last 150 years (Herm 1977).

## 2.1. Methods of Biological Age

There are different methods of biological age determination or possibilities of development diagnosis:

1. *Growth age as a basis (height, weight),*
2. *Ossification (mineralization, fusion),*
3. *Dentition,*
4. *Somatoscopic characteristics with somatic proportion index like Body Development Index with characteristic traits e.g. of the Types of Growth Dynamic,*
5. *Signs of puberty (pubertal age)*
6. *Motoric skill and performance.*
7. *Mental age*

### 2.1.1. Growth age as a Basis (Height and Weight)

Growth with tables of Height and Weight and Body Mass Index (BMI) should be specific for the population concerned. They must be results of a survey in recent years. There seems to be consent that such surveys should be repeated in a 10 year period, as we see in different countries, for instance. Hence, the status of an individual or group can be estimated by comparison with the mean or median or certain percentiles a. s. o. It was created the Height age which is defined by height. Precise values of growth age can be obtained by counting the values of age (in tenths of a year), corresponding to the 50<sup>th</sup> percentile of the child's body height, on the percentile graph of growth.

Whereas today BMI mostly for estimation of overweight and Adiposities used, you will find less information about biological age if it is difficult possible to describe it with BMI. Mostly you will find the information: for this calendar age the body height is to less or too high. Or: This person is too much or to less body weight.

Attention should be paid to that: **The differences in body size between girls and boys in Adulthood are 10 to 12 cm is genetically determined if it is since a long time in the same level.**

One of the first to like to use Height-Weight-tables as a criterion of Biological Age was proposed by Schiötz (1929) 84 years ago.

To estimate the athletic performance of a child or adolescent in a given age, he added the chronological age of the individual, the age belonging to the individual height and the age belonging to the individual weight – the mean from these three ages being the “biological” age. This may seem primitive, seen from our view of point now. But he has been the Basis for more correct evaluation of performance of children and youth. Despite its far-too-simple character, this method makes clear, that extraordinary fitness of an individual, biologically one more years older than other pupils of the same chronological age, cannot be a “standard” of this age group.

Partially we can find scientifically research about types of Growth Dynamic in Sports with using height velocity and velocity of biological age (Herm 1988).

The analysis of long-termed trends in growth and development can be informative about evolving sports performance and health status over time.

Since decades it is well known that also a critical weight is needed for the occurrence of menarche. The existing variability of developmental tempo in children, especially in age of menarche is an enormous chance of adaptation to changing environmental conditions.

### **2.1.2 Ossification (*Mineralization, Fusion*)**

Mineralization of the chondrous parts of the skeleton and epiphyseal fusion (bone age, skeletal age) of bones can be tested by x-raying at most parts of the body. Technically it is preferable to take X-ray pictures from the carpus and the hand. Rotch (1910) proposed the grading of a child's development as early as 1910. It seems characteristic, that this proposal was published in a journal of physical education.

This characterises the degree of ossification in various areas of the child's skeleton from birth to final stages of growth. It implies estimating the number and size of different cores of ossification as well as the closure of epiphyseal slots.

As the hand, wrist and the forearm can be easily posed in a flat position parallel to the film, there is only slight deformation of shadows of bones by divergent X-rays. Therefore it is possible to have exact measurements of diameters of carpal bones or breadth of corticalis, to determine planimetrically the ossificated (mineralizes) area and so on.

Since decenniums years we can use some series, edited by Todd (1937) and Greulich and Pyle (1950), Kapalin at all (1957), Tanner and Whitehouse (1984), Tanner et al (2001) to make a diagnosis of "skeletal age" of an individual. There are some little differences in the standards of these series, because the researches were made in different populations at different time. Therefore we need to know in every case, what a standard was use for comparison. For scientific use, the scoring tables of Tanner (1962) and co-workers are recommended now. In some clinical handbooks this is neglected – but it is very important. There are other standard-books of normal and pathologic development of hand) was found not be valid for girls of Berlin from Groh, Schorr, and Strass (1967), their height and weight according to the norm of their age group.

We often do not know, if deviation from given standard in another population (eventually not subjected to intensive research till now) may result from genetic factors or from environment.

Lee (1971) for example found a disparity against Greulich and Pyle Atlas in Chinese children from Honkong. Ossification of proximal parts (distal ends of radius and ulna, carpal bones) was delayed. But middle and distal phalangeal parts were ossificating faster. It was not possible to break up this effect into genetic causes and environmental factors. Important is that osseous changes continue to occur at all age.

For sports participating children mineralization of the chondrous parts of the skeleton and epiphyseal fusion (bone age, skeletal age) **tested by x-raying** is not easy and difficult for a great population of children during talent selection. You have the big problem of exposure dose of x-rays which are dangerous for growing children!

### **2.1.3. DENTITION**

It is also as a basis for biological age diagnosis. Dentition is a more simple but exact method. To inspect the oral cavity is a very practicable and useful method for screening great of children and youth also in sports.

Dental age is determined according to the state of maturity in the first denture (milk teeth) and the second (permanent) denture. The index of dental age is evaluated by comparing the stages of eruption in different teeth by means of direct inspection or on the basis of X-ray photos. Counting developmental stages from X-ray photos also makes it possible to observe the state of denture before eruption, i.e. from the rise of the dental pouch to the complete formation of the tooth root Grimm (1966).

It is also possible to use the method of so-called dental degrees, the evaluation of which is based on determining the number of teeth cutting their way from jaws or scrutinising the state of eruption in a definite group of teeth. An adequate number of teeth, present in a given chronological age, are considered as the index of maturity. This is based on the assumption of

linear dependency between dental stages and chronological age. This method is characterised by simple diagnostics and does not presuppose X-ray examination.

You can describe the dentition age for babies and infants between 5 and 35 month of age, but for sport the biological age determination is with the eruption of permanent dentition starts around the age 6 years, again with broad inter individual variance, and it's completed in young adults with 13-14 years. That means if you need a clear information later than 14 years of age than the dentition is much difficulty to use if there are not so big differentiation possible. The use of dental age in axiological diagnostics is limited owing to its well-known disproportion with skeletal age. Various methods of measuring dental age pay little heed to differences in the eruption of teeth in the upper and the lower jawbone (incisors and canines cut their way in the mandible approximately one year earlier), intersexual differences (the teeth of girls cut their way out two months (for M1) to eleven months (for C) sooner than those of boys). The lower canine of girls often starts its eruption earlier than the first upper premolar tooth. We also come across the sequence P2, M2 more frequently. The ethnic group differences seem less in disparities in the level of development in dentition.

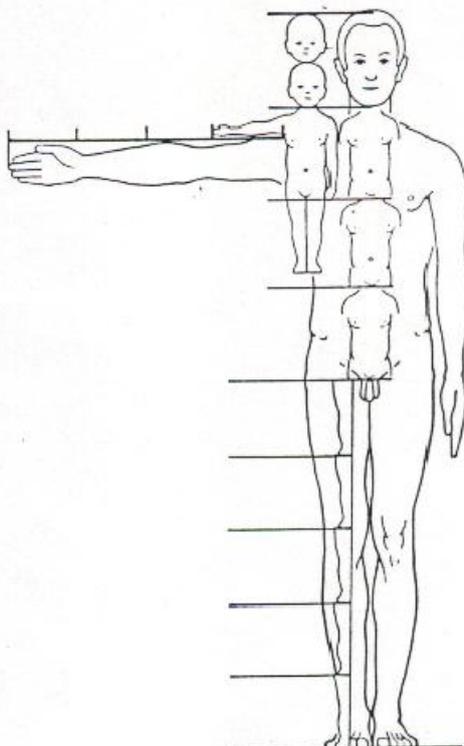
For sports children dentition age can be used if you have diagnostic possibilities during a dentist visiting. It is in sports not common practice but possible.

**2.1.4. Somatoscopic characteristics with somatic proportion index like Body Development Index with characteristic traits e.g. of the Types of Growth Dynamic**

Growth age evaluates the degree of the child's somatic growth. To determine growth age various age-specific growth standards are required, represented mostly by percentile graphs of body height (or body mass). The state of growth in a particular child is evaluated by comparing the position of its body height on a percentile graph.

Body proportion of new born child and adult person is showing the complexity and biodiversity of growth and development and describe the image understanding of "Biological Age". Head will grow two times of the output value, trunk will grow three times, arm four times and legs five times of the basic value (Fig. 4).

**Figure 4: Growth and development of the proportion of the man.**



A higher degree of precision can be reached by taking into consideration the growth mainstream, which is defined by the genetic growth potential expressed by the average height of parents (midparent height).

Precise values of growth age can be obtained by counting the values of age (in tenths of a year), corresponding to the 50<sup>th</sup> percentile of the child's body height, on the percentile graph of growth.

The growth age of a child may also be determined by comparing the values of height and body mass in relation to chronological age:

To recognise the biological age is important if you can estimate better the final status of the somatic development of sports children. That means: act your age!

There are different methods publicized like the formula from Riegerová and Sedlak (1996):

$$RV = a + b + 2c/4$$

or

$$RV = a + b + c/3$$

a = height age, i.e. chronological age represented by the child's height as the 50<sup>th</sup> percentile

b = body mass age, i.e. chronological age represented by the child's body mass as the 50<sup>th</sup> percentile,

c = chronological age, determined with respect to the date of examination

All values are counted from percentile graphs given in national referential studies Czech child population standards 2004.

The methods of determining growth age do not require demanding measurements, but their informative import is relatively low because, owing to the high inter individual variability of growth, they do not convey much information about the child's complex biological development. This is why they are regarded as insufficient for the needs of clinical Auxology.

However, Wutscherk (1973) reported an easy and economical biological method of developmental age assessment popularly known as in German called **Körperbau-Entwicklungsindex (KEI)**, that means since 1987 (Herm) this method can be used in India too as "**BODY DEVELOPMENT INDEX**" (**BDI**) method.

Following calculation is possible:

### **Body Development Index (BDI)**

#### **Males:**

$$\underline{\text{Middle Breadth} * 2 \text{ Forearm Circumference (corrected)} / \text{Body Height} * 10}$$

With

$$\text{Middle Breadth} = (\text{Biacromiale Breadth} + \text{Biiliospinale Breadth}) / 2$$

*Forearm Circumference (corrected) = Forearm Circumference given - Rohrer Index (RI) (corrected)*

$$\text{Rohrer Index (RI)} = \text{Body Weight (kg)} / \text{Body Height}^3 \text{ (m)} * 10$$

## **Females:**

### **Middle Breadth \* tight circumference (corrected) / Body Height \* 10**

#### VARIABLES REQUIRED:

Following five anthropometric measurements are required to calculate BDI:-

1. **Height (cm)**
2. **Body weight (kg)**
3. **In case of males: Forearm Circumference (cm)**  
**In case of females: Tight Circumference (cm)**
4. **Biacromial Breadth (cm)**
5. **Biiliospinale Breadth (cm)**

*STEPS: ASSESSMENT OF DEVELOPMENTAL AGE BY USING BDI METHOD HAS FOLLOWING TWO STEPS:*

- **Step 1:**

*Calculation of BDI = Body Developmental Index.*

- **Step 2:**

*Whatever value of BDI is obtained that has to refer against standard norms table and at once the developmental age of the given child is known.*

#### INTERPRETATION OF BDI:

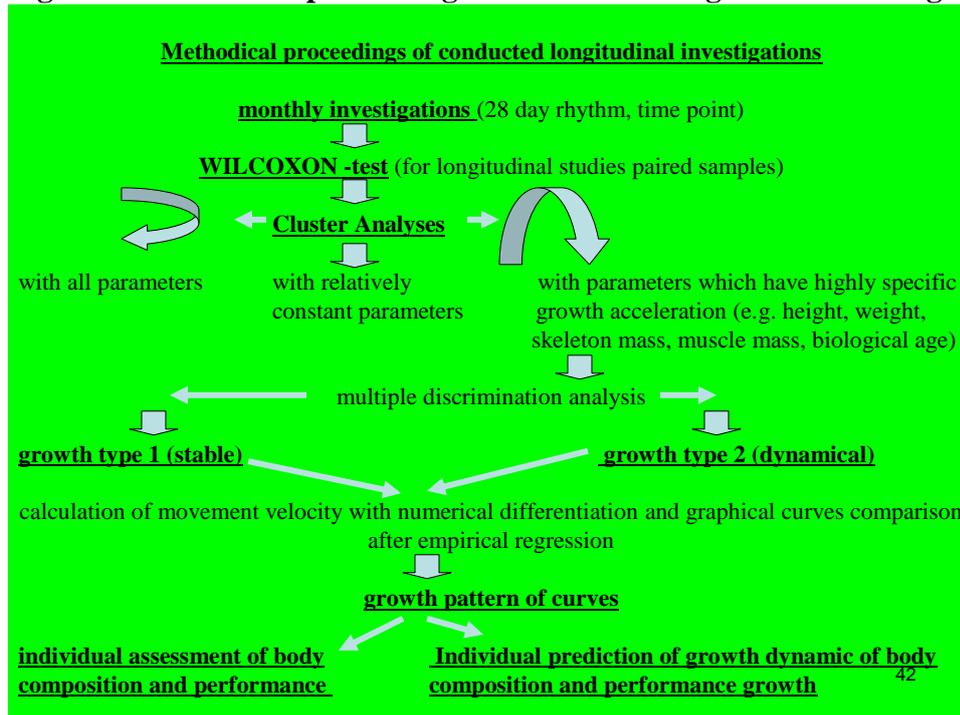
- The BDI method involves the investigation of a child in terms of his body proportions
- Quite satisfactorily this method demonstrates the relation of one's chronological age to the developmental status.
- BDI values for all children are <1 (variation is between 0.50-1.00)
- BDI is valid up to 18 years old males and females.
- Correlation with other methods e.g. bone age (according to Medved 1962) or sex sign (according to Zeller 1939) is high. ( $r = 0.85$ ).

***Biological age according BDI is a practical method in sports and can differentiate the girls and boys in one age group up to 5 years ( $\pm 2.5$  years) in late or retarded growth and development, in normal growth and development or in early or accelerated growth and development.***

***With Biological Age you can find characteristic traits e.g. of the Types of Growth Dynamic!***

Very important are longitudinal investigations if these observations give us better and more information. See next overview (Fig 5).

**Figure 5: Methodical proceedings of conducted longitudinal investigations! (Herm 1987)**



### 2.1.5. Signs of Puberty as a Basis (Pubertal Age)

During the first quarter of last century we found some systems of development diagnosis, using the whole ensemble of signs of puberty in both sexes:

Brest, pubic and axillaries terminal hair, menarche in girls, pigmentation and enlargement of the genitalia, pubic and axillaries hair beard in boys. After developing different methods in different countries (Germany, French, American and English systems, Russia, Poland), these schema was at first not wholly congruent, but after developing the IBP Handbook – Weiner, J.S. and Lourie, J.A. (1969) the maturation age was usually determined according Falkner and Tanner (1986). They describe secondary sex characters, so called **Tanner stages**, or **Tanner scores**. In these fields Prader (1966) developed Orchidometer for estimation the size of the testis from boys. To determining of all these puberty signs are not simple and require carefully instruction.

### 2.1.6. Mental Age

The mental ability can be estimated through Mental Age according standard developmental and intelligence development of the children (Hermanussen 2013). Also the intellectually side of the child can be shown. A differentiation between girls and boys is difficult. It is the least reliable measure for development age and can used as on other part of mental and psychological situation.

For sports it has a small position in relation to the attitude to training and competition.

## 3. Results as Point of Origin

Since the seventies and eighties also India has had a look that for talents development in Sports the biological age is one research point (Muthiah 1976, Herm and Sodhi 1987, Kumar 1987, Kuntal Roy 1993, Kaur 2010).

Attend different growth of girls and boys (Table 2):

**Table 2: Indication marks and specific of age during the process of training (Herm 1987)**

Age in years	girls	Boys
4-9	Parallel growth of height (girls slightly lesser)	
9-12	pubertal growth intensity, beat boys with 10 years	
12	Decrease of height growth	Increasing of height growth
14	Partially finalisation of growth	pubertal growth intensity
16-17		Partially finalisation of growth
19	Reached final level of stature	Reached final level of stature

Look to the indication marks and specific of age during the process of training as an example in long jump between the age 11 and 20 years (Herm 1998)

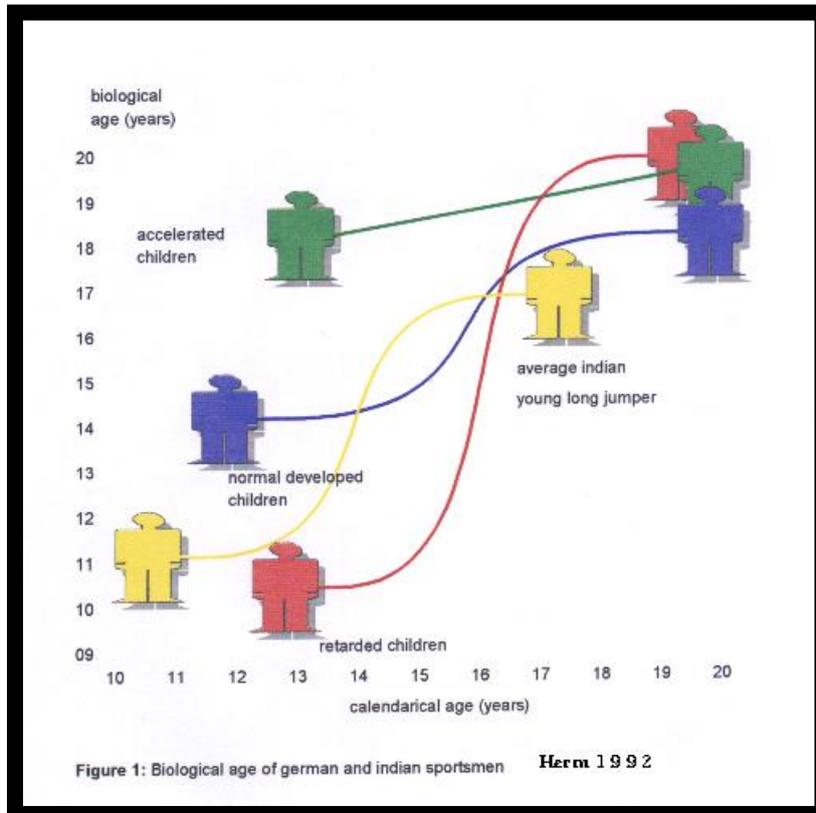
age	step of training and selection	institution of promotion and main points of training
11-12	fundamental training	responsible: free training in sports clubs and in the school
12	first standardised and organised talent selection	contents: track and field norms
13-15	building up training step 1	responsible: fundamentals in the sports organisation contents: various training in kinds of sports, e.g. running, jumping, throwing
15	second standardised and organised talent selection	responsible: federation of sports norms

16-17	building up training step 2	responsible: federation of sports contents: long jump specific and various training
17	third standardised and organised talent selection (central competition of the federation)	responsible: federation of sports, norms
18-20	additional training	responsible: guest house for sports, central training camps contents: powerful individual and specific long jump training

19	fourth standardised and organised talent selection as a central national youth competition)	responsible: guest house of sports and central training camps view of talent selection: recognition of talents in long jump
20	high performance training	responsible: national federation of sports, central training camps contents: individual and specific long jump training

Consider the different ethnic development in other countries and areas in India. Shown is the example of Biological Age of German and Indian young sportsmen (Figure 6)

**Figure 6: Biological Age of German and Indian young sportsmen Herm 1987)**



Correlation between development rate of performance and Biological Age is significant, but since 1973 we know that in talent selection the influence that we collect in athletic sports kinds the calendar older talents in one age group!

They have with 10 years more than 10% better performance - development is significantly advanced!

That means: we have to see to the Growth Dynamic (Herm 1973, Kupper 1993, Rudolph 2011).

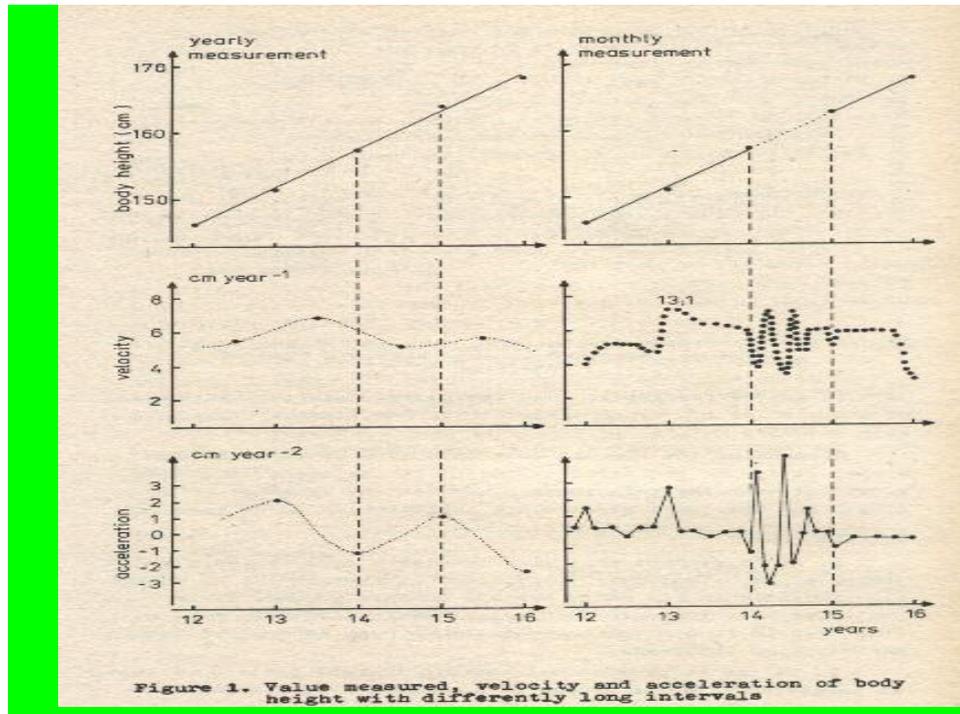
We have experience about the different Biological Age for example from 5 to 18 years, but we know also that sometimes the changing of the body is not suddenly and exact recognizable. We see growth and development of these children so often without pay attention to the individual biological development.

By investigations of characteristics of Growth Dynamic of sports children it is very important to see that to recognize the Growth Dynamic of sports children is with different methods possible: *Comparative study of measurements (average of growth and development data)*

But better is the proposal:

*Sensible analysis of longitudinal investigation like short term measurements (daily, weekly, monthly) with calculation of growth velocity and growth acceleration with careful attention of the main and important growth data of the body (Fig.7).*

**Figure 7: Value measured velocity and acceleration of body height with differently long intervals (Herm 1988)**



Important are problems of growth and development in sports and growth dynamic of sports children

#### 4. Fundamentals to reach high performance

- Health
- Insurance
- Risk of Injury
- Conception of Training.

Training and Exercising during Childhood and Youth: A question concerning health or insurance in conception of training is: **what is enough and what is too much?**

Early starting off too intensive training loading gives rise to damages of

- **The hyaline cartilages and**
- **The osteochondral fiber**
- **The growth zone inside of the long bones at the Epiphysis (fibromyalgia-syndrome - FMS).**

The number of sports injuries in childhood is increasing There are some other particular aspects:

- **Luxations**
- **Tendoninjuries**
- **Change over Fracture**
- **FractureofEpiphysis**

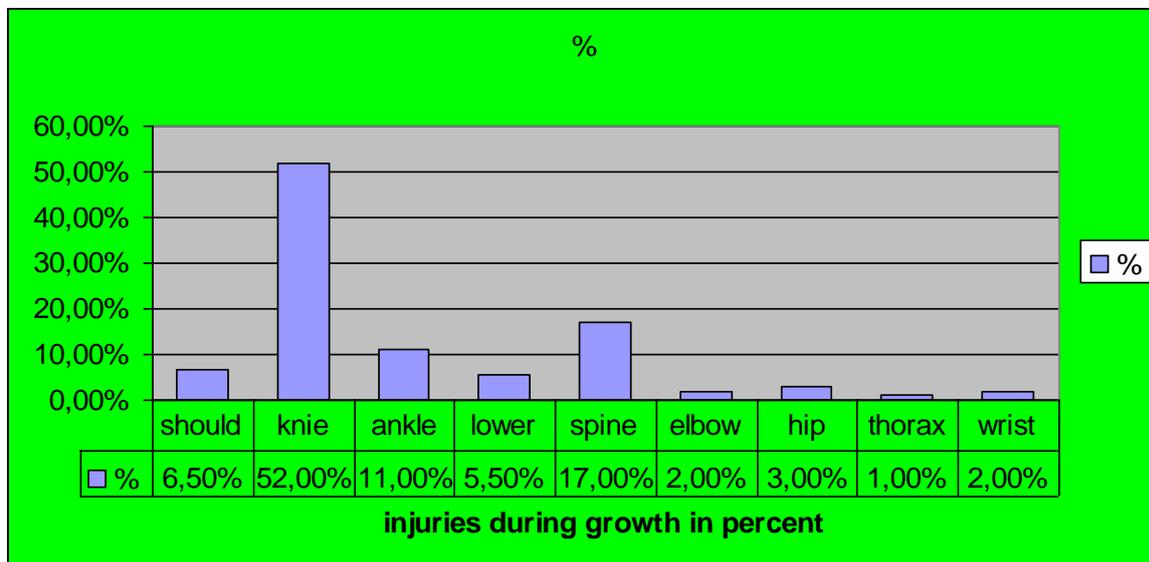
- **Apophysis demolition**
- **Greenstick Fracture**
- **Sprain Fracture**

One aim of this lecture is to focus on these particularities

- **High level sports is beginning in very early age**
- **we find there very dangerous sports kinds**
- **increasing of sports injuries and overloading damages in childhood**
- **specific on relation to adults with different mechanical nature and quality of the bone and also open growth/epiphyseal cartilage**
- **growth is so fast that growth cartilage is bulked and loosened**

You can recognize that the most injuries during growth and development are very often (Figure 8).

**Figure 8: Injuries during growth in percent (Herm 1987)**



We have to answer what are dangerous sports kinds?

- **Fractures after fall down from big high like Riding, Gymnastics, Climbing etc.**
- **Downfall with high speed e.g. skate board, ski downhill, race bicycle etc.**
- **Ankle injuries and tendon rupture after fast turns like Jump on the Trampoline, Gymnastics etc.**
- **All sports kinds with suddenly high power and speed loading.**

It is to give an answer how to reach high performance for competition and how protect injuries (in all age groups up to adult)

- **Plan and analysis of training (using PC and measuring daily, weekly, monthly and yearly dynamic)**
- **Proportion of Training (e.g. distance, repetition, loading, velocity, number of training hours)**
- **Proportion of training areas and dynamic of loading with duration of recreation and different distances like interval's**
- **Development of loading during training (meso- and macro-cycles, e.g. Tr. per week, km, v, s)**
- **Test sporting performance through criteria of quality (competition, tests, heart rate, lactate, technique)**

***But: have always time to see the relation between conception of training and effectively during training***

Here some information about regulation of training for young children:

- **Not more than 16 up to 20 hours per month.**
- (See the discrepancy between realities with 6 -18 hours per week in basic training)
- **Under the age of ten years use an ability exercise program without specialization.**
- **It is not useful to train running more than ten kilometers per trainings hour up to the age of eighteen.**
- **Very important is training under guidance of qualified coach for children.**
- **Consider the difference between male and female sex concerning the development of bone mass peak.**
- **Growth of muscular strength and mass is similar by both sexes.**
- **No extreme power and strength training under age of 16 years.**

The orientation for frequency and time of training

**GLT (fundamental Training) ABT (building up training) AST (connection training) HLT high performance training)** is shown in following table 3:

**Table 3: Orientation for frequency and time of training during youth sports (Herm 1987)**

<b>Orientation for frequency and time of training GLT ABT AST HLT (sportland.nrw)</b>				
	Basic Training (GLT) Up to 5 years	Building up Training (ABT) Up to 5 years	Joint Training (AST) Up to 4 years	High Performance Training (HLT)
<b>Compositorial Sports Kinds, Swimming</b>				
trainings sessions per week	3 - 8	5 - 9	6 - 11	8 - 12
Hours of training per week	6 - 18	12 - 21	14 - 24	18 - 27
<b>Other Sports Kinds</b>				
trainings sessions per week	3 - 6	5 - 9	6 - 10	7 - 12
Hours of training per week	5 - 12	10 - 18	12 - 20	14 - 28

10

***Some advice:***

**Develop a good flexibility of the whole body, especially of the tip to reduce the rise of bone injury.**

**If defects may be surgically created osseous defects or osseous defects from traumatic injury to the bone the children need a specific therapy.**

**One aspect to recognize high growth velocity is growing pain of bone of the children especially during night and after loading.**

**Recognize the right interventions to increase physical activity in children and the right physical activity in youth.**

We know the average of height, weight, breath, circumferences and all somatic development, but we have to less experience about these facts:

- **How is growing the child at the moment or**
- **How strong was the actual influence of training at the organism or**
- **What during growth is genetic determined.**

Mostly we can see the result of good or risk training very late and sometimes too late.

**The results are:**

- **Injuries,**
- **psychological problems and you need**
- **More time for recreation and development of performance.**

The most physical injuries and traumata during childhood are:

- **Lesions of joints of the long bones,**
- **preferred of the knee joint, foot link, shoulder joint and**
- **Musculature of the legs and arms included shoulder.**

Children with growth pain and which receive an injury:

**During stable phases of development**

**(Less growth velocity)**

- *more problems with inflammation of hamstrings or Achilles tendon and*

**During dynamical acceleration phase of growth**

**(High growth velocity)**

- *More problems of advance and join of tendon near of the intersection tendon to bone.*

See every time the somatic sex differentiation e.g. for body height

- **Between 9 and 12 years girls have a higher growth velocity than boys**
- **Up an age of 12 years you find by girls an decreasing and by boys an increasing of body height growth**
- **With 14 years girls finished this and boys with 16/17 years**
- **final stature by both nearly 19 years**
- **Look every time at the biological differentiation**

Look at the monthly and seasonable and lead-dependents growth peak to peak value

- **There are 3-4 growth peaks between 13 and 14 years possible**
- **There is a higher growth velocity of size during summer time**
- **And a increased body mass during Autumn**
- **Synchronic development of the body during Winter and Spring time and**
- **Asynchronies growth during Summer and Autumn time**
- **According high loading you will find an stunted growth and after finishing overloading a catch-up growth**

The Most case of injuries during reach puberty an age at  
**Boys with 14.3 years (s = 2.5 years) and at**

**Girls with 12.4 years (s = 2.4 years).**

Can coaches recognize growth dynamic?

- = **what keeps typically during growth and development?**
- = **what is changing during growth and development?**
- = **it's possible that during growth period performance is going step backwards!**

During growth and development phases you have not every time to train power, coordination, endurance, speed.

Often we use inadequate prognostic development of the body.

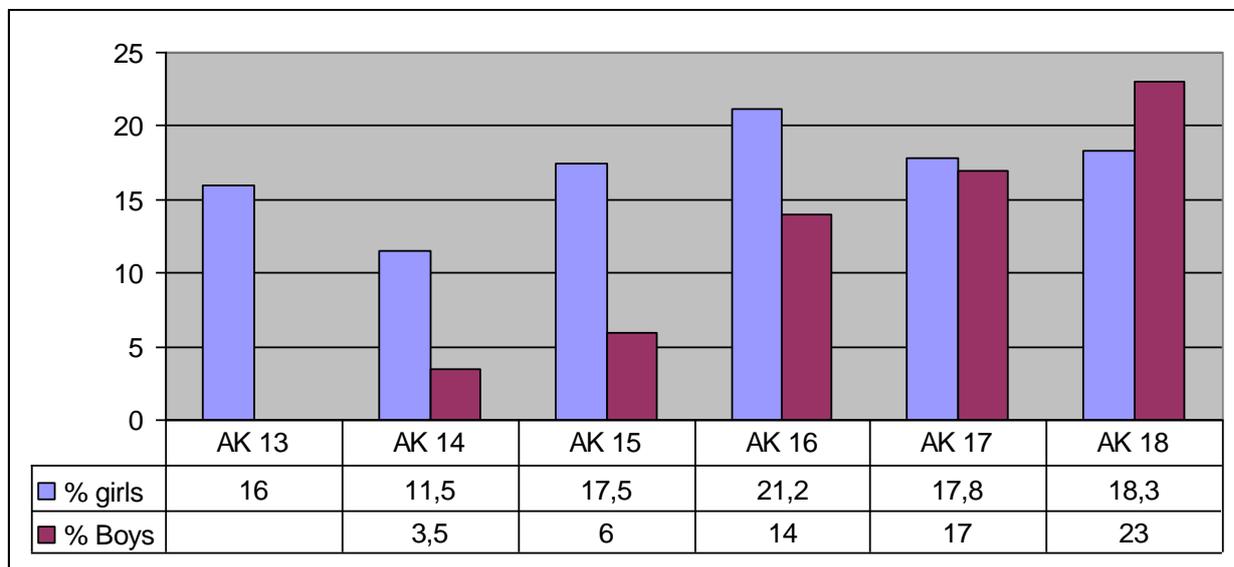
Some times in youth sport we see that somatic aspects are determinate for performance and we have to accept this knowledge before we improve the efficiency.

Can we bring in line the finale performance in sport with the test performance during age of 12 to 14 years?

Yes: relation is significant and we found in swimming that sports children with all-round training are on the top and not such with early high specializations

If you see the age of the end of the top level career of boys and girls (%) in Germany – swimming (Figure 9) (Rudolph 2011), than you can recognize the biggest problem in top performance sports all over the world. **One problem of talent development to reach national team is that success rate will be not more than two percent.**

**Figure 9: Age of the end of the top level career of boys and girls (%) in Germany – swimming**



### 5. Universal Standards, Rules or Norms for Using Biological Age

1. Biological Age is one of the important and interesting problems during growth and development of children up to adult age.
2. For sports children and coaching it's very important to recognise the exact differences between **Calendar** and **Biological Age**.
3. The age groups from 10 to 18 Years have different size of Biological Age.

4. During this age time we can find the highest differentiation of growth and development and during this time children start for training and exercising in sports.

5. According the different biological age we will find an early or a late high development in performance of sportsman.

6. The differences in body size between girls and boys in Adulthood is 10 to 12 cm is genetically determined if it is since a long time in the same level.

7. To recognise the biological age is important if you can estimate better the final status of the somatic development of sports children; that means: act your age.

8. With estimation of Biological Age it succeeds better the growth potential of a child under consideration of current height and final height. Growth potential will be up rated less than ever the current height and younger the Biological Age (retarded) is.

9. The aim of this lecture is to focus on these particularities

- High level sports is beginning in very early age
- we find there very dangerous sports kinds
- increasing of sports injuries and overloading damaged in childhood
- specific on relation to adults with different mechanical nature and quality of the bone and also open growth/epiphyseal cartilage
- growth is so fast that growth cartilage is bulked and loosened

#### ***6. Results of Growth, Training and Nutrition Analysis in Children and Youth Sports***

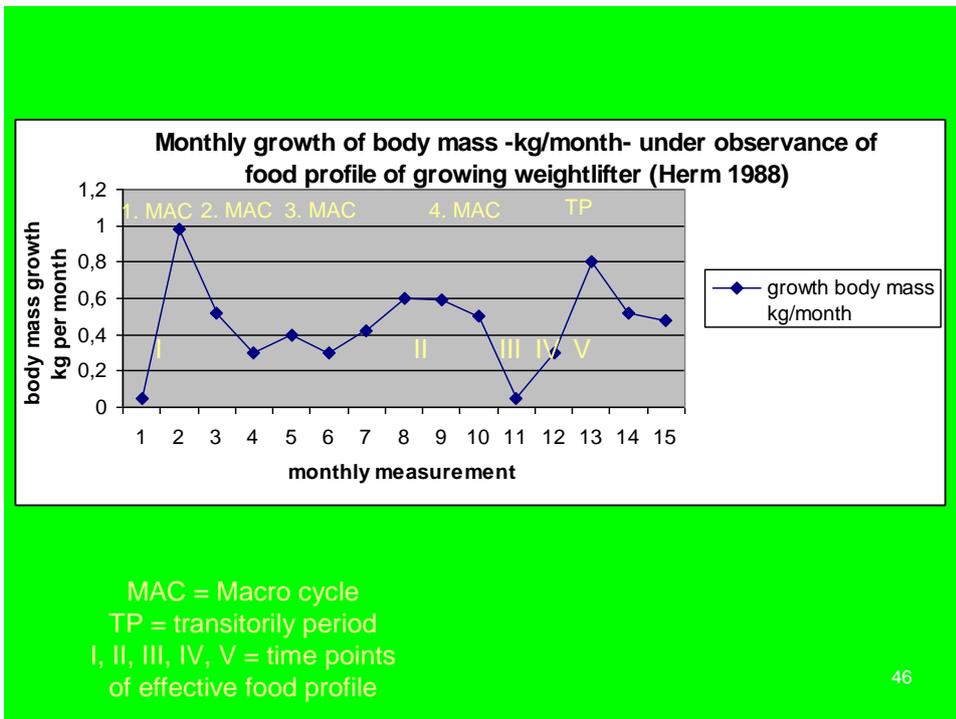
If you like to train young sportsmen for long term development than you need beside the trainings programme a right nutrition programme. I described the growth dynamic of young sportsmen also in relation to the food programme, demonstrated in following figures body mass, body height and muscle mass (Herm 1988).

For example aspects of Nutrition program and growth dynamic in sports kind with weight class problems like weight lifting are:

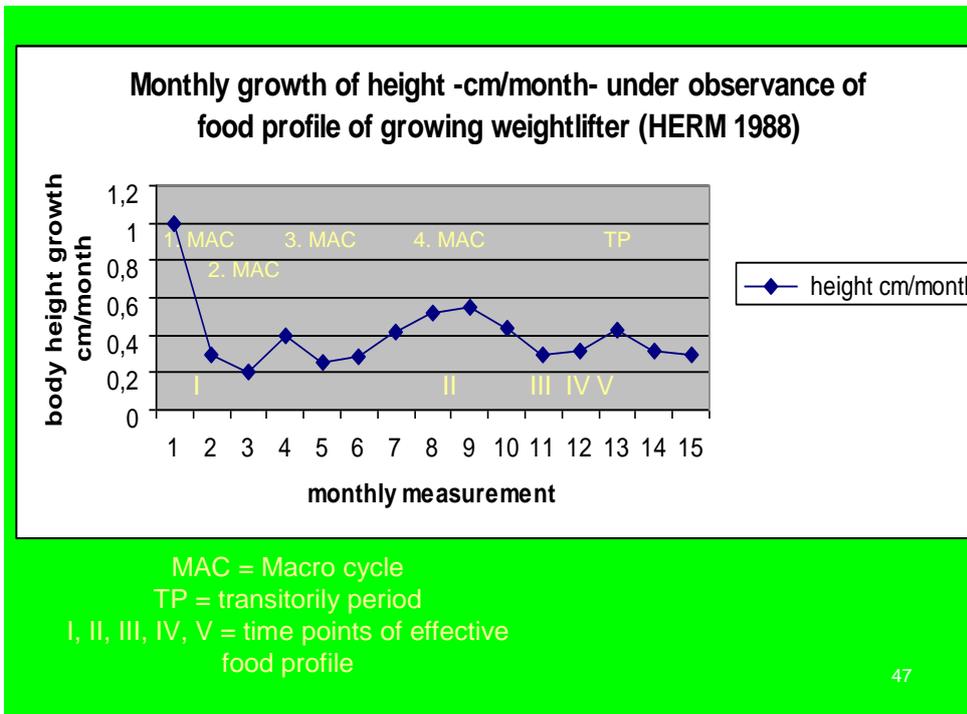
1. Basic nutrition
2. reduction food for weight down training
3. high calorie food for continuous increasing of body mass
4. Pre competition food
5. Competition food
6. food for recreation after loading

The next tree figures (Figures 10,11 and 12)demonstrate growth velocity of mass, height and muscle mass under the view of trainings period (Macro cycle and transistorised period) and the time points of effective food (see in figures marked with I –V) as equivalent to energy input of young sports men. Similar aspect I could shown also in other sports kinds of Athletics, Handball, Canoeing, Soccer etc.

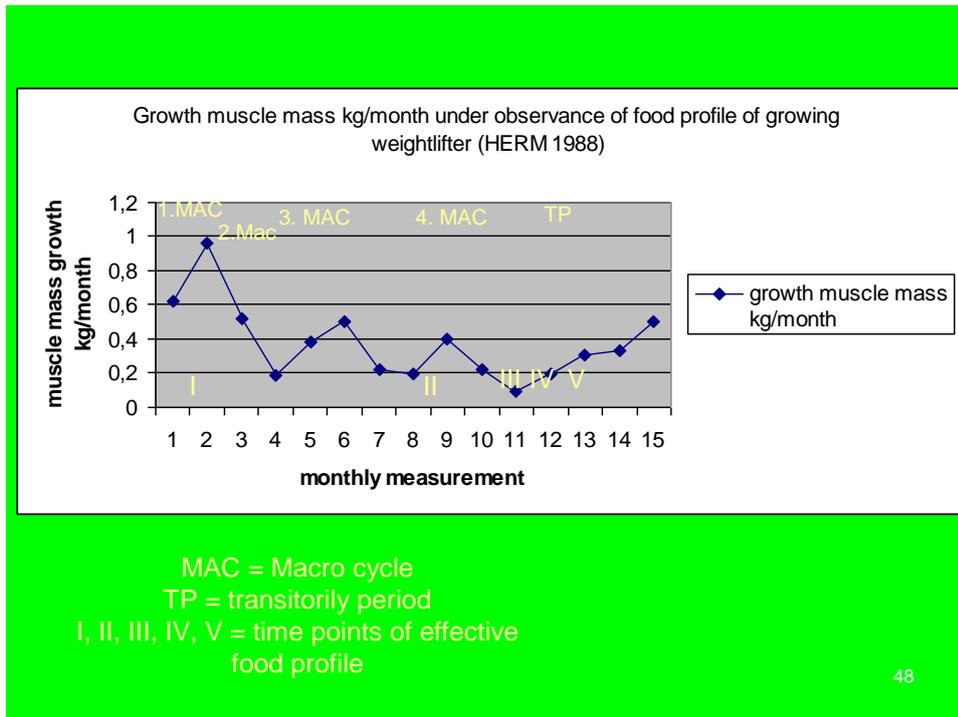
**Figure 10: Monthly growth of body mass –kg/month- under observance of food profile of growing weightlifter (Herm 1988)**



**Figure 11: Monthly growth of body height –cm/month- under observance of food profile of growing weightlifter (Herm 1988)**



**Figure 12: Monthly growth of muscle mass –kg/month- under observance of food profile of growing weightlifter (Herm 1988)**



The result is that

1. With beginning of the trainings year is an increasing of the body mass if you against the year before use a higher basic food (I).
2. The basic food and the high caloric food bring especially during the time of March up to June a higher body mass (II).
3. During the phase of performance development to the main competition it was found that with the pre competition food the required stable body mass was not reached. It was obviously that beside the higher specific training loading it was not requested an increasing the body mass (III).
4. A competition food with normal fare and higher carbohydrate part manage a higher growth velocity of body mass prime after main competition (IV).
5. A higher carbohydrate and protein after competition food tends to result of abrupt rise of body mass.

For **Muscle Mass** is the result that:

1. The basic food was increased according the year before and has as cause an increasing of the muscle mass (I).
2. In contrary to body mass a longer basic food with high caloric food tends not to a higher muscle development (II).
3. Also the pre competition food brings not the stable muscle development and it is to recognise a decreasing of growth development (III). This can lead back that the protein deficit after exhaustively loading can be very high according uptake rate of contractile proteins enzymes depletion, increased elimination of proteins e.g. with sweat.
4. The competition food (normal food with increased part of carbohydrate) it was found a higher grow of muscle development as a later date after the high point of competition (IV).
5. The after competition food (carbohydrate rich and protein rich) assisted a farther increasing of muscle mass velocity (V).

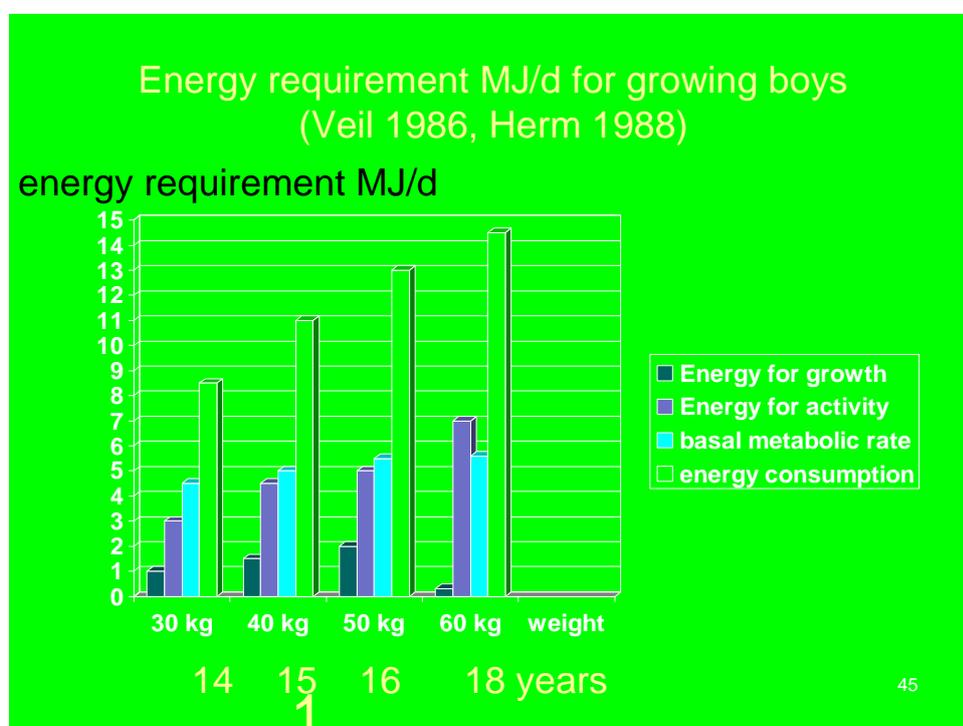
In summery I could say that how the following figure (Figure13) about energy requirement (MJ/d) for growing boys (Herm 1988) shows that for 14 up to 18 years old boys the contingent for growth or sports activity are unequal and the differentiation in energy for growth, for basal metabolic rate, for activity and total energy consumption but they are the same in the sum line. That means also that energy which the sports child did not use for activity will add to a higher increase of body fat.

The investigations showed also the relation between growth dynamic, health situation, trainings periodic and nutrition.

So it be could demonstrated that there are positive correlation between growth velocity of body height and body mass in relation to health of the children. The intensive growth periodic has a higher frequency of health sequence.

One interesting aspect was that the decreasing of case of illness during the end of training phase before high point of competition also in relation with the higher specific sports loading and after this time an increased number and peak of health cases could be recognise.

**Figure 13: Energy requirement MJ/d for growing boys (Veil 1986, Herm 1988)**



## 7. Conclusion and Perspective of Growth Dynamic

We have to see in Sport anthropology:

1. the general and specific body peculiarities the different sports require, that means the body composition as assumption for sport performance and health;
2. the influence of training and motor activity to the body composition, which means that body composition, is a result of training and motor activity;
3. In this connection it is useful to see the individual differences of body build. In these directions we have to see and to recognize dynamic system of man from childhood to older age.

4. Structures of performance – in relation to biological age – please ask how to mark?
5. Norms of young sportsmen in biological age and performance as diction of requirement of recognition of talents in different kinds of sports.
6. Ask what are dangerous sports kinds?
7. How to reach high performance for competition and how protect injuries (in all age groups up to adult)?
8. Plan and analysis of training (using PC and Online Data Bank of Offspring Competitive Sports (OCS))

What means using **PC** and **Online Data Bank of Offspring Competitive Sports (OCS)**?

***Aim is institutional and standardised quality management of all young sports men for using all data and performance diagnostic and you can trainings plans and diagnostic of performance use time contemporary via Internet!***

Advantage of Online Data Bank of young athletes are:

The big benefit is, that athlete every time the development master data with his training situation, health (sports medicine) and performance diagnostic dates can call and directly discuss with his coaches and medical doctor.

International activities in preparation of World Champion Ships and Olympic Games show the ways for development of young athletes for reaching high performance. One way for youth sports in India is to finalise the Conception Offspring Competitive Sports (OCS) for India 2013 (HERM 2012, 2013).

One possibility is a long term OCS up to 2020. Important is developing of trainings systems and conceptions of kinds of sports associations. Sports sciences have to positioning of advancement of youth sports with technological and scientifically assistance.

Problems of Growth and development in sports and growth dynamic of sports children  
Fundamentals to reach high performance,

- Health
- no Injury
- less risk of Injury
- Right conception of training.

From lots of possibilities to analyses should be demonstrated Somatotype and growth dynamic specifics of sports participating children.

Remark of the author: "This title of publication is one aspect of cooperation in Kinanthropometry between India and Germany since 1987 and is one example of different ways of talent identification and selection".

Correlation between development rate of performance and biological age is significant, but since 1973 we know that in talent selection the influence that we collect in athletic sports kinds the calendar older talents in one age group! They have with 10 years more than 10% better performance - development is significantly advanced!

That means: we have to see to the growth dynamic (Herm 1973, Kupper 1996, Rudolph 2011).

We have experience about the different biological age for example from 5 to 18 years, but we know also that sometimes the changing of the body is not suddenly and exact recognizable. We see growth and development of these children so often without pay attention to the **individual biological** development.

In the area of offspring sports we have a very fast and deep and good of respect of content how you can see in the following overview of conference theme:

**ACMS Conference 2012 to this time before, but we have some more articles to following main points:**

Pediatrics and Concussion

Pediatric issues

Tumors and abnormal Growth

Knee Examination in Pediatrics

Application of Exercise in Children with Chronic Disease

Public Health Sciences of Sedentary Behavior in Youth

Physical Activity in Youth

Increasing of Physical Activity in Youth

Promote Physical Activity in Schools

Children and Exercise

Muscle Fatigue and Exercise in Youth

So the perspective to make characteristics of growth dynamic of sports children will be very important and trend-setting during the future with high level computer and wireless LAN connections.

**To recognize the growth dynamic of sports children is with different methods possible:  
*Please use comparative study of measurements (average of growth and development data).***

And my proposal:

***Sensible analysis of longitudinal investigation like***

- ***short term measurements (daily, weekly, monthly)***
- ***with calculation of growth velocity and growth acceleration***
- ***with careful attention of the main and important growth data of the body during longitudinal investigations.***

And have a view to analyses typically performance development like the next figures about methodical proceedings of conducted longitudinal investigations and developing test performance of 800 m running or 30-m fly running and the growth and development of muscle mass during age between 12 and 17 years for track and field athletes or during one year with estimation of growth types in weight lifting. There is shown growth type two as dynamical growth type and in relation to strength capacity and her muscle mass of these young sportsmen (Herm 1988).

Important are the growth pattern and the very difficult and different realisation of the performance in different trainings time during the training year and in preparation for the main competition. According these longitudinal investigations it is possible to interpret the long term performance and biological development. You can recognize increasing or decreasing of performance during the trainings year or during different trainings periods.

The energy requirement of sports children is in relation to non-sports children strongly higher. This is especially for high level sports children. For adult sports men like top level cyclist for the Tour de France can the energy consumption during performance power peaks short time increase over the level of 8000 kcal/d (e.g. Alpine-stage).

If you have leisure time athletes there is the daily energy consumption insignificantly less in relation to not active peoples.

Importance of Indian Food for young sports children!

Use all local traditional food and specific nutrition of the cultural and geographic characteristics!

The best example for future nutrition research is to find a team in a nutrition department an University (Figure 9). To development program for mobile devices, applications – short apps is the right and optimal way during this day and age.

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