

## Sports Nutrition and Sports Performance in Youth Sports

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### **ABSTRACT**

*Hard training during puberty is one problem of young sportsmen for the long term top level development. Sports and nutrition form the whole body of the children, beginning with the brain and mental development and the growth process of the somatic parameters.*

*There are relations between nutrition, training and somatic development.*

*In relation to hard sports overloading and strain is reported about catch-up-growth.*

*Hypothesis was how it is possible to recognize these characteristic aspects during monthly investigations of short term growth. It was to raise the question if there are also relation between these aspects and health status of the youngster?*

*Fundamental was the aspect of newest nutrition sciences.*

*During one year, all 28 days young sportsmen with age between 12 to 18 years (Athletes, Handball Player, Soccer, Weight Lifter, Normal Population) where investigated. Every investigation was morning between 9 and 11 am o clock.*

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

*Determined were the biological age, the growth velocity and the growth dynamic with growth type estimation. Estimation of Muscle Mass, Skeleton Mass and Fat Mass was performed.*

*It could be recognize the different growth types, the high of loading, the relation to performance development and the different nutrition aspects during period of 12 month.*

*The results shown, that there are very strong relation between growth dynamic, nutrition, training loading, training periodic and the performance development of the young sportsmen.*

*All results must face the facts in unity and complexity.*

*So it could be described the different growth dynamic of the body (stable growth type, dynamical growth type) e.g. of muscle mass, bone mass, fat mass, height and weight, the relation to strength and speed performance and the nutrition status during the different training periodic.*

*The training loading, nutrition and growth velocity influenced the health and performance status. The results show that the coaching team has to bear a big responsibility for the right and optimal sports way of the growing sports youth.*

*Typical opinions of nutrition, drinking and food using are described.*

*Characteristic growth during the process of one year could be demonstrated for training.*

*Practical recommendations for training and the periods of training and phases of growth dynamic were given.*

*Nutrition of the young sportsmen is one main aspect for the long term development of children and youth during the growth period as well as for the right nutrition and for the best health of these talents.*

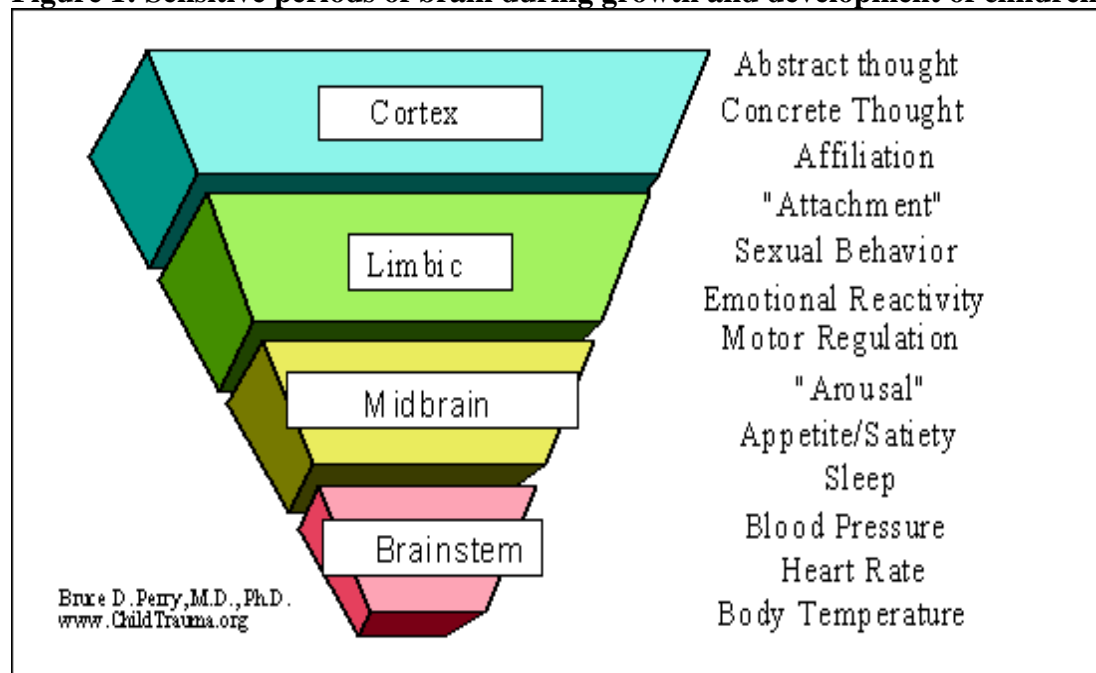
**Key words:** *Functional Sports Anthropometry, Growth and Development, Dynamic Changing Somatic Characteristics, Nutrition, Drinking, Youth Sports, Training periodic.*

## 1. INTRODUCTION

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: "To eat and to drink 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, Weight, Muscle Mass, Height)

Diseases,

Injuries,

Sports kinds,  
Trainings terms,  
Training volumes,  
Training intensity,  
Trainings frequency,  
Trainings fitness,  
Profession or school level,  
Climate influences,  
kind of food and specific dynamically force, food induce thermo genesis (Malina 1987, Herm 1988, Konopka 2006, Weineck 2009).

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

## **2. PROBLEM OF NUTRITION IN YOUTH SPORTS**

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**

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

- 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 ***L-Carnitin*** and ***Creatin*** are described here 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 Creatininephosphat. 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**

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

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

***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 estimation of Basal Metabolic Rate (BMR) for different age groups was found:

<u>Age group</u>	<u>Formula</u>
<b>3 to 10 years</b>	<b>BMR = 0.085 x KG [kg] + 2.033</b>
<b>11 to 18 years</b>	<b>BMR = 0.056 x KG [kg] + 2.898</b>

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

<b>Age</b>	<b>male</b>	<b>female</b>
15 up to under 19 years	3100 kcal	2500 kcal

### 3. TRAINING AND DRINKING IN YOUTH SPORTS

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?*

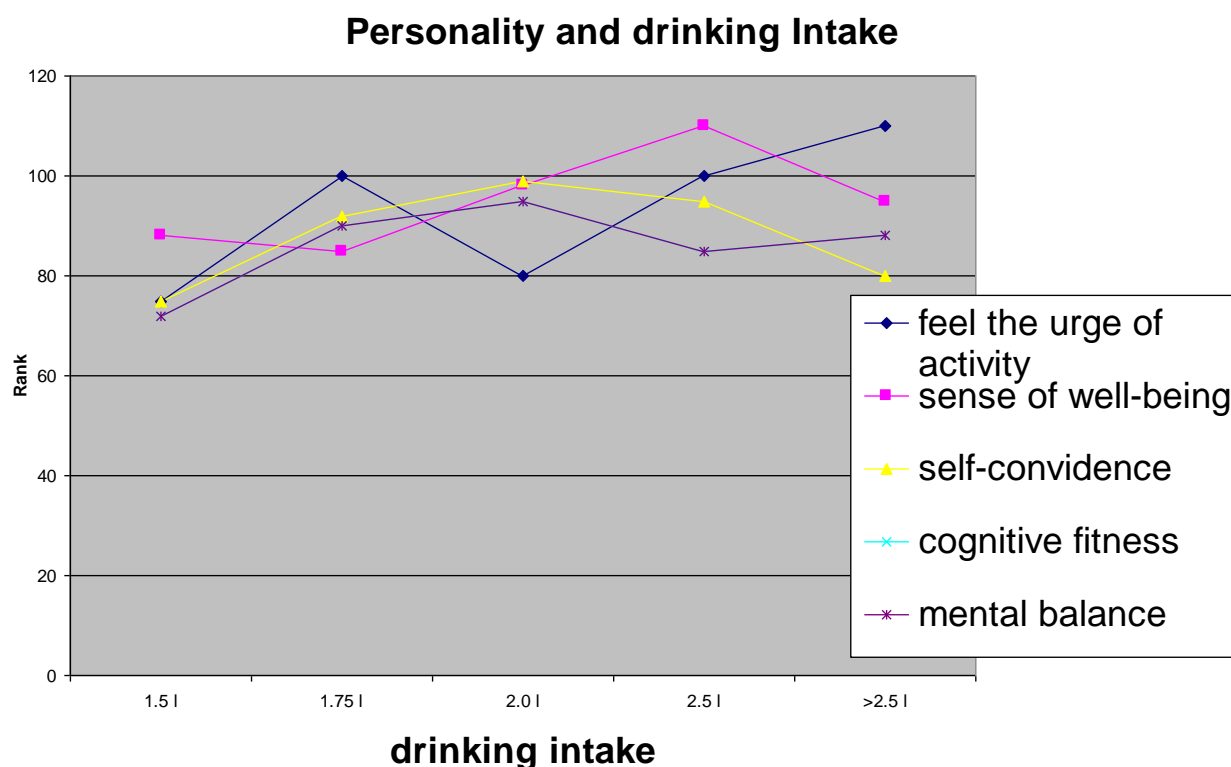
For intensive and long training

- 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!***

#### ***4. 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 unhealthy 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 (Fig. 3).

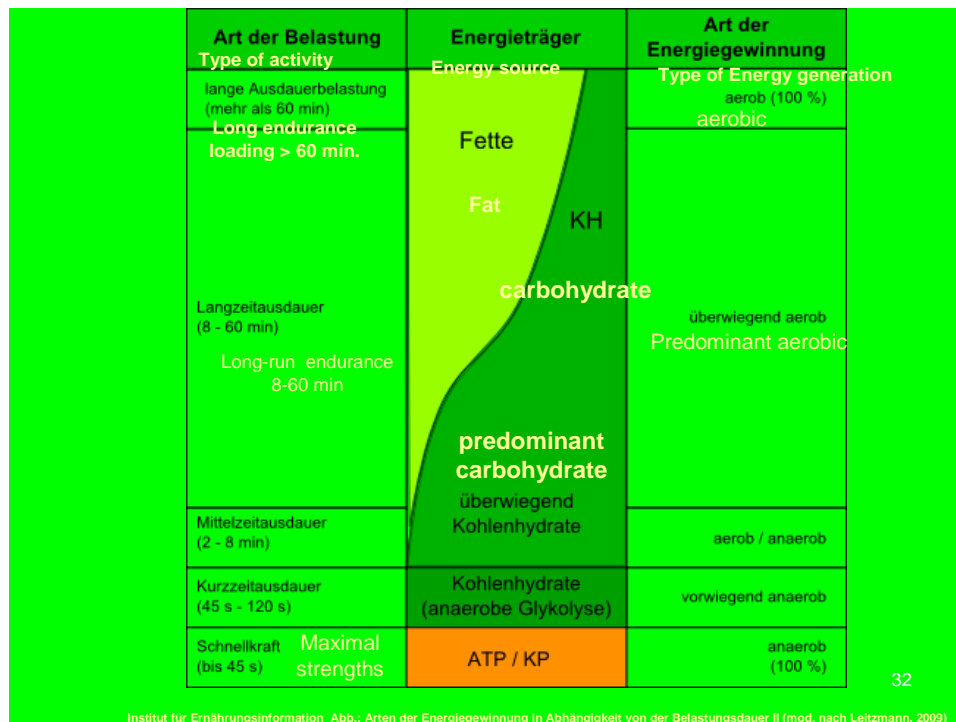
There the coaches, parents and children find the best form for a healthy, high-performance and effective form also of drinking in relation to training, coaching, nutrition under and in consideration of all circumstances.

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.

**Figure 3: Young sports athletics children in Kolkata**



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 4.

**Figure 4: 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

#### **Non classified sports kinds**

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

### ***5. 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.

### ***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).

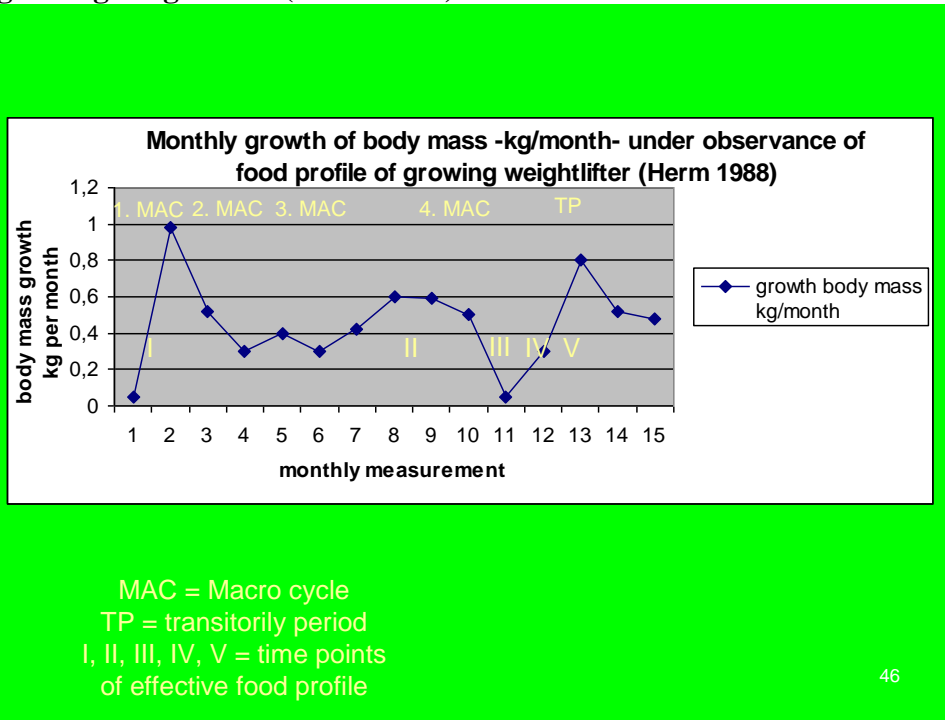
For example aspects of Nutrition program and growth dynamic in sports kind with weight class problems like weight lifting are:

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

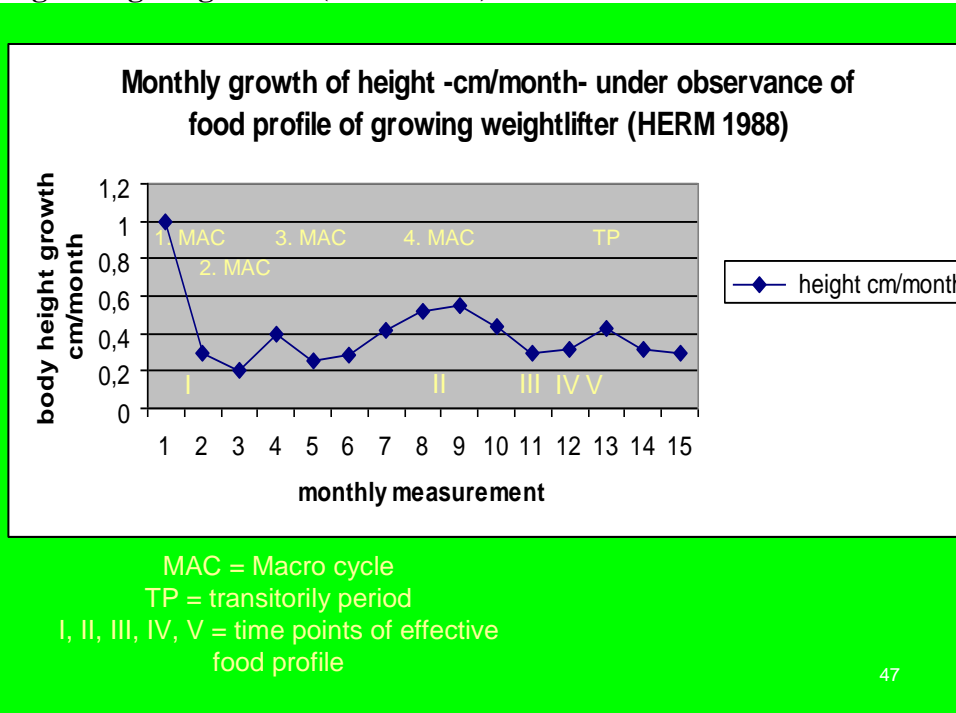
6. food for recreation after loading

The next three figures (Figures 5,6 and 7) demonstrate growth velocity of mass, height and muscle mass under the view of trainings period (Macro cycle and transitorised 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.

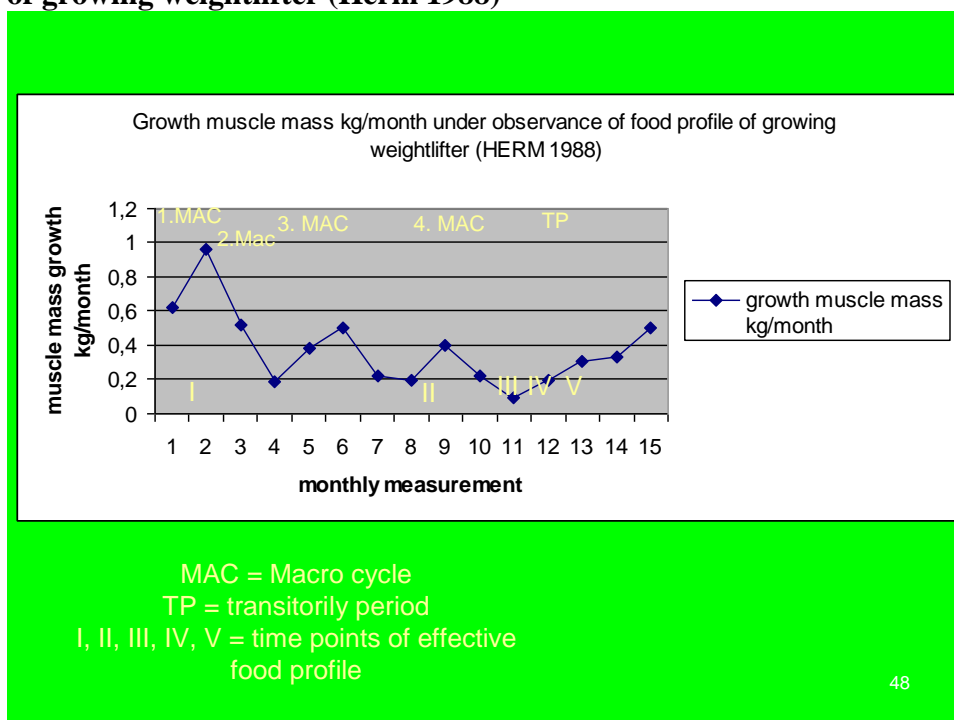
**Figure 5: Monthly growth of body mass –kg/month- under observance of food profile of growing weightlifter (Herm 1988)**



**Figure 6: Monthly growth of body height –cm/month- under observance of food profile of growing weightlifter (Herm 1988)**



**Figure 7: 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.

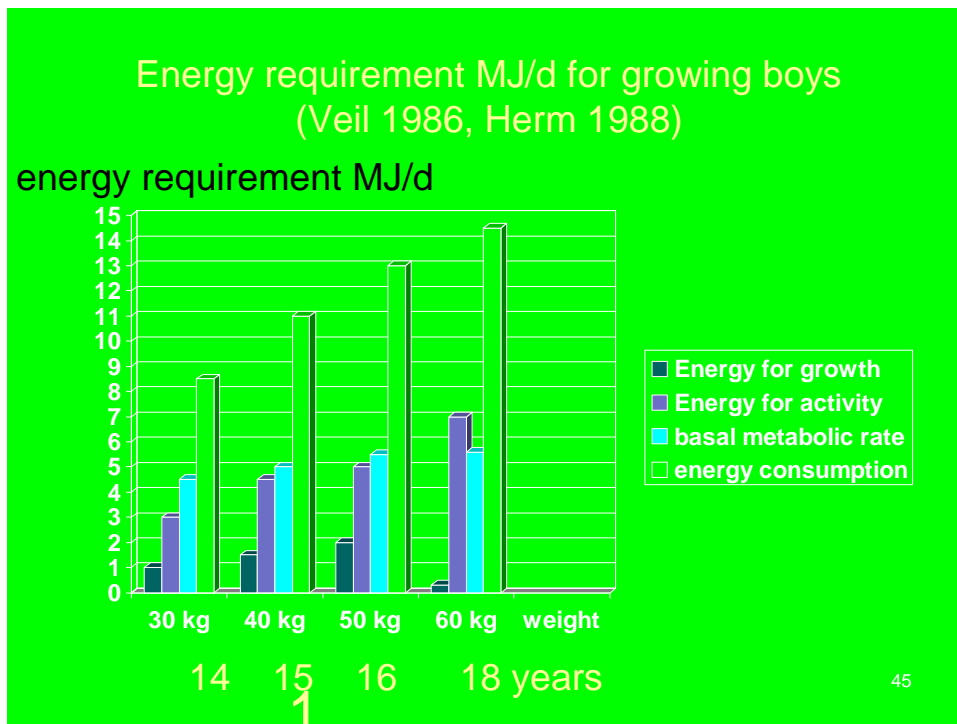
For **muscle mass** is the result that:

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 summary I could say that how the following figure (Figure 8) 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 8: Energy requirement MJ/d for growing boys (Veil 1986, Herm 1988)**



## 7. CONCLUSION

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 have a team in a nutrition department.

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