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How can we use Somatic Growth Dynamic of Children and Youth in Sports

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ABSTRACT

To recognize the relevance of right type of growth dynamic of sports children during childhood by observing the following aspects:

- *fundamentals to reach the later high performance,*
- *health and insurance*
  risk of injury
- *conception of training.*

One way to recognize growth dynamic of sports children is:

- *1. Sensible analysis of longitudinal investigations like short term measurements (daily, weekly, monthly) with calculation of growth velocity and growth acceleration with careful attention.*
- *2. The talent identification and selection for high sports performance and other areas of all talented children with different steps in the age range of 7 to 20 years.*
- *3. To support the selection for sports schools through reliable sift methods and suitable judgment or manner.*
- *4. To see specific norm systems in the development of sports and to assess the changes in the children and youth during the training with different profiles, e.g., different biological age, growth and development rates of the individuals.*

Anthropometric methods were used to estimate Somatotype and body composition (muscle mass, skeleton mass and fat mass). The biological age and growth types in different kind of sports can be used in different countries of the world.

The various methods of the investigations are used to describe Body Composition, Somatotype and Growth Type during childhood. It is possible for young sportsmen in different types of sports, using the models for the first time meant that the results were applicable for a longer period, is valid for the whole year in the age groups from 11 to 20 years.

Talent identification and selection is connected with "Models of special norms" in the field of Sports Anthropology.

The objects are:

1. To secure data on body measurements which reliably describe the characteristics of group, race or stock being studied, and

2. Publish the data in a form which may be readily and safely used for anthropological comparisons and deductions.

Growth dynamics and growth types will give more and directly the biological characteristics of the growing child.

KEYWORDS: Body Composition, Biological Age, Somatotype, Growth Type, Norms, Muscle, Bone, Fat, Talent.

1. Problems of Growth and development in sports

As one part of Sport Sciences the International Sports Scientific Academy has to develop the field of **Exercising and Sports Anthropology.**

In this area we have to see three points:
Category 1: Globalization,
Category 2: Identity,
Category 3: The Body.

Success and failure in Sports Anthropology depends on the aim of the investigations. The different kinds of Anthropological problems are to recognize the fundamentals and biological development of modern *Homo sapiens*.
In sports, Kinanthropometry and Anthropometry are special fields of Anthropology by which we can recognize a wide area of problems in growth and development.
In this position turned and developed as one example the "Special Norm" for variant kind of sports, training and short as well as long term development. During childhood with different investigations of talent identification, talent selection and talent development was found especially in sport differing high degree of adaptation not alone in height and weight but also in muscle mass, bone mass and fat as well as in the whole Somatotype development. Sometimes the baseline level of the somatic development is important.

To recognize the relevance of right type of growth dynamic of sports children is relevant, if during childhood we see the

- Fundamentals to reach the later high performance,
- Health and insurance
- Risk of injury
- Conception of training.

To train and exercise with the right loading, to see what enough is or what is too much during youth sport is the great question up today.

An early starting of high training loading has to give rise to damage of the hyaline cartilage and the osteochondral fiber as well as the growth zone inside of the long bones at the epiphysis, fibromyalgia – syndrome (FMS),

If you like to decrease the risk of injuries in children and youth sports, it's important:

- to use warm up,
- stretching the muscles,
- reducing of muscular dysbalances,
- avoid wrong training methods,
- eliminate a threat of over fatigue muscles,
- reduce overloading.

We can find problems in growth and development by studying a lot of growing children and young adults.
So we found children with growth pain and which receive an injury:

- During stable phases of development (less growth velocity) especially more problems with inflammation of hamstrings or Achilles tendon and
- During dynamical acceleration phase of growth, children have more problems of advance and join of tendon near the intersection of tendon to bone.

A study conducted on114 children showed that the most of injuries occurred during an age at

- Boys with 14.3 years (s = 2.5 years) and
- Girls with 12.4 years (s = 2.4 years).

The age of beginning of training and exercising is variable in different kinds of sports. But the growth dynamic of children from birth up to adulthood is internally inherent, quite sensible and so sizable difficult to recognize.

During growth period of children we have contradictory situation of biological development and loading of training.
At first we have to recognize the high metabolic and specially the anabolic character of development and during the same time the problems of trainings influences with

- musculoskeletal injuries during training,

- other bone injuries,
- bone injuries after trauma,
- all post-traumatic conditions and
- all musculoskeletal and connective tissue disorders (affecting bones, joints, muscles, tendons and nerves).

Since years, the regulation does apply that during growth period children have:

- Not more than 16 up to 20 hours have to train.
- Use an ability exercise programmed without specialization under the age of 10 years.
- More than ten kilometers running is not useful up to the age of eighteen years.
- Training is very important under qualified coach for children.
- Both sexes have different developments especially in bone mass peak but have similar growth of muscular strength and mass.
- Develop a good flexibility of the whole body, especially of the tip to reduce the rise of bone injury.
- The children need a specific therapy, if defects may be surgically created osseous defects or osseous defects from traumatic injury to the bone.
- One aspect to recognize high growth velocity is growing pain of children's bone especially during night and after loading.
- See the right interventions to increase physical activity in children and the right physical activity in youths.

But you have to see also, that in the modern time, children's exercise, movement and the activities are less than 20 years ago during our working days under the guidance of parents and grand parents. So we found a lower level of physical performance in childhood and youths.
It is not an antagonism to the meaning that physical activity and physical fitness are important for health if this aim is right but difficult to realize.

We know the average of height, weight, breadth, circumferences etc. But we have little experience how the growing child is at the moment or how strong was the influence of

training at the organism or what is genetically determined. Mostly we can see the result of good or risk training very late and sometimes too late. The result is: Homer sometimes nods.
We would therefore recommend that we have to look how the changing of growth during trainings process of youth is.
We have experience about the different biological age for example from 5 to 18 years. But we know also that sometimes the changes of the body are not suddenly and exactly recognizable. We see the growth and development of these children so often without the individual biological development.
Therefore we have methods for estimation of biological age.
That means to recognize the difference in growth and development like normal development, late development, and early development.
It is difficult to describe growth dynamic. Investigation on the relationship between biological maturation and anthropometric characteristics of a given population can use two different methodologies:
a) Statistical correlation analysis or
b) Contrasting of mature girls.
The idea is that Growth Dynamic and Growth Type will give directly and efficiently the biological property of the growing child.

2. Characteristics of Growth dynamic of sports children

To recognize the growth dynamic of sports children is with different methods possible:

- 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 (Fig.1).
- 1. System of talent identification and selection for high sport performance and other areas of all and talented children with different steps during the age from 7 to 20 years.
- 2. Support the selection for sports schools through reliable sift methods and suitable judgment or manner.
- 3. To see new development of sport specific norm systems for the training in children and youth sports with different profile of demands for example to the different biological age, growth and development rates of the individuals.

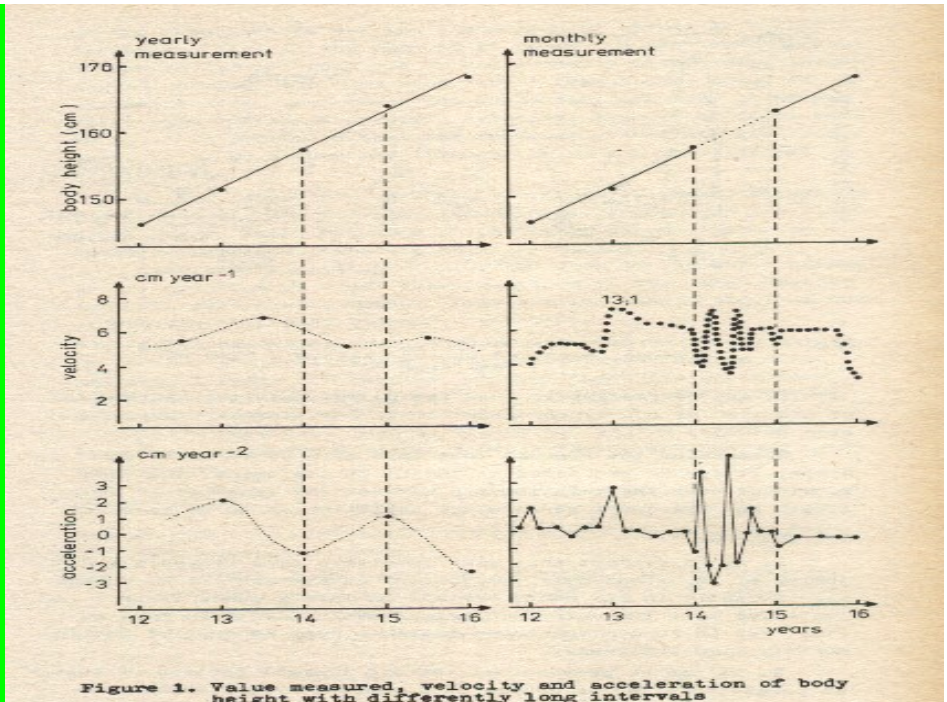

Figure 1 Value measured velocity and acceleration of body height with differently long intervals

2.1 Fundamentals

We have to see in Sports Anthropology:

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

The hypothesis is that from lots of possibilities to analyse the **growth dynamic specifics and Growth type of sports participating children** should be demonstrated**.**

2.1.1. Muscle Mass, Bone Tissue, Body Fat and Biological Age as Part of Somatotype and Growth Types

Muscle mass

In sports we have to analyse the *skeletal musculature* as very important organ of sportsmen. The gradual preparation of human efficiency in sports is mainly dependent on the adaptability

of skeletal muscular fibres. According to our findings intensive strength training caused aerial increases of fast twitch (FT-) fibres by 15.5%, as compared by 10.6 % with slow twitch (ST-) fibres, only. Following endurance – training loads ST-fibres showed aerial increases by 21.3%, FT-fibres to 16.3% only. It seems remarkable that the oxidative and rate of glycolysis metabolism has been functionally consolidated at the 12 year of age. The investigations gained similar results in the adaptation of skeletal muscle fibre areas and distribution of ST- and FT-fibres during specific sprint and endurance training programmes with children and adolescents including de-adaptation after a 6-month-non-training-interval and related activities of succinate-dehydrogenasis and phosphofructokinasis.

While the endurance trained subjects showed an increased SDH-activity by 42%, the sprinters had an increase by 21% in their PKF-activity. After the rest interval these activities returned to significantly lower values.

Contrary to these positive reactions an immobilization of the leg (after an injury) leads in a relative short time to a considerable decrease of muscular fibre airless (in particular in ST-fibres) by more than 20% and in connection with this to a diminished oxidative enzymatic activity (SDH).

Therefore, in sports we avoid trauma and longer immobilization.

We know that more than 95% of the consumed oxygen disappears in the mitochondria of skeletal muscles during maximal aerobic efforts. Therefore it seems reasonable to register adaptation reactions of them from training stimuli by determining the number of mitochondria as well as the density of their volumes. It could register increased surfaces of mitochondria by 37% and numbers by 18 % after 5 weeks of endurance loads causing an increased oxidative cellular capacity from an enlarged total surface (by 69%) of the Christy mitochondrial, and leading to “super compensations” during the period of recovery.

There is a significant increase of mitochondrial volume density, particularly in ST-fibres after 6 months endurance training, again supporting the fibre-type-specific reaction upon prospective training stimuli (Tittel, 1996).

Who regulates and controls these biological adaptations? Decisive effects on muscular growth results from the hormones of the peripheral endocrinal organs particularly by thyroxin, by the somatotropic hormone (STH) as well as by testosterone, controlled by hypothalamic nuclei fields. These hormones become highly active during puberty after changing secretion processes (e.g. reduction of suprarenal activity and increasing thyroidal function) in the form of secretion peaks and react very sensitively upon training loads. It can be demonstrated in the form of the plainly flattened follicular epithet of the glandular thyroidal immediately after

endurance efforts. On the other hand, we know that essential improvements of strength capacities can only be achieved after increased testosterone- production and - release and "peripheric sensibilisation" towards that hormone. Therefore, at first strength training should be concentrated on the consolidation of motor processes and control of movements during prepubertal stages!

The oxidative capacity of individual muscular fibre types is related to clear training-specific adaptations. We may conclude that the capillary density and capillarisation are also adapting to loads in a similar manner.

The experiments with endurance-trained individuals showed functionally enlarged capillary beds by 45% as compared to the control group caused by an increased metabolism and a higher osmotic pressure and initiates because of a hyper-polarization of the smooth vascular wall muscles of arterioles and pre-capillaries, thus an increase of the skeletal muscle's oxygen- consumption up to the 50 fold. The capillary density and mean inter-fibrillar mitochondrial volume density are correlated significantly with endurance loads (e.g. after a 100-km-race). There is a nearly complete depletion of the inter-fibrillar and lipids, but no evidence of an acute redistricting of mitochondria. The microcirculation in FTG-fibres is significantly weaker developed in untrained and trainability of trained conditions than in untrained and trained ST-fibres.

These findings of skeletal muscles and their components in children's and adolescent's age clarify the physical range of performance and the trainability of skeletal musculature presuppositions when systematic training programs taking the biological adaptability of musculature into consideration and sufficient periods for active recovery are established; they are more liable within the mass of connective tissues.

Skeletal Mass

The second main organ for anthropometrical measurements of sportsmen is the *bone tissue.*

Now some remarks to the adaptability of bone tissue upon regular training loads. Both the peculiarities of our total skeleton structure "lamellary" or "breccial" bone possesses manifold adaptation reactions because its intensive metabolism need blood supply; for 5 to 6 times within our life!

To the most important adaptations of bone tissue which need experience about 3 to 4 years regular training belong among others?

- The circumferential growth of short corticalis and long tubular bones (demonstrated with a polio myelitis patient, with an untrained person and with a 50-km-walker, all of the same age);
- The enlargement and ventralisation of the supporting areas of the rich capillarized lumbar vertebral bodies;
- The increased osseous formation in the zones for the attachment of muscles, tendons and joint capsules caused by high and regular tensile loads;
- slackening in the area of symphysis pubis to be registered among others with younger female gymnasts, and
- Changes in the internal structure of bones in the direction to another increasing sclerosis; example; the femoral-patellar joint.

Body fat

Fat or adipose tissue is an important structure of body composition in all ages of sportsperson's bodies. Lots of investigations have been conducted to find out adipose tissue or body fat. Adipose tissue is also one of the aspects to estimate growth type (Herm, 2002). Anthropometric profiles are mainly used for the evaluation of the level of body fat in both athletes and other members of the general community. There are a variety of measurements in which anthropometrist uses these as basic parameters to quantify regional body fat levels (Norton and Olds, 1996). Many of these methods have been applied without appreciation of the errors and assumptions associated with their use (Herm, 2003). This uncritical estimations of body fat is one of the most abused areas of anthropometry. This part will address some of the major problems associated with fat estimation by using regression equations and suggest ways to minimize the inconsistencies in this application of anthropometry.

Body fat follows changes throughout life in a way which, on a population basis, is quite predictable. Cross-sectional and longitudinal data demonstrate that there is an increase in subcutaneous fat stores from relative high levels of fatness in the first year after birth, and then slowly decrease to their lowest levels between the ages of 6 and 8 (Tanner, 1962). After this, subcutaneous fat rises progressively throughout most of the developing years except for a noticeable dip at about the time of the growth spurt (about 11 to 12 for girls and 14 to 16 for boys). From this point, subcutaneous storage fat increases, reaching a peak during the fifth decade of life in men and the sixth in women, subsequently falling as age increases. There after there is a declination in external fatness that is probably due to selective mortality thereof fatness is a known risk factor for developing a number of diseases. Since most people

are concerned about their level of fatness, fitness centres and gymnasia. Similarly the established relationship between excess fatness and decreased sports performance has resulted in fat assessment becoming an integral part of the physiological preparation of athletes. In both of these examples, the method used to determine the level of storage fat typically involves taking skin fold measurement. These external skin fold measurements are useful to predict total body fat by using any one of a number of prediction equations available in the literature. Whenever these types of methods are applied to know the body fat, then it is necessary for the measurer to get knowledge of its limitation, important assumptions and Technical Error Measurement (TEM). In this way meaningful and appropriate information would be conveyed to the person on whom the measurements have been taken by measurer.

Biological Age

The *biological age* refers to an individual's age as it is examined by biological maturation and exogenous influences, which may differ from chronological age (Tittel and Herm, 1992). The variables for the determination of biological age are: the skeletal system, development of primary and secondary sexual characteristics, height, body mass, and body surface area. The deviations from normal development are characterized either as acceleration or retardation. In the sports sciences areas in Germany, we have found the "body development index" as the method of choice for estimation of biological age (Wutscherk 1985).

Among the variables, working capacity of children and nutritional requirements in sports depend on biological age.

Note: Especially at development of puberty, there are great individual differences in biological age among people of the same chronological age. Work capacity must therefore be examined on an individual basis.

Less training is an example of some bad outcomes for children up to adults like:

- simultaneous increase in fat and decreasing muscle mass
- Decreasing bone density and at the same time developing of motorically related problems or movement disorders.
- Somatic problems like changing of blood fat
-Overweight/Adipositas and increasing Osteoporosis

Cardiovascular Risk Factors

Overweight and Adipositas is a problem of modern civilisation illness and it is also a very big problem of the modern society as well as in developed industrial countries and in not so high underdeveloped countries.

2.1.2 Exercising and Training

Exercising and Training is a very complex, wide and extensive field therefore we focus on a few aspects.
Following are the well known universal fundamentals for training or no training, if you miss your workout:

- for 2 days: you start losing muscle mass and strengths
- for 4 days: you start losing muscular endurance
- for 15 days: your heart start losing cardio vascular efficiency
- for 30 days: you start losing your flexibility
- for 3 months: you start losing your coordination
- for 6 months: you start losing your agility/speed
- for year: you start losing your skin tone
- for year: above functions of your all system start deteriorating.

And if you start again to train with exercising:

- Pain persists again
- Muscles needs to work harder
- Heart and all systems working under load
- You are back to the starting point.
- You have higher risk of injuries.
- You must train with different high, mostly lower level of loading.

Can we find contributions about growth and development in Anthropology of Sports in Sports Medicine Conferences?

In 1990, I found the following papers in the ACMS:
- Body composition = 63 articles
- Nutrition and Sports = 59 articles
- Growth and development = 6 articles

- Rehabilitation/Prophylaxis = 16 articles

And what is the situation today after 22 years? It is impossible to have a clear comparison of issues in the actual ACMS Conferences up to 2012, but we have some more articles pertaining to following numerous other topics and 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

It has been difficult to find a paper exclusively about Growth and Development.

I am thinking that we must start with more investigations about sport sciences investigations in Growth and Development.

2.2. Methods

The following methodological processes can be applied:

Methodical proceedings of conducted longitudinal investigations

Monthly investigations (28 day rhythm, time point)

WILCOXON-test (for longitudinal studies paired samples)

Cluster Analyses

1. **with all parameters**
2. **with relatively constant parameters**
3. **with parameters which have highly specific growth acceleration (e.g. height, weight, skeleton mass, muscle mass, biological age)**

Multiple Discrimination Analysis to find Growth type 1 (stable/steady) Growth type 2 (dynamicaly/steady)

Calculation of movement velocity with numerical differentiation and graphical curves comparison after empirical regression

Growth Pattern of Curves

1. **Individual assessment of body composition and performance**
2. **Individual prediction of growth dynamic of the body composition and performance growth**

2.3. Results

According to these methods, it is possible to differentiate in different sports various kinds of pattern of growth (two growth types, at first **Growth type 1 (stable/steady)** and second **Growth type 2 (dynamically/steady)).** And so it is possible to calculate the speed of growth, to see the movement or velocity indicator with numerical differentiation and graphical curve comparisons after empirical regression.

So it's possible to analyse the problems of growth dynamics with following curves, for example, of Muscle mass and 800 m running time (Fig. 2, Growth velocity of Muscle Mass and 800-m performance):

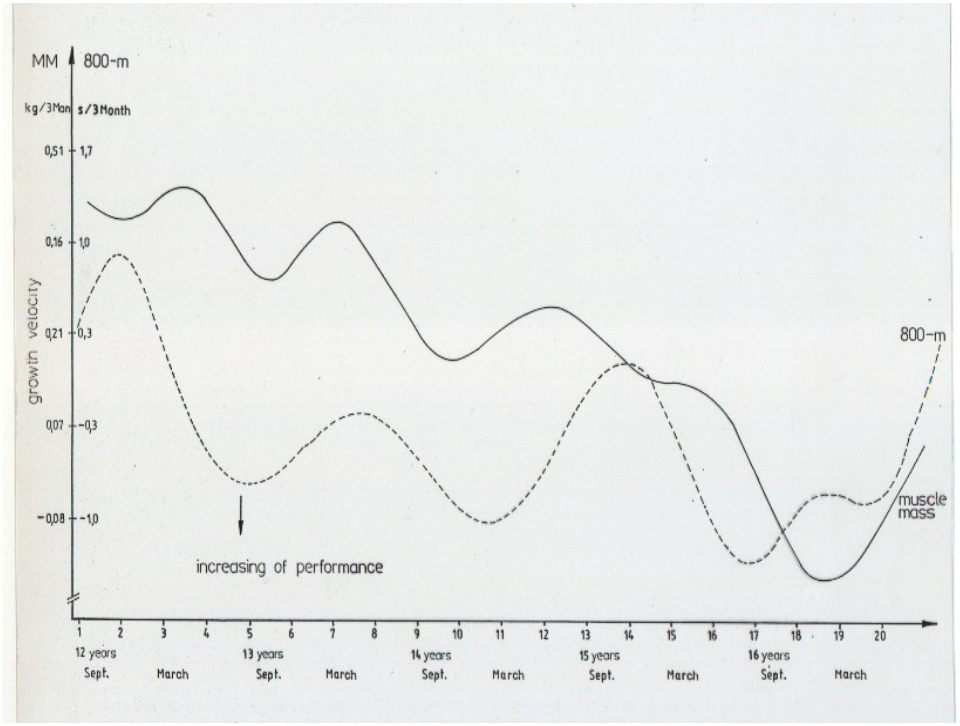

Figure 2 Growth velocity of Muscle Mass and 800-m performance

In high performance sport we can't see alone the development of performance in children we have also to see the health as fundamental for success. According to our investigation from

birth up to the age of 60 years, 22 percent of injuries occurred between 11and 15 years and 23 percent of injuries between 16 and 20 years. That means nearly 50 percent of problems can be described during a time span of ten years.

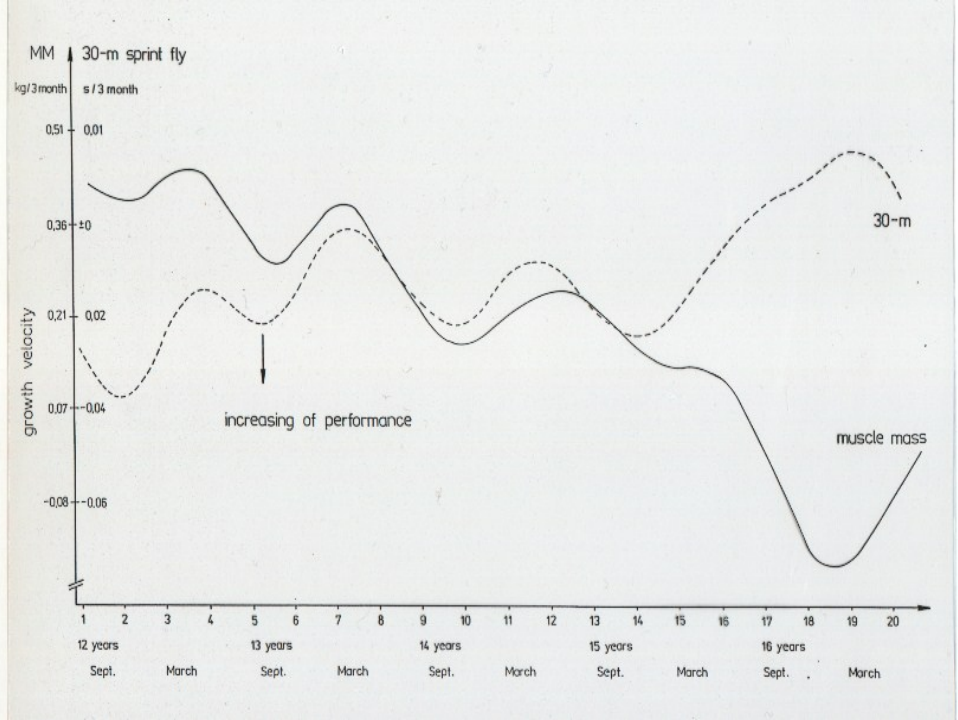

Figure 3 Growth dynamic and 30 m sprint fly

Amongst most of the physical injuries and trauma during childhood we can find lesions of joints of the long bones, particularly of the knee joint, foot link, shoulder joint and musculature of the legs and arms included shoulder.

For the important problem of talent development, six articles seem too less!
The big problems are the numbers of injuries during growth and development as given in Figure 4 (Fig. 4, Injuries in percent between 11 and 20 years):

We found fissure of cartilage, damage of muscle onset of muscles, hematoma, seldom fatigue break, durable painfully defect inside of bone, capsular irritation e.g. in hip (peroarthropathia coxae), if we have 10-30 % muscle trauma.

But see also: To enjoy exercise and movement, children are regulation by adults.

If we use these aspects you can speak then from **Functional Sport Anthropology.**

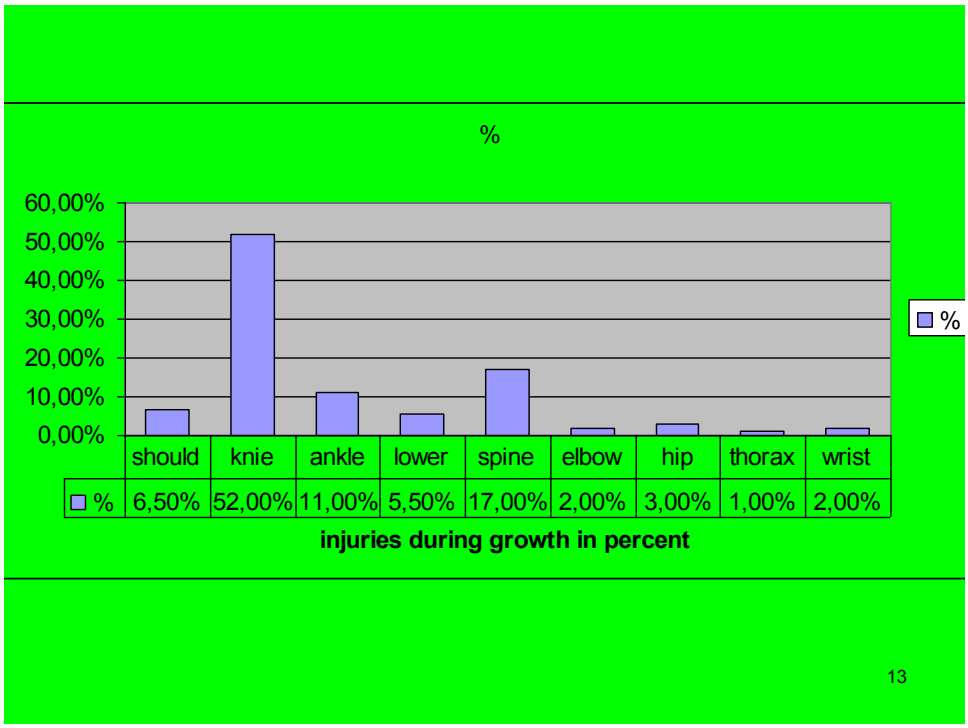

Figure 4 Injuries in percent between age of 11 and 20 years

The results are growth pattern of curves with

1. Individual assessment of body composition and performance and

2. Individual prediction of growth dynamic of body composition and performance growth.

So we could find time ***points of reduced or increased growth acceleration of body height and weight*** during the progress of a training year

Reduced growth acceleration:

Body height:

- After beginning of the training year
- After beginning of training periods, for example macro cycles
- During the competition preparation period and during high competition points and during great parts of specific training loading

Body weight:

- After adaptation at the high sport load
- With great parts of general training
- During the stages of competition preparation

And

Increased growth acceleration:

Body height:

- During break of training, e.g. winter or summer holidays
- With great parts of general training or during periods of reduced intensities of training
- After adaptation on the high sport load

Body weight:

- After beginning intensive sport loading
- With great parts of specific training
- During interrupting of training

2.4. Discussion

Practice of Sport Anthropology

1. Description models of body parts and locomotion's (dimensions and proportions of sportsmen in different kinds of sports)
2. Comparison models of body structure and sports (based on similar systems like distribution curves)
3. Regression models of body parts and in relation to locomotion
4. Relationship and correlation models (multivariate statistics)
5. General allometric equation (models of growth curves, relation to training loading and growth)
6. Dynamical models (growth and development, growth dynamic, as a description of changing of body development)
7. Somatotype models
8. Body composition analysis (muscle, bone and fat)

9. Anthropology of body image in sports
10. Models of movement, place, design and equipment of sports and biomechanical aspects
11. Sports performance models like morphological optimisation, selection of talents, implication or talent selection in different kind of sport
12. Norms of different kinds of sports groups
13. Health models (overweight, anorexia nervosa, malnutrition, obesity and Adipositas etc.)
14. Sports training and heredity of body structure
15. Evolution of human body size (secular trend of development)
16. Computerised anthropometric and allometric databases

Sport Anthropology and Norms

To designing special norms is a long and different process and therefore following theoretical and practicable methodical way was constructed (Herm,1993).

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 sports 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 recognise dynamic system of man.

3. Conclusion

As a part of the International Sports Scientific Academy you will find the proposal to develop the field of **Exercising and Sports Anthropology.**

The main aim of the investigations of Body Composition, Somatic Type and Growth Type during Childhood is to develop the sports art, specific kinds of norms for talent selection in children and youth sport.

It is useful to develop following fundamentals:

1. Growth and development, Growth dynamic and aspects of biological age for sports children in relation to normal population.

2. Talent selection, talent identification and talent coaching for motor development in different kinds of sports from the view of Exercising and Sports Anthropology.

3. Biological aspects of training in high performance sports training.

4. Theoretical and practical aspects of

    - Physical culture,
    - methods of investigations and
    - Teaching.

5. Health aspects in adulthood from the view of Sports Anthropology
    - prevention of overloading
    - elimination of injuries
    - age-based exercising
    - achieve of moderate and very good sports performance in childhood which increasing continue see in Figure 5 (Fig. 5 Performance development from childhood up to top level sportsmen).

3.1. How to use and what to do with the experiences of Growth dynamic during training

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).
For future it is usefully

- To see if during growth periods we have an increasing of number in orthopedic-clinical problems.
- Age of ambulant patients
- Procedure during orthopedic-clinical rehabilitation
- Prophylaxis and programs of Rehabilitation with
    - functional kinetics of exercising program

- extension and stretching program

Important for children's rehabilitation a "soft" trend of loading specially in endurance training (Aqua running, deep water running) if you can reach a faster rehabilitation and simultaneously a higher performance and efficiency (for example 3 time per week water exercising will bring an increasing of maximum oxygen uptake of nearly 20 %).

So in most countries a talent identification and development programs were developed, e.g., *See the Indication marks and specific 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**

3.2. Perspective of Growth dynamic for sports children

It is useful to develop step by step better methods for estimation of somatic growth dynamic. They must with the help of computerization be made easy to realize and in praxis of exercising and coaching easy to use.

Thereby you can show the sensible phases of body development.

Trainer can use the different phases of growth dynamic for planning and realization of training.

How much loading is enough and what is too much, can be described.

Advantageously is to decide, during which time loading of power training is the best.

Prevent of injuries and damages' of somatic structure and tissue are better possible.

Knowledge of growth velocity and acceleration of development in relation with the final structure of stature can give a better fundamental for long time development of the children.

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