The preserving of the physiological functions

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The purpose of gymnastics is to preserve — eventually train — the physiological functions, both the physical and the mental.

The factors which destroy the natural functions are diseases arising from overstrain and wear and tear on the muscles of the skeletal system, often concealed behind the diagnoses of neurosis and rheumatism. During the war there was a great increase in the number of disorders due to overstrain and wear and tear in the skeletal muscular system. We must still reckon that about *20 per cent* of the office employees in Oslo suffer more or less from these maladies, which manifest themselves, especially during work, by aching pains in back, arms or legs. *The pains* originate from *overstrained muscles,* which are tender and stiff (primary myoses) or from tender, swollen *tendon attachments* (peritendinitis), artrosis of the joints or the *spinal column* with degeneration of the intervertebral discs (spondylosis with cervicobrachialgia or lumbago-sciatica).

Even though many of us do not have pain, there are, nevertheless, few who do not have organic changes in the skeletal-muscular system due to functional diseases. By *functional diseases* I mean principally those ailments that are caused by changes in the functioning of the musculature, whether they occur in the skeletal muscles or the unstriated muscles of the intestines, the bronchial passages, the heart and the blood vessels.

We can distinguish three stages in a functional disease, namely:

1. A cause — e. g. nervousness, long working hours.

2. A functional defect — e. g. a tense manner of breathing, a cramped working position, or a disturbed bowel function.

3. The illness itself or the damage caused (see Tab. I).

From this point of view, physical education can be carried out in three trends:

1. *We can remove the causes* of the functional disorders (tab. I, col. 1). We do this partly through prophylactic work and partly indirectly as indicated in the following.

2. *We can influence the physical functions* (tab. I, col. 2).

a) By actively training the functions of the muscles and the joints. Included in this is the training of muscles that we neglect in daily life and the prevention of passive strain on joints, f. inst. as in a standing posture, when the body is suspended on the ligaments.

A survey of which functions should be trained can be seen in table II. It shows how we should educate the human being in his entirety. The various forms of physical education develop only the individual functions. It should not be a competition between them but cooperation. (See supplement nr. 1).

b) We can exert an influence on the physical functions by removing the functional disorders — especially nervous tension, wrong posture and gait, wrong manner of working with undue strain on muscles (supplement no. 2).

3. The third trend in physical education concerns choosing the *exercises that aim to prevent or directly remove the organic changes that are caused by strain disorders.* Even if a functional ailment is due in the first place to a defective muscular function, the changes caused by the ailment do not necessarily make their first appearance in the musculature. Thus, if the functioning of some part is impaired, the changes may first arise in the backbone itself. Morbid changes in the backbone and joints are very often caused by the combination of a functional defect and changes due to age, such as the drying up and stiffening of the cartilages in the joints. We cannot put influence directly upon joints and spine but we know that an effective use of muscles can prevent arthrosis and spondylosis.

As mentioned, training of the muscles can be inhibited if, by overstrain, they have become firm and tender. Many of them are in a state of *contracture* that restricts the mobility of the joints. This makes it difficult to relax these muscles. Thus the training of the muscles will also be inhibited because during work they will quickly cause fatigue and pain (pain-tension). The pain comes from the

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reunieron en grupos correspondientes a un aumento de 10 centímetros en la talla (h), clasificados y agrupados sobre papel long-long. Las curbas que mejor reflejan los resultados son las líneas rectas y las funciones estudiadas, podían, por lo tanto, expresarse por la formula general $y=a\times h^b$ en la cual a y b son las constantes que pueden determinarse.

Cuando b se compara con los valores presumidos en el exponente h, se puede diferenciar entre éste aumento de la capacidad física con el crecimiento, los debidos solamente al crecimiento y con los que dependen entre otros de un cambio específico de los órganos del cuerpo en crecimiento. Los resultados se discutieron y se demostró que principalmente todas las funciones que dependen del esfuerzo muscular máximo, aumentán, comparadas con la talla, más rapidamente que las previstas. Estos resultados prueban el hecho de que una habilidad aumentada de la mobilización y coordinación de los músculos del cuerpo, son la causa de un aumento rápido en la capacidad física de los escolares.

Table I. *Functional diseases*

I. Diseases caused by strain in the skeletal-muscular system.

Causes → Functional disorders → Organic changes.

Psycho ←——→ somatic

Causes	Functional disorders	Organic changes
1. Nervousness.	Rigidity.	Myosis (in muscles) and/or
2. Wrong physical education. Fashions. Lack of education in manner of working.	Coordination-tension (sit, stand, walk, work).	Functional neuritis and/or
3. Inadequate working equipment. Protracted, monotonous work.	Strenuous working position (static muscular activity). Hyperfunction.	Tendoperiostoses (in tendon attachements) and/or
4. Chronic state of pain.	Tension caused by pain.	Arthrosis (in joints). Spondylosis (possibly with root lesions).
5. Disability (anomalies, deformities).		

Symptoms:
Pain, fatigue, etc.

II. Functional diseases in the internal organs.
(The strictly psychosomatic diseases)

Table III. *The most important contractures*

Functional disorders.	*The contracted muscles.*	*Limited functions.*
1. Working with elbow fixed in a flexed position.	M. bracialis, m. bracioradialis, m. triceps.	Extension in elbow joint.
2. Walking with fixed shoulders. Wrong working position.	M. supraspinal., m. infraspinal., M. pectoral. minor, m. teres major.	Fixed shoulderjoint, especially abd. + pronation.
3. Shoulderhoisting and costal respiration.	M. m. scaleni. m. levat. scapulae. m. trapezius.	Sink shoulders, scapula fixed.
4. Jaw clenching.	Muscles of mastication.	Movements in the jawjoint.
5. Stooped, slack posture with chin up.	Distal neck muscles. Prox. neck muscles. Prævertebrale m.	Fixed neck-crook. C. 5-7. Fixation in artic. atlanto-occipitalis.
6. Tenseness or wrong working position.	Rectus abdom., proximalt diaphragma? m. m. intercostalis.	Sidebending of thorax, movements of ribs.
7. Posture of backward tilted upper trunk. Tenseness.	Errector trunci in transition to thoracal.-lumbal.	Fixed high lordosis. The lo-L_2, movements of ribs.
8. Working or walking with hips fixed in a flexed position, stooped posture.	Psoas + adductors, m. quadratus lumbarum, erector trunci distal.	Outward rotating + abd. in hip joint (patrick) hipwriggle, fixed low lordosis (L_4—S_1).
9. Walking with knees, fixed in slightly bent position.	Hamstrings both sides.	Extension in kneejoints.
10. Walking with ankles fixed in a dorsalflexed position.	The joints dorsalflexors + m. soleus.	Extension in anklejoints.
11. Backward tilting posture + gait.	Ext. dig. comm. + flexors of the great toe.	Flexion in metatarsus and toes.

Table II

1. That which releases the action — Stimulus —.	2. Activity in the nervous system. — »The Will» —.	3. Nerve-muscle system. Functions. Actions.	4. Functional disorders.
1. Full bladder, intestines, CO^2 tension in blood.	Unconscious reactions in reflex-center.	Defecation reflex. Respiration.	Disturbed by will-tension.
2. Stretching of muscle.	,,	Tendon reflex (spinal).	Increases by brain injury.
Tear in skin.	,,	Skin reflex (cortical).	Decreases by brain injury.
Pain.	,,	Pain reflex (spinal).	Inhibits other functions.
3. Balance disorder.	,,	Postural reflexes (sit, stand, walk).	Will-tension destroys.
4. Something we feel a need to touch.	Unconscious reaction.	Grip reflex.	Slack posture. Will-tension destroys.
	Conscious control.	Instinctive graspaction.	
		Instinctive hereditary actions.	The natural handclasp.
5. Need: Mental of love, etc.	Feelings, partly unconscious.	The normal tension.	Frustrations or exaggerations can cause unbalanced personality.
Physical for actions, etc.	Muscle awareness.	Embracing — Play.	
6. Help, play, superiority.	Pleasure.	Escape.	Destroys the will-directed.
	Fear.	Affected movements.	Checked by will-tension.
		Anxiety-tension.	Increases by relaxation.
7. Conflict — Command.	Anxiety. — Partly unconscious (complex).	Adopted reflexes. Relaxing of unnecessary tension.	Inhibits or increases all other activities and functions. Apathy.
8. Friendliness.	Feeling of security. Partly conscious.	Unconscious and conscious.	Slack posture.
9. Duty. Summons.	Fading impulses. Judgement (common sense). Decision (will) (motor impulses).	Will-directed movements (work) speach, written coordination, automatically.	Will-tension (Prussian-gymnastics) coordination tension (beginners).

muscles themselves and their tendon attachments, but is often caused by lesions in the adjacent nerves (functional neuritis).

Our investigations show that contractures due to functional disorders occur much oftener than previously presumed, and can be found, f. inst., in the spine of many children. These contractures that we have called *functional contractures* is the primary reason for the rigidity of the joints and spine that is so prevalent that it is considered to be normal. This view is due to the fact that previously the contractures were thought to be mostly a result of age. The most important causes are overstrain due to static muscular activity in a muscle which is in a state of contraction, first and foremost because we cannot counteract the influence of our weight. This point of view does not mean that other factors, like f. inst. age, do not also play an active part.

In the past, contractures have been counteracted by the so-called *limbering exercises.* However, they have to a certain degree had an effect contrary to intention. If one makes an arch f. inst., it will entail an increased mobility at one place in the small of the back, while the adjacent sections become rigid. Limbering exercises have also been overdone as the joints have suffered, f. inst. in the so-called split where one falls down with one leg to each side.

By making a survey of the contractures (see table III) one will get a better basis for the choice of the most suitable exercises.

The best way to find the contractures is by using a local anæsthetic in the firm and tender muscles. By injecting a local anæsthetic in the tender muscles along the side of the neck m. scaleni f. inst., the shoulders will drop down (tab. III, nr. 3). Injection in the tendon attachments of m. erector trunci on the skull, increases the flexion in artic. atlanto-occipitalis. Injections into the tender tendon-attachment of m. psoas will give increased mobility in the lower part of lumbal columna (tab. III, nr. 8).

When the contractures lead to pain (neck-, arm pains, cervico-cephalagia, lumbago), the patient must be treated individually with massage-relaxation and exercises. (Local anæsthesia can be very beneficial as a supplement.)

But most of the contracturese do not lead to pain and are so prevelant that they can be found in all gymnastic classes. The gymnastic pedagog must therefore recognise these contractures so that they can employ the most suitable exercises to remove them or, if possible, prevent their onset.

We find some objections to a gymnastic pedagog being ac doctor, but within their sphere they should consider themselves as such, as we might not otherwise get the most suitable prophylactics. Conditions as they are now are wrong, as the patients become so ill that they need local physical treatment of the muscles before they can benefit from gymnastic exercise (See supplement nr 2).

Conclusion

A survey as found in this table II, over all of the factors we have to deal with regarding education can seem complicated. I think it would be much easier to understand it if we were taught to think more in the direction of the functions. The anatomical view has dominated our education far too much. Added to this is the fact that we have overestimated our conscious will-power. It is in reality only a small part of our personality, just about as big as that part of an iceberg that extends above the water.

The profound purpose of physical education is to teach the human being in his entirety, and show him how to work with himself.

Bodily movements (relaxation) is the easiest method of learning how to know yourself.

Physical education is an important entrance into personal mental hygiene.

Conclusion

Une vue générale — comme celle que l'on trouve dans le Tableau II — de tous les facteurs entrant en considération au sujet de l'éducation, peut sembler compliqué. Il me semble qu'elle serait beaucoup plus facile à comprendre si on nous avait appris à penser davantage aux fonctions. Le point de vue anatomique a beaucoup trop dominé notre éducation. De plus nous avons surestimé notre volonté consciente. En réalité elle ne constitute qu'un petite partie de notre personnalité, comparable à celle d'un ice-berg émergeant de l'eau.

Le but profond de l'éducation physique est d'enseigner à l'homme ce qui constitue l'ensemble de sa personnalité et de lui montrer comment faire travailler son corps.

Conclusión

La recopilación contenida en la Tabla II de todos los factores de la educación, con los cuales tenemos que tratar, puede parecer complicada. Creo que se comprendería con más facilidad si dirigiéramos la atención a las funciones en sí. El punto de vista anatómico ha dominado demasiado nuestra educación. Además de esto, hemos estimado en forma exagerada nuestra fuersa de voluntad consciente. Esta es, en realidad solamente una pequeña parte de nuestra personalidad, no mayor que la superficie del «iceberg» visible sobre el agua.

La idea esencial de la educación física es el enseñar al ser humano en su totalidad, y el mostrarle como trabajar consigo mismo.

Movimientos corporales (relajamiento) es la manera mas fácil de aprender como conocerse a sí mismo.

La Educación Física es un punto muy importante en la higiene mental y personal.

Supplement No. 1.

Which functions should be trained?

Use and misuse of the will in physical education

The human being is so versitile and complex that it is difficult for us to grasp the *whole human being* at one time. The various pedagogs have therefore often worked with a reduced *school* edition of the human being.

Take the conception of the *will*. Have we not here mostly meant the conscious will? and insisted "where there's a will there's a way?"

But in our daily life we see time and again that it is not the will but the emotions that determine what we do. But determining our actions must then necessarily be a form of will that conquers our conscious will? I think it is correct to say that *to the will belongs all the factors that create actions, both the conscious and the unconscious.*

Such a view of the will is supported by the fact that it is difficult to decide when the conscious state of mind leaves off and the unconscious takes over. The conscious mind acts furthermore never by itself, but always together with the unconscious factors.

The unconscious factors, f. inst. antipathy or fear of a task or a person, also influence the planning of our actions. This is the reason why it is so difficult to be sensible, by which we mean, judge the situation correctly.

Table II shows how the human functions originate. Column (1) because of certain impulses. Column (2) that which leads to a reaction in the nervous system. Column (3) that which releases an action.

The question now is: In which way should one teach the pupils to use their will?

A. **Actions** (Tab. II, column 3)

The will is an extremely difficult conception to define. Let us rather start by trying to find out what the will does — that is to say, the *actions*. We will start with the simplest functions regulated by the sympathetic nervous system and work gradually up to the higher, conscious mental and physical functions.

The school education has previously been based to a too great degree on an unvaried development of the *conscious functions* (no. 9). Luckily we have lately also understood the importance of *relaxation* (no. 8). I also know that in Swedish schools they have laid great stress on the fact that gymnastics must enhance pleasure. This one promotes by play and other *emotionally-directed movements* (no. 6). The instinctive *selfassertion* increases in a healthy manner through competition in sports (no. 5).

The griping phenomenon (no. 4) is set up as examples of functions that are placed between the reflexes and the actions in which the whole organism partakes. They commence quite unconsciously as reflexes but resemble actions in that they can be extinguished by relaxation.

The 3. no., *postural reflexes,* are superior to the tendon-reflexes (no. 2). As a group by themselves we can set up functions lead by the autonomical nervous system (no. 1).

The conscious will can bring forth the will-directed actions (no. 8) and relaxation (no. 7). Our conscious will can also be used to *train* our *muscle-awareness,* which can be done in one way by training on *relaxation.* Through relaxation we can also *reduce anxiety-tension* that otherwise inhibits our actions, which one can observe in gymnastic exhibitions. With the simpler functions (no. 1—7), the conscious will can only arrange things so that the subordinate (partly or entirely unconscious) functions have the chance to develope. In regard to postural reflexes we must only adjust the body in an erect balance posture so that the reflexes can exert influence on the joints in their intermediate position.

As to the emotionally-directed actions, our conscious will must start the actions but let them be formed under the influence of muscle-awareness. Our will moves us to dance f. inst., but our emotions form the movements. We must above all things feel our way toward performing movements without unnecessary strain of the antagonists.

But the will itself cannot create the emotionally-directed actions. They can, though, be made tempting if the gymnastic teacher arranges things so the pupils wish to join — f. inst. in ball games.

Another way of increasing the desire for emotionally-directed movements is music. Releasing the emotionally-directed actions is one of music's greatest contributions to gymnastics. One can say that the exercises one performs to music border on the purely willful actions. But the difference is that we can be *lead by emotions* to the accompaniment of music. Only in this way can one avoid the undesirable tension that makes our actions rigid, clumsy and uncoordinated. Muscle-awareness is the stipulation we must have in order to feel the movements of the body and to derive pleasure therefrom.

When the will-directed actions have become automatic, they seem more and more to be under the influence of the emotions. That is what is needed to make soldiers who act without reflecting.

B. **The psychical functions that create actions** (Tab. II, column 3)

Psychical functions in the nervous system are required in order to start actions. Therefore these psychic functions will not get a chance to develop if we do not practice on how to perform actions. This is just what makes it such a big and important task for pedagogs in gymnastics.

By performing will-directed movements, *e. g.*, a jump, we learn how to judge a situation and how we should go about it. (9). As time goes on we incorporate habits in the nervous system so that actions and movements become automatic and are carried out more or less unconsciously.

We find a comparative effect on the psychical functions if we train ourselves to relax — partly total and partly in avoiding unnecessary muscle-tension when we move. We know by experience that this produces a feeling of security and self-confidence. The *emotionally-directed* movements, (embracing, play, escape), develops the ability to open-up, be oneself and give vent to our feelings. *Self-assertion in sports* preserves the natural instincts (5). The importance of preserving the natural instincts, f. inst. self-assertion, is easy to understand when one studies children who are strongly intimidated by authoritarian discipline.

C. **Stimulus** (Tab. II, column I)

Pursuing a physical education will have an influence not only on the psychic functions but also on our capacity to react to stimuli which normally start the various physical functions. The gymnastic pedagog should take these stimuli into account. *Exercises in balance* are therefore beneficial (3). NB. if they do not at the same time cause anxiety-tension. *Hand tools* are very handy to use but beneath the surface lies the *grip-reflex* and the instinctive griping reaction. (4). The griping phenomenom is released unconsciously (like other reflexes) when we are at the point of falling or when we wish to take something. They are therefore the subordinate means to fulfil a need, f. inst. when we wish to shake hands. A hand shake will not be natural without releasing the griping reflex. The grip-reflex becomes in this way a link in a chain of functions that serve us when we wish to come in contact with our fellow men. (5). In addition is required the capacity to be ourselves. This we will get when we spontaneously express our feelings through the emotionally-directed movements. We can see how a *superior function* — namely to contact a person — is dependent on the simpler functions. (5 and 4).

Modern pedagogy now understands the importance of enhancing needs. Of special importance is the task that the pedagog has in preserving the child's need for movement — that is, the need to react to the bodily stimulus that normally releases the need to move. This need is definitely suppressed when the children are forced to sit still in their wrongly constructed *school desks* many hours each day, and is most likely the reason why many lose their need to move.

As to stimulating the pupils, the *pedagog's personality* is of the greatest importance. If they can get the pupils to feel that they will get help (6), that they will be treated with friendliness (8), they will perform the movements eagerly. When there is real delight in movements, it is easier to coordinate the functions of the muscles. Look at the "good" movements of the child who plays joyfully f. inst., or consider the broad smile that expresses pleasure in comparison to the rigid, conventional smile.

If, on the other hand, the pupils get a feeling of superiority or command, most of them will perform the actions out of duty — they use the conscious part of the will. One can see that they perform the movements reluctantly. Some pupils like to conform to command and use the conscious will in the performance, but frequently without pleasure.

Many maintain that when they straighten up with force, they are making a coordinated movement. This is wrong. In this way one has not combined the various functions but used the will to brutally suppress the subordinated functions, among others, those which our emotions wish to initiate. Sometimes this can be necessary, but bear in mind that real coordination can only come about by cooperation between the will and muscle awareness. Concerning emotionally-directed movements, the emotions give orders — not our will.

We know that the emotions can release movements that the will cannot manage to do, f. inst. in *children with brain injuries*. Another example is people with unilateral facial paralysis caused by brain injury. Here the patient cannot manage to move the paralized half of the face, no matter how hard he tries, but it will move completely, none the less, if you get him to smile by saying f. inst. "Think about hamburgers". Sherrington has proved this by monkey experiments. He made the following experiment: He severed the posterior nerve-roots — the sensory nerves — in the arm of a monkey so the animal could not feel where the arm was. Consequently the monkey never used his arm except when he got angry but then he used it with great force. (Se emotionally-directed movements).

There is one factor that I think we have dwelled too lightly upon and that is the fact that we cannot use our muscles without sensing where they are. Besides, it is necessary to avoid what we call coordinated-tension. If we are to make a coordinated movement with least possible strain, it requires that we have muscles-awarness, that is, that we are aware when our muscles are tense and when they are relaxed. We must feel the full weight of our arm.

D. **Functional disorders** (Table II, column 4)

An excessive use of the conscious will has brought out many unfortunate effects, not the least of which is that the emotional factors are disregarded. The fact that the emo-

The Physiological Effects of Strenuous Activity upon the Immature Child

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Much concern has been voiced in recent years that strenuous activity may have physiologically damaging effects upon the growing child. This concern has resulted in much vehement opposition to inter-school sports and other competitive athletics for children in the pubescent and pre-pubescent age groups. The physiological areas upon which the greatest attention has been centered are the heart, kidneys, growth rate and the incidence of accidental injury.

In an attempt to discover just how much of the criticism had scientific foundation, the author undertook an analytical study of all available literature pertaining in any way to the effects of strenuous activity upon the immature child. The study revealed some definite conclusions; it revealed, too, a striking need for more scientific experimentation on certain phases of the problem. A brief summary of the findings follows each of the headings which introduces the four areas of physiological concern.

Heart. Not all of the numerous studies reviewed are in agreement concerning the relative heart size of the pubescent child and its relationship to body size. The results of actual heart weighings[1] are not in agreement with roentgenograms[2] of the heart. Roentgenograms show that the heart size/body weight ratio is about the same through all ages while the heart weighing studies would indicate that the heart ratio for the pubescent child was larger than that of the adult.

Some authorities have postulated that if there is a larger heart/body ratio for children than for adults, the heart does more work per unit of weight in the young than in the more mature body.[3]

One aspect of the problem has been overlooked in these studies and that is the relationship of speed of movement and energy consumption. When the speed of movement is increased, the energy consumption is tripled.[4] Since the young child runs at a slower rate than the adult, there is less energy consumption and hence less work for the heart to do when both are running at top speed. This factor raises the question that even if the heart/body ratio is larger in the young child than in the mature person, does the younger heart actually do more work per unit of weight than the heart of the adult if both are operating at full speed, or does the factor of less speed compensate for the unequal heart/body ratio?

Another factor which has caused concern about the desirability of young children participating in competitive athletics is the so-called "disharmony" between the heart

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tions are frustrated can produce in a pupil a feeling of *duality* that often leads to anxiety-tension, it is a tension in the mind provoking muscle tension. Anxiety tension inhibits all conscious movements and a series of subordinate movements, f. inst. the postural-reflexes. Anxiety-tension is inhibiting in a physical way when the muscles are strained. Anxiety-tension is the reverse process of relaxation, that has the effect of decreasing unwanted activity in the muscles and nervous system.

Misuse of the will can also cause tension. By forcing the pupils to perform difficult exercises before each link in the process is worked out, they will continue to make beginner's mistakes because the exercises have become automatic (coordination-tension).

Using our conscious will to suppress the subordinate functions without taking the body's sensory impulses into consideration — will produce what I have called *will-tension.* The military posture is an expression of will-tension where the postural-reflexes for a good part are suppressed. (Consider f. inst. how unnatural it is to straighten up and at the same time thrust the small of the back out, — that is, bend the body when what we should do is to stretch it and attain the normal sway).

Will-tension interferes with the functions of the *intestines,* f. inst. when we don't give ourselves time to go to the toilet. We know very well that it restricts *respiration movements,* f. inst. by contracting the muscles of the abdomen.

The *natural handclasp* can easily become inhibited by will-tension — we notice that often. Our need for love and movement is inhibited by too much will in our education. Left behind are all those poor people who never wish for anything.

Furthermore we have unfortunately had more than enough opportunity to see how many of those who have practiced gymnastics extensively, are rigid and unnatural in their everyday behavior. They have lost the natural movements because their gymnastics have not let the emotionally-directed movements get free from expansion. The reason for the lack of natural movements is therefore that these people have suppressed a good part of the subordinate, unconscious functions. The well known expression "doing what comes naturally" has, like all such expressions, a grain of truth in it.

size and aorta capacity. In 1879 Beneke[5] published one of the first treaties on the subject of the relationship of the size of the aorta to the size of the heart. He pointed out that the volume of the heart increases in proportion to the body weight; the circumference of the aorta and the pulmonary artery increase in proportion to the body length and therefore do not grow at the same rate.

Karpovich[6] thinks that Beneke's observation is correct, but he points out that the cross section of the opening of the aorta should be considered in the computations rather than circumference in finding true capacity relationship between heart and aorta. Using Beneke's figures in his computations, Karpovich has found that the development of the aorta and pulmonary arteries follows closely the development of the heart. He believes that if heart capacity had been used (Beneke had no data on this) rather than heart volume, there would have been a still greater relationship.

The preponderance of evidence indicates that if the heart is sound and not predisposed to cardiac enlargement, possible danger to it from strenuous exercise is very remote, if possible at all, because the reserve of the other body structures will fail before the normal heart reserves are exhausted by the physical demands.[7] Furthermore, the heart is so abundantly supplied with oxygen that it is able not only to reconvert immediately the lactic acid formed within it to glycogen but to have on hand an excess as a factor of safety.[8]

Growth. The two studies made concerning competitive athletics and the growth of children tend to indicate that strenuous competitive physical activities may retard growth; however, both studies are far from conclusive.[9-10] The studies indicated that mild activity stimulated growth while strenuous activity retarded growth as expressed in height and weight.

Kidney. There are no scientific findings which indicate unfavorable chronic alteration in the kidney function of the adult induced by exercise.[11] Precise datum on the effect of strenuous activity upon the kidney of the growing child is lacking, but it would appear to be a logical interpretation that excessive exercise has not been shown to have any detrimental effect upon the kidney of the young child.

Accidents. Accident surveys show that the greatest percentage of boys injured in athletics was to be found among the post-pubescent group. However, the surveys also indicate that the older players spend more time practicing for and playing in interscholastic games than younger players.[12-13] Until such time as all the factors which may produce injuries are known, the actual relationship of age to the number and nature of injuries cannot be determined accurately.

1. L. E. Holt, *Disease of Infancy and Childhood,* D. Appeton Century Co., New York, 1911, p. 56.
2. Hollis F. Fait, *An Analytical Study of The Effects of Competitive Athletics Upon Junior High School Boys,* p. 58. Figures were computed from measurements of heart roentgenograms from the Child Research Council of the University of Colorado School of Medicine.
3. C. H. Keene, "Sports and Games in the School Schedule", *Hygeia* (July 1942), pp. 557—58.
4. A. V. Hill, *Muscular Activity,* William and Wilkins Co., Baltimore, 1926, p. 98.
5. F. Beneke, *Über das Volumen des Herzen und die Weite der Arteria pulmonalis und Aorta ascendens,* as quoted by P. V. Karpovich, "Textbook Fallacies Regarding The Development of the Child's Heart", *Research Quartely* (Oct. 1937).
6. *Ibid.*
7. D. P. Barr, "Exercise in Relation to Heart Disease, "*Archives of Physical Therapy* (May 1931),, pp. 287—291.
8. Edward C. Schneider, *Physiology of Muscular Activity,* 2nd Edition, W. B. Saunders, Philadelphia, 1939, p. 344.
9. Hollis F. Fait, *op. cit.,* p. 28.
10. Floyd Rowe, "Growth Comparisons of Athletiks and Non-Athletes", *Research Quarterly,* (October 1933), pp. 108—116.
11. A. H. Steinhaus, "Chronic Effects of Exercise", *Physiological Review* (1933), pp. 103—141.
12. National Safety Council Accident Facts.
13. N. P. Nielson, "The Nature, Frequency, and Age Incidence of Injury in Interscholastic Football", *Research Quarterly* (October 1933), pp. 78—90.
14. Hollis F. Fait, *op. cit.,* pp. 31—40.
15. C. L. Lowman, "The Vulnerable Age", *The Journal of Health and Physical Education* (November 1947), pp. 635—36, 693.

L'Activité physique intense

et ses effects sur l'enfant en pleine croissance

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Ces dernières années, on s'est beaucoup préoccupé des effets nocifs que, du point de vue physiologique, la pratique des exercices violents peut avoir sur l'enfant qui grandit. Ces préoccupations se sont traduites par une véhémente opposition envers les sports interscolaires et l'athlétisme de compétition pour les enfants ayant atteint ou sur le point d'atteindre l'âge de la puberté. Les domaines physiologiques sur lesquels s'est concentrée l'attention sont: le cœur, les reins, la croissance et les blessures par accident.

Pour tenter de déterminer dans quelle mesure de telles critiques reposent sur des bases scientifiques réelles l'auteur a entrepris l'analyse de tous les écrits disponibles traitant si peu que ce soit du sujet énoncé ci-dessus. Cette étude a mis au jour certaines conclusions bien nettes en même temps qu'elle révélait un pressant besoin d'expériences scientifiques portant sur certains aspects du problème. Un bref résumé des recherches suit chacun des titres de chapitre qui précèdent les quatre domaines d'intérêt physiologique.

La cœur. Les nombreux travaux étudiés ne sont pas tous en harmonie au sujet des dimensions du cœur par rapport à la taille chez l'enfant pubère. Les résultats de pesées réelles du cœur ne concordent pas avec les radiographies de cet organe. Ces radiographies montrent que le volume du cœur par rapport au poids du corps est à peu près le même à tout âge tandis que le cœur est proportionnellement plus lourd chez l'adolescent que chez l'adulte.

Certains spécialistes ont émis l'opinion que si le rapport cœur/corps est plus élevé chez l'enfant, le cœur alors travaille plus par unité de poids chez le jeune que chez l'adulte.

Dans ces études, on a négligé un aspect du problème qui est le rapport entre la rapidité de déplacement et la consommation d'énergie. Quand la vitesse croît, l'énergie utilisée se trouve multipliée par trois. Comme l'enfant court moins vite que l'adulte, la quantité d'énergie consommée est moindre, d'où moins de travail pour le cœur quand jeune et adulte courent à leur vitesse maximum.

Ainsi, le fait que le rapport cœur/corps soit plus élevé chez l'enfant signifie-t-il pour autant que le jeune cœur travaille plus par unité de poids que le cœur de l'adulte quand tous deux se déplacent à vitesse maximum, ou bien cette inégalité de rapport n'est-elle pas plutôt compensée par le facteur de vitesse moindre chez l'enfant?

Un autre facteur, lui aussi à l'origine des doutes quant aux avantages qu'il y a de laisser les enfants participer à l'athlétisme de compétition, est la soi-disant «disharmonie» entre les dimensions du cœur et la capacité de l'aorte. En 1879, Beneke a publié l'un des premiers traités sur le rapport des dimensions de l'aorte avec celles du cœur. Il signale que le volume du cœur croît en proportion du poids du corps; la circonférence de l'aorte et celle de l'artère pulmonaire croissent en proportion de la stature du corps donc à une vitesse différente.

Karpovich tient les observations de Beneke pour correctes mais il fait remarquer qu'il serait préférable de considérer, non la circonférence, mais la coupe transversale de l'aorte dans les calculs ayant pour but de découvrir le vrai rapport de capacité entre le cœur et l'aorte. Se servant des chiffres de Beneke pour ses calculs, Karpovich a trouvé que le développement de l'aorte et des artères pulmonaires suit de très près celui du cœur. Il croit que si l'on s'était servi de la capacité du cœur (Beneke n'avait aucune donnée là-dessus) plutôt que du volume du cœur, la relation aurait été encore plus étroite.

Dans leur majorité, les faits indiquent que si le cœur est sain, sans tendance à un accroissement cardiaque, les dangers créés par des exercices violents sont peu à craindre ou même inexistants parce que les réserves des autres organes du corps feront défaut avant que les réserves normales du cœur soient épuisées par suite des exigences de l'effort physique. De plus, le cœur reçoit une telle abondance d'oxygène qu'il peut, non seulement reconvertir en glycogène l'acide lactique qui s'y forme, mains encore en avoir une réserve toute prête en cas de besoin.

Le rein. Des conclusions scientifiques manquent qui montreraient une altération chronique défavorable des fonctions rénales chez l'adulte qui s'adonne à l'exercice physique. On n'a pas de données précises sur les effets d'une grande dépense physique sur le rein de l'enfant qui grandit, mais une interprétation logique semble être qu'on n'a pas montré les exercices violents comme ayant des effets nocifs sur le rein de l'enfant.

La croissance. Les deux études écrites sur la compétition sportive et la croissance des enfants tendent à montrer que les activités physiques de compétition peuvent entraver la croissance; cependant, les deux études sont loin d'être concluantes. Elles indiquent qu'une activité modérée stimule la croissance alors qu'une activité intense retarde la croissance exprimée en taille et en poids.

Les accidents. Les études d'accidents montrent que c'est parmi le groupe des jeunes ayant dépassé la période de la puberté qu'on trouve le pourcentage le plus élevé de jeunes garçons blessés au cours de manifestations sportives. Cependant, ces études montrent aussi que les joueurs plus âgés passent plus de temps que les joueurs plus jeunes à s'entraîner et à jouer dans des rencontres interscolaires. Tant que toutes les causes d'accident ne seront pas connues, on ne pourra pas déterminer avec précision le rapport de l'âge avec le nombre et la nature des accidents.

Certains chirurgiens orthopédistes ont signalé le danger d'épiphysite et de déplacement de l'épiphyse chez un tout jeune adepte des sports de compétition. Deux études séparées de l'opinion de chirurgiens orthopédistes américains aboutissent à des conclusions différentes: L'étude de Fait montre que 15 % d'entre eux seulement considèrent la possibilité d'accidents de l'épiphyse comme la raison majeure pour écarter l'enfant des sports de compétition; dans l'étude faite par Lowman, la même raison a été donnée par 85 % des chirurgiens.

Résumé. Les faits à notre disposition se rapportant aux quatre plus importants domaines physiologiques d'inquiétude semblent indiquer que l'activité physique intense n'est sans doute pas plus nuisible à la physiologie de l'enfant qu'à celle de l'adulte.

Traduit par: *Gilbert Cestre,* University of Connecticut.

Los efectos fisiológicos de la actividad energica sobre el muchacho inmaduro

por HOLLIS F. FAIT, Ph. D.

En los últimos años se ha manifestado una gran inquietud por el daño fisiológico que pueda causar la actividad enérgica en el muchacho creciente. Esta inquietud ha dado lugar a una intensa oposición a los deportes entre escuelas y otras competencias atléticas entre los niños pubescentes y prepubescentes. Se ha prestado la mayor atención al corazón, los riñones, la proporción del crecimiento y la incidencia de lesiones debidas a accidentes.

Para averiguar lo que hay de científico en esta censura, el autor hizo un estudio analítico de todas las publicaciones asequibles relacionadas en los más mínimo con los efectos de la actividad enérgica sobre el muchacho inmaduro. Este estudio ha revelado algunas conclusiones definitivas. Además indicó gran necesidad de experimentación científica sobre ciertos aspectos del problema. A continuación de cada uno de los encabezamientos que representan las cuatro categorías de interés fisiológico sigue un breve resumen de las conclusiones.

Corazón. De los muchos estudios consultados no todos están de acuerdo en lo que se refiere al relativo tamaño del corazón del pubescente y la relación del corazón al tamaño del cuerpo.

Los pesos comprobados científicamente[1] no siempre coinciden con las radiografías.[2] Las radiografías demuestran que la proporción del tamaño del corazón con el peso del cuerpo queda más o menos constante a través de los años mientras que, por otro lado, los estudios sobre el peso del corazón sugieren que la proporción corazón-cuerpo para el pubescente es más grande que la del adulto.

Algunas autoridades han postulado que si existe para el pubescente una proporción corazón-cuerpo más grande que la del adulto, el corazón hace mayores esfuerzos por cada unidad de peso en el cuerpo joven que en el maduro.[3]

En estos estudios se ha pasado por alto un aspecto del problema; a saber, la relación entre la rapidez de movimiento y el consumo de energía. Al aumentar la rapidez de movimiento, se triplica el consumo de energía.[4] Puesto que el niño corre más despacio que el adulto, hay menos consumo de energía y por tanto, el corazón tiene que esforzarse menos que el del adulto aun cuando los dos corren a toda velocidad.

Este factor nos plantea el siguiente problema: aunque la proporción corazón-cuerpo sea más grande en el niño que en la persona madura, ¿es verdad que por cada unidad de peso, el corazón del joven se esfuerza más que el corazón del adulto cuando los dos funcionen a toda velocidad, o será que el factor de la velocidad reducida compense las proporciones corazón-cuerpo desiguales?

Otro factor relacionado con la cuestión de si es o no conveniente dejar a los niños intervenir en competencias atléticas es la llamada «falta de harmonía» entre el tamaño del corazón y la capacidad de la aorta. En 1879 Beneke[5] publicó uno de los primeros tratados sobre la relación entre el tamaño de la aorta y el del corazón. Señaló que el volumen del corazón aumenta a medida del peso del cuerpo; la circunferencia de la aorta y la de la arteria pulmonar se ensancha a medida de la altura del cuerpo y por eso, no crecen en igual proporción.

A Karpovich[6] le parece justa la declaración de Beneke, pero indica que para encontrar la verdadera relación de capacidad entre el corazón y la aorta, debe figurarse en los cálculos la sección transversal de la apertura de la aorta más bien que la circunferencia. Aprovechándose de las cifras de Beneke en sus propios cálculos, Karpovich ha descubierto que el desarrollo de la aorta y las arterias pulmonares coincide en gran parte con el desarrollo del corazón. Opina que si se hubieran hecho los cálculos a base de la capacidad del corazón (Beneke no incluía datos sobre esto) en lugar del volumen del corazón, habría sido mucho más grande la relación.

La preponderancia de datos indica que si el corazón es sano y no predispuesto a ensachamiento cardíaco, no es probable (tal vez aún imposible) que sufra daño a causa del ejercicio enérgico puesto que fallarán las reservas de las otras partes del cuerpo antes que las reservas normales del corazón sean agotadas por las exigencias del cuerpo.[7] Además, el corazón recibe tanto oxígeno que no sólo puede reconvertir inmediatamente en glicógeno el ácido láctigo allí formado, sino también mantener disponible una reserva como factor de seguridad.

Crecimiento. Los dos estudios sobre competencias atléticas y el crecimiento del niño sugieren que la enérgica competencia física atrasa el crecimiento; no obstante, ambos estudios faltan mucho de ser definitivos.[9-10] Los estudios indican que la actividad ligera estimula el crecimiento mientras que la actividad enérgica la retarda, en términos de altura y peso.

Riñones. No existen datos científicos que demuestren adversa alteración crónica inducida por el ejercicio físico en la función de los riñones del adulto.[11] Faltan datos exactos acerca del efecto de la actividad enérgica sobre los riñones del muchacho creciente, pero parecería lógica la interpretación de que no se ha demostrado ningún efecto perjudicial sobre los riñones del niño a causa del ejercicio excesivo.

Accidentes. Los estudios sobre accidentes indican que el mayor porcentaje de los muchachos lastimados en deportes corresponde al grupo pospubescente. No obstante, los estudios indican también que los jugadores mayores dedican más tiempo al ejercicio y a las competencias interescolares que los más jóvenes.[12-13] Mientras no se conozcan todos los factores que produzcan daños no se puede determinar con exactitud la verdadera relación entre la edad por una parte y el número e índole de lesiones por la otra.

Algunos cirujanos ortopédicos han indicado que la cirujanos energica puede resultar en el *epiphysitus* o en el desprendimiento de la epífisis en el jugador inmaduro. Dos distintos estudios sobre las opiniones de circujanos ortopédicos americanos demuestran pareceres divergentes: El esudio de Fait[14] indica que sólo el 15 por ciento opina que la posibilidad de incurrir en daños a la epífisis sea razón suficiente para que el niño no tome parte en las actividades enérgicas; en el estudio de Lowman[15] el porcentaje es 85.

Resumen. Los datos actualmente disponibles que versan sobre las cuatro categorías fisiológicas de mayor interés parecen indicar que fisiológicamente la actividad enérgica no perjudica más al joven creciente que al hombre maduro.

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Le II:e Congrès International Latin d'Education Physique à Madrid du 15 au 19 juin 1956

Extrait du Programme:

1. JOUR. — Vendredi 15 juin.

Séance de Pédagogie et Methodologie appliquée à l'Education Physique avec démonstrations et discussions .... 9,00 h.—13,30 h.

Visite aux installations d'Education y Descanso près du Manzanares. Démonstrations et Folklore-Souper .... 15,30 h.

2.o JOUR. — Samedi 16 juin.

Séance d'E. Ph. féminine avec démonstrations et discussions .... 9,00 h.—13,30 h.

Visite au gymnase de la Délegation Nationale des Sports et à la piscine, avec démonstration de natation et un peu de Ballet aquatique .... 15,30h.

3.o JOUR. — Dimanche 17 juin.

Excursion à Tolède ..... 9,00 h—17,00 h.

4.o JOUR. — Lundi 18 juin.

Séance sur les sciences de l'E. Ph. avec démonstrations .... 9,00 h.

Réception en l'honneur des congressistes à l'Hôtel de Ville de Madrid avec déjeuner .... 13,00 h.

Visite au Musée de Peinture du Prado et des installations de Education Physique de la Cité Universitaire .... 16,00 h.

5.o JOUR. — Mardi 19 juin.

Séance sur l'organisation de l'E. Ph. et discussions .... 9,00 h.

Séance d'Exposition de sujets libres 10,30 h.

Départ pour l'Escorial .... 11,30 h.

Déjeuner à l'Escorial .... 13,30 h.

Séance de clôture du Congrès .... 17,00 h.

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