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PHYSICAL-KINETIC THERAPY IN ANKYLOSING SPONDYLITIS WITH HIP ARTHROPLASTY

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Key words: ankylosing spondylitis, hip arthroplasty, rehabilitation

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INTRODUCTION
Ankylosing spondylitis is a common type of arthritis with a chronic evolution and multifactorial inheritance (Van der Linden S, colab, 2009). The major histocompatibility complex genes have an important influence in genetic susceptibility to the disease, but today it is known that in addition to the strong strong association with HLA-B27, other genes are also associated with this disorder (Brown MA, 2011). The disease affects 0.1%--1.4% of the population, initially affecting the spine and sacro-iliac joints (Kenna TJ, colab, 2011). It is an important cause of pain and stiffness, leading to long-term disabilities.

Osteoarthrosis, is the most common chronic degenerative joint disorder, with the same long-term evolution and disabling potential (Lane NE, 2007). It is also a multifactorial disease, being influenced both by genes and by environmental factors (Juhakoski R, colab, 2009)

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http://www.fefsoradea.ro/cercetare.html
CASE REPORT

We present the case of a 49 years old male patient, from a rural area, hospitalized in the Medical Rehabilitation Clinical Hospital Baile-Felix, for cervical pain, right hip joint pain, difficulties in walking (using a cane for long distances), functional recovery. The family history revealed that his mother had osteoarthritis and stroke. From his medical history we mention that he has blindness of the left eye, due to a trauma at 5 years old, he was diagnosed with ankylosing spondylitis in 1985 and had a left hip arthroplasty in 2006.

Complains are now of permanent nature, of high intensity, increasing in clinostatism and with discreet improvement after mobilization. These complains are accompanied by dysfunction, thus, affecting activities of daily life. He attended annual medical rehabilitation since 2000 in Medical Rehabilitation Clinical Hospital Baile-Felix, with discrete improvement of symptoms and function.

Based on the history and background we established the diagnosis of cervico-dorso-lumbar vertebral syndrome, static and dynamic, through ankylosing spondylitis. The other diagnoses were: dysfunctional status after left hip arthroplasty and right coxalgic syndrome, possible through hip osteoarthritis secondary to coxitis.

Clinical examination revealed: the abnormal signs regarding the respiratory system were abdominal breathing and restrictive type respiratory dysfunction. Otherwise, examination of other systems revealed normal data with the exception of the locomotor apparatus, with:

- dorsal kyphosis with lumbar lordosis disappearance
- frontal project of the head and neck, resulting the "skier" position
- Cervical column: lack of mobility in all axes
  - distance menton-sternum was 23 cm.
  - distance tragus - acromion 13 cm (right) and 12 cm (left)
  - distance occiput- wall 26 cm
- Lumbar column: - anteflexion of lumbar spine is made from hips
  - lateral inflexion and extension limited = 0

Measurements:
- Schober 13 cm
- OTT= 30/31 cm
- Stibor from C7 to L5 = 48 cm and with flexion = 49 cm
  - Thoracic perimeter = 103 cm / 103 cm
- shoulder joint-normal mobility
- the right hip joint:
  - limited rotation,
  - limited abduction = 10°
  - internal rotation = 25°
  - external rotation = 15°
  - flexum right hip = 30°
  - flexion = 20°
- the left hip joint (hip prosthesis):
  - normal mobility allowed by prosthesis
  - flexion = 65°
  - abduction = 35°
  - internal rotation = 15°
  - external rotation = 15°

Regarding gluteal muscles weakness and limping were also observed. Trendelenburg could not be appreciated, because of the prosthesis and flexum of hip.

Analyzing the medical history and the clinical examination we established the clinical diagnosis of ankylosing spondylitis, clinical and functional stage 3, central-peripherical type (Elyan M, colab, 2006). The other diagnoses were right hip osteoarthritis secondary to coxitis, status post left hip arthroplasty and blindness of the left eye.
We asked for the following laboratory examinations:
- Blood chemistry - where we found elevated triglycerides.
- CBC revealed ESR = 13 mm/h.
- Fibrinogen= 368 mg/dL.
- PCR ++ (strongly positive).
- Rheumatoid factor - negative.

Cervical, dorsal, lumbar spine and pelvis X-rays revealed:
- Cervical rectitude profile.
- Dorsal kyphosis.
- Dextroconcave lumbar scoliosis with rectitude profile.
- Multiple syndesmophyte spinal block, "tram track" aspect at dorso-lumbar level, square vertebrae, osteosclerosis of vertebral angles, osteoporotic background.
- Bilateral sacroiliac ankylosis.
- Uncemented total left hip endoprosthesis with normal prosthetic ratio.
- Right hip joint with severely narrowed space, important osteophytosis and insufficient internal rotation of the thigh.

Conclusion: ankylosing spondylitis with bilateral sacroiliitis stage 4.

Abdominal ultrasound did not show any abnormality. ECG was without pathological changes. Eye examination for uveitis was negative. Spirometry was performed for restrictive ventilatory dysfunction: FEV1, VC.

We assessed the degree of disease activity using BASDAI index (Bath Ankylosing Spondylitis Disease Activity Index), the value of this score ranging between 0-100 (Garrett S, colab, 1994), and obtained 70 for this patient.

Based on history, the objective examination and laboratory examinations have established the following diagnosis:

Differential diagnosis:
1. for ankylosing spondylitis: seronegative spondyloarthopathies, laboratory showed negative rheumatoid factor (ankylosing spondylitis is the central element in this group of arthropathies) (Weisman MH, colab, 2006):
   a) Reiter syndrome, characterized by the triad of urethritis, conjunctivitis, arthritis, but in our case urethritis and conjunctivitis are missing.
   b) Psoriatic spondyloarthopathy, which is characterized by peripheral joint involvement (asymmetric), axial joint involvement (sacroiliitis and spondylitis) that justify inclusion among seronegative spondyloarthopathies. In this case missing dermatosis exclude this diagnosis.
   c) Behcet disease—the elements for easiest differentiation are the evolution in net flares and broad spectrum of extraskeletal manifestations of Behcet disease: skin lesions (necrotic pseudofolliculitis, pseudo-erythema nodosum), vascular involvement (recurrent thrombophlebitis, arterial aneurysms) and neurological involvement (aseptic meningoencephalitis).
2. for hip osteoarthritis secondary to coxitis (Felson DT, 2009)
The diagnosis is based on limited mobility of the hip, presence of pain, radiological aspect, will be differentiated from:
   a) Primitive hip osteoarthritis
   b) Hip osteoarthritis secondary to dysplasia (excluded by X-ray)
   c) Hip osteoarthritis secondary to femoral dislocation, acetabular protrusion
   d) Hip osteoarthritis secondary to other deviations: coxa valga, coxa vara
Treatment:

Objectives:
1. Control of pain and inflammation
2. Combat contractures, muscle retraction and muscular functional imbalances
3. Reducetion of posture, symmetry, body and walking alignment
4. Regain joint mobility, muscle tone and trophicity
5. Ameliorate respiratory function

Therapeutic means:
A) Hygienic-dietary means:
- Sufficient caloric intake, but with a high proportion of animal protein in order to reduce dystrophy
- Supplement of vitamins, especially B and C groups
- Moderate-salted diet and with protection of gastric mucosal
- Avoiding alcohol, spices, meat soups, concentrated sweets (not to increase gastric secretion)
- Smoking is contraindicated because it worsens restrictive ventilatory dysfunction, adding an obstructive dysfunction type. It also increases the risk of complications e.g. tuberculosis.

B) Medication: NSAIDs
C) The patient has an indication for prosthetic right hip surgery,
D) Medical rehabilitation treatment
1. Hidrokinetotherapy at 36 degrees, 20 minutes, with the aim to obtain:
   - better mobility, as water heat relieves pain, relaxes muscles
   - better control of posture
2. Kinetotherapy is crucial in ankylosing spondylitis. It combines exercises addressed to spinal static and dynamic disorders from ankylosing spondylitis and exercises designed for hip prosthesis and hip osteoarthritis.
   It aims to:
   - maintain mobility of vertebral column, to tonify the paravertebral muscles, to preserve respiratory function
   - maintain and correct posture
   - maintain and improve joint mobility
     * Working positions during the program will always be from those with discharge the vertebral column to its gradual charging;
     * Programs and exercises will be interrupted when pain occurs and restarted when pain is moderate, in quiet phases;
   
   Effort dosing is based on physiological factors (heart rate, blood pressure, fatigue occurrence);
   * Programs will focus on maintaining outstanding mobility of the spine both of entire column and segments
   * Toning the muscles that mobilize the spine will be done through specific isometric or isotonic exercises

Objectives and the means that are used:
* maintaining and correcting body positions and alignment:
  - good posture in everyday activities using maintenance of erect position of the trunk (sitting on a chair with a high backrest and permanent contact of the back to the backrest);
  - corrective postures (dorsal decubitus, small pillow under dorsolumbar column, 2 sandbags of 2-5 kg on the anterior face of the shoulder and other 2 bags on the knees).
* maintaining and improving joint mobility:
  - free active mobilization, addressing to the spine, hips and shoulders, trying to reach the extreme limit, focusing on the extension (Hernández-Molina G, colab, 2008).
  - stretching.
Physical-kinetic therapy in ankylosing spondylitis with hip arthroplasty

- maintaining and correcting muscle tone:
  - free active mobilizations, active mobilization with resistance - for shoulders and hips aiming to tone the pectoralis major muscles and active stretches of leg/hamstring muscle groups;
  - reducing flexum of hip through posture and stretching
  - gluteal muscles tonification
  - walking reeducation
- maintaining and increasing mobilized respiratory volumes:
  - in the early stages will focus on respiratory corrective gymnastics. Thoracic respiratory reeducation aims to raise awareness on thoracic cage and abdominal movements during breathing phases.
  An appropriate kinetic program will be performed all the lifetime - 2-3 daily sessions, each session lasting 15 - 30 minutes.

To get a better physical condition and to remain able to move, it is very important that individuals suffering from ankylosing spondylitis also exercises at home.

3. Paraffin cape and on the right hip, with painkiller and muscle relaxing effects
4. Diadynamic cervical currents, with painkiller and decontracturant effects
5. Massage of the superior train/muscles (effects on skin, circulation and muscles)
6. Underwater shower
7. Laser, with inflammatory effect, muscle relaxing

The evolution is chronic, progressive and irregular. Prognosis: the vital prognosis is good, but the functional one is reserved because of the mobility limitation of vertebral column and hip. Work prognosis is also reserved.

Complications:
- atlanto-axial luxations or subluxations, and possible spinal fracture, both with static and neurological consequences
- rigid, osteoporotic and with ankylosis vertebral column is more fragile than the flexible one, and is very susceptible to even minor trauma fractures
- different diseases:
  - cardio-vascular (aortic insufficiency, arrhythmia less often)
  - gastro-intestinal (inflammatory bowel disease such as ulcerative colitis and Crohn disease, peptic ulcer secondary to NSAID administration)
  - renal (proteinuria and microscopic hematuria most frequently)

Recommendations at discharge:
- Kinetic-program daily, 2-3 times / day with a duration of 15 to 30 minutes
- Correct use of cane (cane is held in the hand opposite to the affected hip and will be moved along with the affected limb, putting the foot on the ground on the same line with the cane)
- Biannual medical rehabilitation

The peculiarity of the case: even if this is a typical case of ankylosing spondylitis, with the typical position of "skier", with restrictive ventilatory insufficiency and the disease was diagnosed 28 years ago, only the musculoskeletal system is affected, with maintenance

DISCUSSION
Ankylosing spondylitis is a complex, severe, disabling disorder. The primary goal of the therapy is to maximise long term health-related quality of life, by different means, using pharmacological and non-pharmacological treatments (Braun J, colab, 2011). Today medical therapy has significantly improved prognosis of patients, especially for ankylosing spondylitis. Still, kinetic therapy remains important, complementing medical treatment (Nghiem FT, colab, 2008). Water therapy improves symptoms and also function. Patients who also performed home exercise programs have had an improvement of symptoms, mobility, function and overall quality of life (Elyan M, colab, 2008; Dagfinrud H, colab, 2008).
Long-term effectiveness of exercise therapy was demonstrated by several studies (Pisters MF, colab, 2007; Wright AA, colab, 2011). Pisters MF showed that behavioral graded activity had a better effect on hip osteoarthritis than usual exercise therapy.

Difficulties in management of such patients, in establishing the appropriate physical kinetic program are also due to osteoporosis that occurs in these patients (Korczowska I, colab, 2008; Ghozlani I, colab, 2009).

Medication combined with physical kinetic and thermal baths therapies had led to disability reduction and ameliorated quality of life in patients with ankylosing spondylitis (Colina M, 2009).

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STUDY REGARDING THE USE OF ALTERNATIVE AEROBIC ENDURANCE DEVELOPMENT MEANS IN HIGH-SCHOOL STUDENTS

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Abstract: This paper approaches the content of physical and sportive education for extracurricular activities, aiming to find new means to develop the general endurance, a prioritary goal for this age. The education of endurance at this level has certain differentiations regarding the means that are used, but especially the methods used to apply those means. Out of the forms of endurance, it is required for the adolescents to develop especially their aerobic endurance, which well tolerated by the high-school students. It is a well-known fact that generally, this motor skill is approached only during the physical education lessons, in the last thematic part, through running in a uniform tempo. This study advances the idea that aerobic endurance can develop under good conditions also outside these school classes, using both running of various duration (on flat or varied land), but also other means, more varied and more attractive for the students at this sensitive age. These alternative means, identified as being: hiking, cyclotourism, swimming, and playing games, together with jogging, are concretized in extracurricular athletic activities that can be used effectively in developing the aerobic endurance in adolescents, given that certain methodical-organizatorical indications are respected.

Key words: aerobic endurance, alternative means, high-school students

INTRODUCTION

It is a well-known fact that generally, endurance can develop at any age, and during school years it can be developed very well, especially in regards to long-term, aerobe endurance, without maximal or sub-maximal intensities.

Usually, this motor skill is educated only during physical education classes, using almost exclusively the flat land running. We believe that this can be achieved also outside these classes, both by using running of various durations, and by using other development means that are more attractive for the students, and which, in our opinion, can be used, even in combination, to develop endurance in a more pleasant and varied way.

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ALTERNATIVE MEANS OF DEVELOPING THE ENDURANCE

Jogging
This represents the most common means of developing the aerobe endurance outside the school curricula, and which can be practiced almost anywhere: in the park, on the street, in the forest, on a country road, on the beach, etc.

It is important to choose your own rhythm, for your own comfort, trying to eliminate discomfort as much as possible. During the first hours, a certain time after starting to run, a certain respiratory discomfort can appear. If this happens, you must not interrupt your movement, but diminish your rhythm to walking, to recover, and then keep on running. Gradually, you will see that the distance covered during walking will become smaller, meaning that the aerobe endurance has increased. The distance covered during running will gradually increase, but you must not cover always the same maximum distance, but adapt it to the moment.

When this is used in the physical education lessons, or in some other form of organization of practice of physical exercises, it is done during the last theme of the lesson, lasting 10-15 minutes, framed within lesson cycles formed of 10-12 unități (Tudor, 1999).

We believe to be necessary to emphasize certain methodical-organizational aspects for the use of jogging to develop aerobe endurance (Drăgoi, 2008):

- it must be practiced at least three times a week (it can be done also every day);
- one must alternate running on different surfaces (earth, stone, sand, etc.), avoiding hard surfaces as much as possible (bitumen);
- one must use a gear that is appropriate to the season, especially shoes with an effective sole in attenuating the shocks (Sorbotan);
- in the beginning, one should run for 7-10 minutes, alternating running with fast walking, so that later one should be able to run gradually more, arriving at 20-30 minutes and even more;
- the effort intensity should have low to average values, the heart rate varying between 120-150 beats/minute;
- the breaks will be short, if they are really necessary, but active (fast walking, ample respirations, accentuating the expirations).

Even if most physical education teachers consider running as the only means of developing endurance, we believe that this ability can be developed very well through other means, which we present below.

Hiking
It is the most well-known and most practiced form of tourism, consisting in covering certain touristic roads of different lengths, heights, and difficulties. It can be, for the Romanian physical education system, an important means of developing the adolescents’ motor skills, thus, implicitly, also their aerobe endurance. The hiking can be practiced from childhood up to an old age, taking into account the particularities of age, physical training, and general health, in choosing the right roads, in regards to their lengths, height, and maximum reached altitude.

The hiking tours take, generally, about 4-6 hours, with 10-15 minutes breaks for one hour of walking, but also with shorter breaks, of 1-3 minutes, for shorter intervals (15 minutes), when the difficulty of the terrain impose it.

The effort characterizing hiking is an aerobe one, “steady-state”, with small intervals of mix (aerobe-anaerobe) toward the aerobe area, emphasized when the ascension is performed on a high angle slope.

For developing the aerobe endurance through this means, the following are recommended (Drăgoi, 2008):

- practicing hiking at least twice a week (for those living near a mountain area), or at least twice a month;
- covering accessible roads, with a difficulty adapted to the group components, easy-medium at the beginning;
- the duration should not be, at the beginning, more than 3 hours, increasing then gradually the volume of the effort, up to a maximum of 5-6 hours/day.
Study regarding the use of alternative aerobic endurance development means in high-school students

- The effort intensity, verified through the heart rate values, should be small, with some inherent variation toward medium (120-150 beats/minute).
- The breaks are recommended to be of 10 minutes for one hour of walking, in which there is a recovery of the heart rate to normal, rest values; in the situations when certain more steep sections are covered, short, 1-2 minutes breaks are taken, allowing a partial recovery, up to values over 90 beats per minute.

Hiking can be performed very well in any season, existing however certain conditions (temperature, snow, ice, duration of the light during the day, danger of avalanches, etc.) that impose concrete measures of adaptation: corresponding gear, choosing short or medium roads, avoiding the avalanche-prone areas, covering known roads that are usually covered during the seasons without snow.

**Cyclotourism**

Cycling is a sportive-utilitarian activity, a very good way to relax, being a sports branch at the same time, comprising many events. The effort demanded by this sport is within the category of cyclic efforts, with an increased demand on the cardio-respiratory system, with important energy expenditures, where the determining role is played by the general cardio-respiratory endurance and the local muscle endurance.

The basic motor skill demanded by cyclotourism is long term endurance, type 2 and 3 (over 1 hour). Being a long endurance effort, it will lead to the accomplishment of multiple adaptations (Drăgan, et al., 2002):

- resting and effort mobilization bradycardia with increases up to 200-220 beats/minute;
- 60-90 ml during rest, increased to 200-230 ml during effort;
- heart rate: 5-6 l/min. during rest, increased to 40-42 l/minute during effort;
- cardiac volume: 700-800 ml in the beginner cyclists, it can increase up to 1400 ml to a top performer.

For the high school students, cyclotourism is a very good means of developing the aerobe endurance. It can be practiced individually, or better yet, in physically homogeneous groups, taking into account the emulation state that can appear. For reaching the set goals, we suggest a few methodical-organizational indications:

- cyclotourism should be practiced at least twice a week;
- one should alternate street routes with forest roads, where bicycles are allowed;
- one session should be of minimum 30 minute, but, usually, not over 3-4 hours (recommendable up to 2 hours, according to the individuals’ training);
- the effort intensity should be low to average, the heart rate being 125-140 beats/minute;
- the breaks can be taken every 20-30 minutes, a few minutes long (3-5) needed for recovery, and hydration; in the case of courses of over 2 hours, one needs a longer break, of 15-20 minutes (or even more, if one considers also some touristic objectives).

**Swimming**

The large popularity of this sport in all age categories is due to the favorable effect exerted by the water effort on one’s body, this being considered one of the most important means of strengthening one’s body (Demeter, 1972).

After a regular and prolonged practice of swimming, one can observe an increase in the thoracic perimeter and diameter, in the vital capacity, in the maximum respiratory flow, and in the VO2 max. values, which clearly indicates the favorable influences of this means on the development of aerobe endurance.

Next, we suggest several methodical-organizational indications for developing the aerobe endurance in adolescents (Drăgoi, 2008):

- swimming should be practiced at least twice a week;
the duration of a session should be of 30-45 min. for the beginners, and 1h for the advanced;

• in order to avoid the premature appearance of fatigue, an alternation of the following styles is recommended: freestyle, breaststroke, and backstroke, which will lead to an increase in the covered distances, without needing to interrupt your swimming;

• the effort intensity will be regulated in such a way so that it would not put an excessive demand on the body, and the heart beat values should remain between 130-150 beats/minute; the breaks are necessary and are more frequent than for other sports, determined by fatigue, or for avoiding passing to another type of effort; they can be of 1 min 30''- 2 min., so that the aerobe process of producing energy is not interrupted.

Playing games

Playing games (soccer, handball, volleyball, basketball, tennis) represent some of the most beloved means of developing the students’ motor skills, and not only, constituting an attractive segment of physical education and sports.

The demand on the body is different from one game to another, depending on the duration, the continuity or discontinuity of the effort, the dimensions of the court, and the number of players comprised by the team. Even in the same game, the demand on the body presents higher or lower oscillations, depending on the microclimate, the game tempo, the performance level, and not in the least, on the position the player has within the team.

In playing games, the effort intensity is variable, starting from small and moderate to sub-maximal, or even maximal.

Usually, playing games have a long duration, requiring the intensification of the autonomous functions (circulation, respiration, internal secretion, thermal regulation), conferring them the characteristics of cardio-respiratory efforts. Short and intense efforts are combined with mix efforts (anaerobe-aerobe) and with aerobe efforts. The rapport of these types of effort differs, both during one game, and (especially) during various games (Demeter, 1972).

Out of the playing games practiced on a large scale by teenagers, soccer, handball, and basketball offer the best possibilities for developing the endurance, under its various forms, including aerobic endurance. Certain methodical clarifications are needed (Dragoi, 2008):

• the playing games should be practiced twice a week;

• the maximal and sub-maximal efforts should be avoided, and when they produce, enough time should be given for the recovery and for the oxygen intake;

• a heart rate between 120-150 beats/minute should be kept for as long as possible;

• the duration of a “training” session is variable, recommending it to be over 40 minutes, up to 90 minutes;

• the breaks are usually between half-games, with a variable duration (5-15 minutes), but supplementary (short) breaks can be added of 1-2 minutes, depending on various situations

• the playing games should be alternated between them, but also with other endurance development means for this level.

CONCLUSIONS

The education of endurance represents a prioritary goal during adolescence, with certain differentiation notes regarding the means that are used, but especially regarding their application methods.

At this age, it is required for the adolescents to develop especially their aerobic endurance, which well tolerated by the high-school students.
Running still remains the main mean of developing the endurance, being the most accessible.

There are other, alternative means through which the endurance can be developed, such as extracurricular, more attractive activities, which are less used.

Hiking, cyclotourism, swimming, playing games, can be successfully used in developing the endurance, especially the aerobic endurance, in high-school students, respecting certain given methodical-organizatorical indications.

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SPECIALIZATION IN SPORT: AN OVERVIEW AND SOME UNSOLVED QUESTIONS

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Abstract: The Deliberate Practice Theory postulates that experts are always made, not born. This theory translated to the youth sport domain means that if an athlete wants to be a real high level performer, he/she needs a deliberate engagement in practice during the specialization years, spending time wisely and always focusing on tasks that challenge the current performance.

However, literature suggests that the sport promoting strategies are being maintained despite of the increased demands in the anthropometric characteristics of professional players and demands of the actual professional soccer competitions. On the other hand, the task of the researchers to identify biological variables that can predict performance turned almost impossible.

Persistence in activity seems to represent a complex process of conciliation between personal expectations and the climate fostered by others with a progressive reduction of sources of conflict.

This underlines the importance of the social environment and of the athletes’ long-term membership in their clubs. Mutual perceptions from coaches and athletes have a crucial role in fostering motivation for athletes to stay in sport and are linked to satisfaction with the sport.

Key words: youth sport, talent, specialization, enjoyment, predictive models

* * * * *

INTRODUCTION

Excellent performance in sport has a strong positive relationship with the accumulated number of hours of practice, and the specialization years are seen as a decisive moment to lift an
athlete’s skill level, readiness and commitment (De Bruin et al., 2007; Gonçalves et al., 2009). The assumption behind the argument is that experts are always made, not born (Ericsson et al., 2007). This theory translated to the youth sport domain means that if an athlete wants to be a real high level performer, he/she needs a deliberate engagement in practice during the specialization years, spending time wisely and always focusing on tasks that challenge the current performance.

Early specialization and accurate observation by expert coaches or scouts remain the only tools to find a potential excellent athlete among a great number of participants. In the present study we present two of the problems raised by talent search and the risks of such search. Growth and maturation are two important concepts to better understand the identification, selection, and development processes of young athletes.

However, literature suggests that the sport promoting strategies are being maintained despite of the increased demands in the anthropometric characteristics of professional players and demands of the actual professional soccer competitions. On the other hand, the task of the researchers to identify biological variables that can predict performance turned almost impossible.

Sport can foster positive personal and social development in young people (Côté, Strachan, & Fraser-Thomas, 2009; Light, 2010a) with environment playing a crucial role in shaping their beliefs about sport through their perceptions of the practice and competition climate (Krebs, 2009). However, as Light (2008) suggests, sport must be enjoyable, have meaning, and be relevant enough to attract and keep children and young people involved long enough for positive developments to occur. If sport experiences are enjoyable for individuals, it seems reasonable to expect that participation in activity will continue for a long period.

Smith, Ntoumanis, and Duda’s (2007) study on British athletes found that autonomous goal motives positively predicted effort, which is linked to well-being. These findings suggest that autonomy in goal setting plays a positive role in the athletes’ satisfaction with their sport and it is not reducible to goal difficulty. This sense of autonomy is strongly dependent upon the training climate fostered by coaches and peers (Vazou, Ntoumanis, & Duda, 2006). At the same time, sport and physical education literature points toward the importance of fun in engaging young people in sport and for their persistence in it (Siedentop, 2002; Smoll & Smith, 2002; Bengoechea, Strean, & Williams, 2004), but declines in importance as young people move into specializing and investment phases from around age 13 (Côté & Hay 2002; Helsen, Hodges, Van Winckel, & Starkes, 2000). It is, however, generally accepted that coaches must promote a practice environment in which young athletes can experience pleasure and fun and these seem to be of particular importance up to early adolescence.

However, the pursuit of expertise in sport means that progress in performance must be constantly evaluated and the most efficient kind of evaluation is competition, with its wins-losses record. If practice is oriented to improve performance, it is reasonable to expect that athletes show a strong interest in competitive outcomes and see victory as an important moment of the process. Gould, Dieffenbach and Moffett (2002), in a study with Olympic champions found that they are very competitive and self-confident. Harwood et al., (2004) in a study with young performers showed that they express a high task-ego orientation, and argue that elite athletes cope better with competitive stress when their achievement orientations are both high.

Hence, the decision to engage in such programs should be founded on a clear orientation towards competitive success and on a strong will to become an expert player, ready to practice at the standards of volume and intensity required by excellent performance. Although the athletes are first of all adolescents, the characteristics we expect to discriminate elite players from their peers playing at a lower level are achievement orientations and the will to become experts through deliberate practice. We argue that it would be useful for coaches and families who carry the responsibility of choice and lead the young performers to have better information about important non biological variables when making decisions that can influence all the youngsters’ life.

**EMPIRICAL EVIDENCES**

*Social environment issues*
De Bruin et al. (2007), in a study with young chess players, designed an instrument, called Deliberate Practice Motivation Questionnaire (DPMQ), to assess the individuals’ will to become an excellent performer and to improve in competition. The DPMQ was adapted to basketball, soccer and volleyball. The questionnaire addresses both long time goals (“I want to be a professional basketball/soccer/volleyball player”), and specific changing situations (“I like tough drills in practice because they help me to improve my skills” or “I prefer to play with my friends rather than practicing hard”). In a study with basketball young players (Gonçalves, Coelho e Silva, Carvalho and Gonçalves, 2011), we found that will to excel and will to compete represent variables that can discriminate players by elite and non-elite level (figure 1).

Figure 1. Random forest obtained from the WOFO and DPMQ factors.

It is known that the effects of sport participation depend of the years of exposure to training environments (Stephens, 2000; Visek & Watson, 2005). Therefore, longitudinal designs should explore the potential effects of a multi-seasons-long participation in practices and competitions on the constructs under analysis, and indirectly, on the way young athletes deal with the complexity of personal interactions provided by sport and how they shape their own vision about sport. To this purpose, the multilevel approaches are deemed suited to evaluate the effects of training in diverse settings, with diverse interactions, on all kinds of variables (Papaioannou, Marsh & Theodorakis, 2004).

Because these particular assets or constraints affect young people in a time when they are searching their own identities and roles, their contribution to a rewarding sport experience in a group of peers is a very important one. Creating a supportive environment by providing encouragement and a positive climate can enable young people to enjoy their experience. Findings indicate that the relations between sports participation and enjoyment or positive attitudes are not to be direct and may be influenced by contextual factors. The quality of the athlete-coach relational context is one potential factor that might moderate the relations between sport participation and self-esteem (Conroy & Coatsworth, 2006).

Various studies show that sport engagement causes effects that are never neutral. The youngsters enter the practices with their own personal assets that are to be confronted with the climate, rules and social interactions inside the team. The dialogue, sometimes the contrast, between these two realities is going to build and shape an experience that is going to last for the rest of the participants’ life. How far can the environment interact with personal dispositions is a question still open. The answers are possible through longitudinal studies designed to monitor the evolution of the observed variables during years of sport participation. Holt (2009) argues that time limitations are the main obstacle to observe positive adaptations with experimental groups.

The perceptions of “doing well” are closely related to environment and practice climate as shaped by peers and the coach. The importance of the interaction between dispositional and situational variables has
been stressed in various studies (Whitehead, Andrée & Lee, 2004; Sage & Kavussanu, 2007) indicating that outcomes are perceived as being positive by the athletes when achievement perspectives have the same meaning for them, for their families, for their coaches, and for their peers. According to the athletes’ responses this convergence of meaning between their achievement orientations and the environment is perceived as clear especially when reaching adulthood. Persistence in activity seems to represent a complex process of conciliation between personal expectations and the climate fostered by others with a progressive reduction of sources of conflict.

This underlines the importance of the social environment and of the athletes’ long-term membership in their clubs. Mutual perceptions from coaches and athletes have a crucial role in fostering motivation for athletes to stay in sport and are linked to satisfaction with the sport (Lorimer & Jowett, 2009). Previous studies with elite and adolescent athletes (Jackson, Knapp, & Beauchamp, 2009; Fraser-Thomas & Côté, 2009) underlined the importance of that interaction and how sport experiences can be positive or negative, depending of the ecology of the practice environment. The complex relationship between coaches and athletes as a social grouping is strongly influenced by context within which the coach assumes a leading role (Fraser-Thomas & Côté, 2009).

**The search for a biological model**

From a biological point of view, sports scientists never gave up the goal of identifying young talents for specific sports and of building a predicting model for success in adult competitions, but the obstacles are multiple and apparently without a satisfactory solution. The multidimensionality of sport performance and the variability of competences needed to be a top athlete mean that the number of variables able to fit an explanatory model of future performance is enormous. Sports like team games, with open game situations demanding complex abilities in confrontation with different opponents, demand a tactical excellence to succeed in competition, making impossible the task of the researchers to identify biological variables that can predict performance. It seems plausible that in less complex sports, like track and field, swimming or rowing, it would be easier to establish a consensus about the key biological variables able to predict potential success.

Several attempts were done aiming to explain the performance and select the most predictive traits or states in young athletes. As an example, in a longitudinal study with a large group of Portuguese young swimmers (494 boys and girls aged 13 to 16 years and 12 to 14 years respectively), the only parameter that showed to be correlated with performance and predict it in competition was the ability to maintain a fast velocity over 30 minutes. As one could easily interpret, a test like this is strongly dependent of training load (meters swimmmed and number of training sessions). Despite the several algorithms used to the regression models the expected prediction was under 65%. Hence there is space for a lot of unexplained factors that could affect the performance capacity in a determined moment in every athlete and sport. The role of heritability assumes a new interest in talent identification. However due to his complexity, it is not yet possible to identify consistent models taking into account the large phenotypic variance that can explain future performance.

**CONCLUSIONS**

Some findings contradict the research suggesting that fun and enjoyment are essential for persistence in sport per se. Bengoechea, Strean, and Williams (2004) qualify this contention by arguing that what constitutes fun and enjoyment varies between individuals and that they are strongly related to achievement orientations, perceptions of the climate, and relevant information from significant others. Once again, fun seems to be related to a good practice, a good competition, and a sense of accomplishment among the young athletes and across the various sports in which they are involved. As Long and Carless (2010) suggest, fun means little without skill acquisition and competence development. This contention is evident in other research on youth sport (Light, 2010b).

This sense of accomplishment, of serious effort and things well done appears to be linked with a sense of autonomy. The athletes’ answers in qualitative researches reveal the need to be in control of their own choices and personal schedules. This perception of agency becomes stronger with age, with the athletes feeling less and less dependent upon their families. Looking retrospectively, as young adults, they all link their present satisfaction with sport to a sense of autonomy in sport when younger. These results are similar to the findings of Smith, Ntoumanis, and Duda (2007) whose study also suggested the importance of autonomy in goal setting for the athletes’ satisfaction with sport independently of goal difficulty. The importance of the role the coach plays in making sport a positive experience is suggested by the participants when they refer to the importance of a relaxed environment, free of pressure and the need to have clear goals that can be monitored through competition (Vazou, Ntoumanis, & Duda, 2006).
Recent studies showed that motivation is a more important variable to differentiate elite young athletes from non-elite ones than athletic readiness or skill proficiency (Elferink-Gemser et al., 2007; Figueiredo et al., 2009; Gonçalves et al., 2009; Gonçalves et al., 2011). From an anthropological point of view, Malina showed that readiness for sport performance is a matter of right time, demanding years of adaptation to higher intensities, volumes and stressful situations. Hence, talent identification is a long process, and the earlier a decision is taken, the bigger are the uncertainty about the final outcomes. Recent trends to start the specialized training before puberty raise the risks of injury and are no guarantee of success.

Human performance in sport showed a constant improvement in recent decades, despite the lack of a reliable model to identify the fittest at lower ages. It seems that a good sport and educational system, providing opportunities for all and the necessary autonomy to choose our own way at the right time continues to be the best talent identification model of all.

REFERENCES


ASSESSMENT IN CHILDREN WITH SPASTIC TETRAPARESIS

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Abstract: Background. Children with spastic tetraparesis who benefit from early and continuous kinetic intervention have a chance to an almost normal neuromotor development and to a better integration into society, in this way the quality of life of these children being increased.

Design and methods. The 17 years old patient’s present and over time conditions, and her quality of life were assessed using the questionnaire method, ataxia test, Thomas test, Dynamic Gait Index and the assessment of the ADLs.

Results. Regarding the ataxia, it seems that it was installed throughout the patient’s development and there was no improvement. According to the Thomas test results, the hip flexum decreased throughout the years from an angle of 13° in 2001 to 5° in 2006, before stopping the physical therapy. From then up until now the hip flexum reinstalled, getting worse by 3°. Regarding the gait, the patient has a slight impairment and both a moderate and severe impairment, depending on the obstacles and walking directions.

Conclusions. The continuity of physical therapy resulted in the improvement of the patient’s state and the independence in carrying out various activities, such as household and selfcare, even if she needs an almost constant supervision.

Key words: cerebral palsy, spastic tetraparesis, quality of life, ADL, ataxia, gait, physical therapy

INTRODUCTION

Cerebral palsy is a lifelong condition that affects the individual, family and immediate community. Therefore, the goal of allowing the individual with cerebral palsy to live life with the least impact of the disability requires complex attention to the individual and the family.

The aim of physical therapy is to help the child with cerebral palsy to develop into an adult in whom the effects of the disability are managed so that they have the least impact possible on adult function (Freeman, 2007).

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http://www.fefsoradea.ro/cercetare.html
Since cerebral palsy hinders a child’s development and usually causes problems that persist into adulthood, it is classified as a developmental disability. Even though the brain injury that causes cerebral palsy is present at birth, it is often difficult for doctors to recognize it. For this reason, there may be a delay in diagnosis (Sieglinde, 2006).

Cerebral palsy is a disorder of movement and posture. It is caused by a brain injury that occurred before birth, during birth, or during the first few years after birth. The brain injury hinders the brain’s ability to control the muscles of the body properly. The brain tells our muscles how to move and controls the tension of the muscles. Without the proper messages coming from the brain, infants with cerebral palsy have difficulty in learning basic motor skills such as crawling, sitting up, or walking (Sieglinde, 2006).

Spastic tetraparesis is affecting all four limbs, with the possibility to affect more one one half body or the upper limbs (Popescu, 2001). The spastic form of infant cerebral palsy is the most common form, being present in 70-80% of all cases (Vereanu D. et al,1963). If the level of spasticity is high, the child has certain typical patterns due to the severity of the co-contraction of the involved sides, especially around the proximal joints: hips and shoulders (Căciulan, Stanca, 2011).

Once the spasticity is installed, the child with spastic tetraparesis cannot keep his head up and straight, he cannot keep balance in different positions and he cannot use his hands and arms. In supine, it can be observed a strong retraction of the neck and shoulders. The head rotation to one side causes a characteristic attitude of the asymmetric tonic neck reflex (the swordsman’s position) and an asymmetry of the trunk and limbs. Any attempt to rotate the trunk in the same direction as head and to roll is hindered by the shoulder retraction and the inability of the spine intersegmentary rotation, through the absence of the recovery reactions.

In prone position, the child can’t lift the head or he can’t use his arms and hands to support himself; thus he doesn’t have the „doll’s position”. In sitting, the shoulders, arms and spine are flexed. The hips and knees may also be flexed. If the trunk and upper limbs are extended, there is possible to lift the head from prone position and to maintain the „doll’s position supported by the forearms”. On the attempt to do the quadruped position, the trunk and lower limbs are flexed (Căciulan, Stanca, 2011).

The inability to bend the head from supine and to lead the upper limbs to body midline, prevents the child to initiate the sitting position, emphasized by the inability or difficulty to bend the hips, due to the increase of the extensor’s spasticity caused by touching and pressing the buttocks (Bobath, 1980).

HYPOTHESIS

Children with spastic tetraparesis who benefit from early and continuous kinetic intervention have a chance to an almost normal neuromotor development and to a better integration into society, in this way the quality of life of these children being increased.

OBJECTIVES

The aim of this research is to follow the neurological development of the child, from the diagnosis moment until now; to assess the current status of motor function; to assess the present subject’s quality of life; to assess the degree of social integration; to assess the ADLs.

DESIGN AND METHODS

Subjects: The research, held in March-June 2012, at School with I-VIII classes „Nicolae Popoviciu” Beiuș, was performed on a 17 years old teenager, diagnosed at birth with infant disabling encephalopathy, extrapyramidal syndrome. As associated diseases, she suffers from spastic tetraparesis predominantly on right side and psychomotor retardation. Patient data was collected from the questionnaire which was completed by the mother. The affection was detected at birth, being caused by perinatal factors. During birth, the child was asphyxiated by the umbilical cord. The APGAR score was 1/3, the newborn being inert, cyanotic, without reflexes and there was no crying. At birth she weighed 2.5 pounds.

Regarding the neurological development, according to the mother, the child acquired the main „movements” thus: the head control after 1 year; assisted gait after 2-3 years; individual gait
after 5 years. Until now, surgery was not necessary, instead, she received medical treatment and physical therapy. She is continuously taking the medical treatment since birth and this is the Encephabol syrup and B vitamins.

She started physical therapy after 2 years, at Băile 1 Mai Recovery Hospital, 21 days, once-twice a year, until the age of 8. After that, she didn’t do physical therapy until third grade, when she started physical therapy at Beiuș. Since 2007 she has not done physical therapy, because the financial conditions don’t allow it. Instead, her mother does exercise with her 3-4 times per week. These exercise are: walking; going up-down on stairs; dancing; riding the 3 wheel bicycle; various coordination and skill activities (eg. drawing, household chores etc.) The progress mother noticed after the kinetic intervention are: a better trunk and lower limbs control.

Currently, D. has a height of 1.64 m and a weight of 60 pounds. Mother said that since 2007 (after stopping the physical therapy) and so far, she has noticed a neuromotor regression, compared to her condition until then.

**ASSESSMENT METHODS**

To gather all the patient data, we used various assessment methods and tests, presented below: a) The test for ataxia (figure 1):

![Test for Ataxia](http://www.dinf.ne.jp/doc/english/global/david/dwe002/dwe002g/dwe00211g19.gif)

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**Figure 1.** The test for ataxia

(Source: http://www.dinf.ne.jp/doc/english/global/david/dwe002/dwe002g/dwe00211g19.gif)

b) Thomas Test (figure 2): It is used to identify unilateral fixed flexion deformity of the hip. The test consists of 3 steps:

- Step 1: the patient lies supine on the examination table. The clinician passes the palm of his hand beneath the patients spine to identify lumbar lordosis.
- Step 2: The „normal” hip is flexed till the thigh just touches the abdomen to obliterate the lumbar lordosis.
- Step 3: measure the angle between the affected thigh and the table to reveal the fixed flexion deformity of the hip.

![Thomas Test](http://tiger.towson.edu/~mlipka1/thomas_test.htm)

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**Figure 2.** Thomas test

(Source: http://tiger.towson.edu/~mlipka1/thomas_test.htm)

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c) Dynamic Gait Index - DGI: DGI was developed as a clinical tool to assess gait, balance and fall risk. It evaluates not only usual steady-state walking, but also walking during more challenging tasks. This consists of 8 functional walking tests, performed by the subject and marked out of three according to the lowest category which applies. Total score is 24.

d) Questionnaire on subject’s personal, clinical and treatment data:
This questionnaire is a personal contribution, made with the aim to gather data about the patient, her disease and details about the physical therapy she has done.

e) ADL – Activities of Daily Living: This assesses the functional independence level in the daily self-care activities.

**RESULTS AND DISCUSSION**
Following the previous and current assessments, and comparing the results, there have emerged the following conclusions:

a) Ataxia test: positive.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TEST RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Positive</td>
</tr>
<tr>
<td>2004</td>
<td>Positive</td>
</tr>
<tr>
<td>2011</td>
<td>Positive</td>
</tr>
</tbody>
</table>

It can be noticed that ataxia was installed throughout the subject’s development. There has been no improvement so far (table1).

b) Thomas test: positive.

In this chart (figure 3) it can be noticed that the hip flexion decreased during the years when the subject did physical therapy, from an angle of 13° in 2001, to 5° in 2006, before interrupting the physical therapy. Since then until now, the hip flexion was reinstalled, increasing with 3°.

c) ADL – Activities of Daily Living:

<table>
<thead>
<tr>
<th>ADL</th>
<th>Lvl. 1</th>
<th>Lvl. 2</th>
<th>Lvl. 3</th>
<th>Lvl. 4</th>
<th>Lvl. 5</th>
<th>Lvl. 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Solid food</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Liquid food (soup)</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Liquids (water, juice etc.)</td>
<td></td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 http://www.physio-pedia.com/Dynamic_Gait_Index
Regarding the daily activities, the dependence levels differ, depending on the activity itself. For example, when about feeding, she is almost independent with the solid food, unlike the liquid food, where she is total dependent. Because of the ataxia specific movements, the subject cannot handle fine, coordination and balance movements, as leading the soup spoon to mouth, or handling a glass with water without straw.

Regarding the selfcare, she is permanently dependent on mother, especially when it’s about dressing the lower body and taking shoes. When it’s about handling the upper body (dressing, washing teeth, overall care) sometimes she manages to do it herself, mother interferes only occasionally.

When it’s about daily activities, she is folding clothes alone, without help, slowly, as much as allowed. She also washes dishes, but only the plastic ones, because sometimes she throws them and there are risks to get hurt. She really enjoys doing the household, she likes to feel useful and to help her mother.

The gait assessment was done only in present. The final score is 8/24. The subject shows: mild impairment, in terms of stepping around obstacles and walking up/down stairs; moderate impairment, in terms of gait level surface, change in gait speed, gait with horizontal head turns, gait and pivot turn; severe impairment, in terms of gait with vertical head turns and steps over obstacle.

**CONCLUSIONS**

Following this study, we came to the following conclusions:

Throughout the years when the subject did physical therapy, it has been noticed an improvement of her condition, which appears both from the assessments and her mother’s observation, who is permanently with her daughter. It was also noticed that, since stopping physical therapy in 2007 until present, there is a slight regression regarding the neuromotor development and the execution of various daily and other activities.

Regarding the subject’s general outlook on life, this is the same as the mother’s, because her mother understands what her daughter is going through and how she sees things. They are both relatively pleased, more specifically resigned, though they wish the social function to be improved.

The continuity of physical therapy resulted in the improvement of the patient’s state and the independence in carrying out various activities, such as household and selfcare, even if she needs an almost constant supervision.
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PROGRESS OF SOCIAL GROUP RELATIONS IN MOUNTAIN TOURISM

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Abstract: The motivation that stands for this study is determined by the proportions that tourism tooks in the last years, becoming a real social-economic phenomenon, with instructive-educative influences.

In the new context, unanimously accepted by the permanent education, the spreading of these influences is made not only over the pupils and students, but also over all the categories forming the population. The number of persons choosing tourism has grown and is caused by the need of finding a modality to compensate the characteristics of the modern human being (pollution, stress, inadequate nourishment or supercharging, sedentary life). In relationship with all the other components of sports, tourism has a main advantage through its broad availability.

Key words: group, social relations, mountain, tourism

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INTRODUCTION

Tourism is, by its impact and consequences, an industry becoming more and more important, a vital component of economic and social life for a growing number of countries, for some being the only real chance of economic success (Minciu, 2002 & Fieroiu, 2008). Through its own and propagated characteristics also, tourism stands out in almost all countries as an activity with a high degree of economic efficiency in comparison with other sectors of the national economy (Bran et al., 2000).

The ones who want to practice tourism are not conditioned by certain qualities, skills or physical aptitudes, and boundaries of age does not exist. Nowadays, tourism was given a much more complex content, economically, socially and spiritually speaking, its growing being seen also in the fact that, yearly, over 1.5 billions of persons representing almost the third part of the global population do travel in tourist purposes, spending over 2000 billions US $; these means 10% for abroad travels, international tourism being 25-30% of the global commerce (WTO 2010 Anual Report).

Why is tourism so important?

* Gh. Lucaciu
economic consequences are emphasized by great amount of money spent for tourist services, by the consequences connected to the work market and so on; in Romania, data offered by National Institute for Statistic (2012 Annual) shows that after four years of increasing (2005-2008), in the last two years (2009 and 2010) the number of tourists decreased (table 1).

Table 1. Arrivals of tourists in the establishments with functions of touristic accommodation
(Data source: 2012 Annual, Romanian National Institute of Statistics)

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>6815</td>
<td>6216</td>
<td>6972</td>
<td>7126</td>
<td>6141</td>
<td>6073</td>
</tr>
<tr>
<td><strong>in case: străini</strong></td>
<td>1430</td>
<td>1380</td>
<td>1551</td>
<td>1468</td>
<td>1276</td>
<td>1346</td>
</tr>
</tbody>
</table>

In this context, we can guess the role and importance of mountain tourism both economically (in Romania, in 2008, from 1.466 thousand foreign tourists – figure 1, 580 thousand representing 39.56%, chose tourism in mountain area – table 2) and formative.

Table 2. Foreign tourists incoming, by destinations
(Data source: 2009 Annual, Romanian National Institute of Statistics)

<table>
<thead>
<tr>
<th>By zones</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mountain - cities</strong></td>
<td>343</td>
<td>340</td>
<td>340</td>
<td>312</td>
<td>341</td>
</tr>
<tr>
<td><strong>Baltic</strong></td>
<td>302</td>
<td>307</td>
<td>360</td>
<td>330</td>
<td>346</td>
</tr>
<tr>
<td><strong>Seaside</strong></td>
<td>297</td>
<td>327</td>
<td>376</td>
<td>304</td>
<td>338</td>
</tr>
<tr>
<td><strong>Mountain – villages and touristic routes</strong></td>
<td>111</td>
<td>92</td>
<td>166</td>
<td>180</td>
<td>239</td>
</tr>
<tr>
<td><strong>Historical places</strong></td>
<td>70</td>
<td>59</td>
<td>68</td>
<td>62</td>
<td>80</td>
</tr>
<tr>
<td><strong>Religious pilgrimage</strong></td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>River cruises</strong></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td><strong>Circuits</strong></td>
<td>17</td>
<td>11</td>
<td>7</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td><strong>Other places</strong></td>
<td>153</td>
<td>89</td>
<td>82</td>
<td>100</td>
<td>75</td>
</tr>
</tbody>
</table>

AIMS
In the framework of a wider research conducted through sociological survey, using questionnaire method, we aimed - among others - to emphasize the characteristics of social relationships within the group (first year students - Faculty of Physical Education and Sports) and evolution of its cohesion in order to improve psychosocial, relational and communication climate.

We tried to get primary information, asking members of a group with well-defined boundaries (students from an year of study) to indicate the colleagues / partners who would like to join for a concrete actions or in a future situations. It is about to put subjects in natural conditions of choice, ensuring real motivation. Sociological study had a threefold orientation:
- knowing the affinities expressed by members of the group and therefore the relationships within the team;
- better knowledge of the subjects of their own positions in the group;
- improving relations and group psychosocial environment through specific psychological actions.

HYPOTHESIS
We proposed the hypothesis that knowind and acting on interpersonal relations, we can indirectly exert an influence on school performance, sports performance and vice versa. The information thus collected can be used for formative purpose: shall be communicated to the involved persons the collective opinion about them (avoiding any nomination).
Within individual calls, the subject is made aware of the qualities and defects (that he possibly ignores), although he possess in the judgment of the group members. Are expected, thus, the reduction of the illusion in the minds of its position in the group or remove perceptual gaps, which favors the formation of a self-image more fair (Dewey, 1990, Cucoș, 1996).

RESEARCH METHODS

Using documentary method was essential for theoretical foundations of the study and for obtaining scientific informations, which in addition to informations from own sources stands behind the research. We used also, the method of sociological survey, applying the questionnaire before and after the practical activity (the same protocol for all subjects), aiming to highlight the sociological structure of the group (Georgescu, 1979). The questionnaire was a combined one, including questions with closed, at choice and free answers. Data processing was performed using graphical method and sociometric method (sociogram).

The data were processed, converted into comparative tables, then we proceeded to calculate the preferential status index (PSI), also introduced in tables sociometric matrix form (figure 1).

CONTENT OF THE EXPERIMENT

To function, a group must have a common task, to produce, to achieve, to succeed. Personal needs that members bring in groups require solves, solutions, needs can be met only through the interrelations between them (Dragnea, 2006). Because of the importance of processes (process of implementation of tasks, the process of communication, affective-appreciative process, the influence process) that occur within the group - in terms of the importance of the tasks – it is important to know the group dynamics, including through sociometric instruments (Dragnea et al., 2006).

In this investigation, we included a series of questions that give content sociometric test which aims to highlight the characteristics of relationships within the group and its cohesion development to improve psychosocial climate, relational and communication. The character of this questionnaire was mainly sociological but also for personality, aiming to:
- highlight the socio-cultural, instructional and economical level of the subjects;
- know of educational influences which have previously received, including how they were initiated into physical education and sport practice and possibly in mountain tourism practice;
- highlight the sociological structure of the group;
- assess how subjects relate to specific conditions of tents camp and availability for individual involvement in joint activities.

RESULTS

After we applied tests, we codified the subjects initials first and last names to facilitate the procedure, giving to each initial a number from 1 to 48, introducing into comparative tables (Tables 3 and 4) and then we proceeded to calculate the preferential status index (PSI), also introduced in table form sociometric matrix. For example, we developed a sociogram (figure 1) for the data obtained in items 23 and 24 - Questionnaire 1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Initials</th>
<th>+</th>
<th>-</th>
<th>PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SC-38</td>
<td>15</td>
<td>1</td>
<td>0.32</td>
</tr>
<tr>
<td>2</td>
<td>BA-1</td>
<td>8</td>
<td>18</td>
<td>-0.23</td>
</tr>
<tr>
<td>3</td>
<td>BRB-6</td>
<td>8</td>
<td>0</td>
<td>0.18</td>
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<tr>
<td>4</td>
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<td>5</td>
<td>1</td>
<td>0.05</td>
</tr>
<tr>
<td>5</td>
<td>TA-43</td>
<td>3</td>
<td>0</td>
<td>0.07</td>
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<tr>
<td>6</td>
<td>HCF-17</td>
<td>2</td>
<td>6</td>
<td>-0.1</td>
</tr>
<tr>
<td>7</td>
<td>PE-43</td>
<td>2</td>
<td>18</td>
<td>-0.27</td>
</tr>
<tr>
<td>8</td>
<td>XM-33</td>
<td>2</td>
<td>3</td>
<td>-0.02</td>
</tr>
<tr>
<td>9</td>
<td>SN-42</td>
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<td>0</td>
<td>0.05</td>
</tr>
<tr>
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<td>TL-48</td>
<td>2</td>
<td>1</td>
<td>0.02</td>
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<tr>
<td>11</td>
<td>CA-9</td>
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<td>1</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>GOV-16</td>
<td>1</td>
<td>0</td>
<td>0.02</td>
</tr>
<tr>
<td>14</td>
<td>PN-13</td>
<td>1</td>
<td>0</td>
<td>0.12</td>
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<tr>
<td>15</td>
<td>KA-19</td>
<td>1</td>
<td>0</td>
<td>0.02</td>
</tr>
<tr>
<td>16</td>
<td>RC-20</td>
<td>1</td>
<td>0</td>
<td>0.02</td>
</tr>
<tr>
<td>17</td>
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<td>1</td>
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<td>0.02</td>
</tr>
<tr>
<td>18</td>
<td>XJ-23</td>
<td>1</td>
<td>0</td>
<td>0.02</td>
</tr>
<tr>
<td>19</td>
<td>PM-31</td>
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<td>-0.13</td>
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</tr>
<tr>
<td>24</td>
<td>TR-46</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3. Options polarization
It is surprising to note the radical changes in the structure and relationships of the group, reflected in responses to the questionnaire no. 2, which once more highlight the educational valences of such activities and need to be valued in relation to the population of all ages, but especially in relation to the young people.

We believe that all issues raised and conclusions should return - in a relationship of feed-back – to research subjects, in their dual feature as current subjects and future trainers.

Table 4. Represented preferential type values

<table>
<thead>
<tr>
<th>Number of preferences</th>
<th>Subjects with the same preferences</th>
<th>PSI</th>
<th>Psychosocial value</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>8</td>
<td>0.32</td>
<td>POPULAR</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.07</td>
<td>ACCEPTED</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>24</td>
<td>0</td>
<td>INDIFFERENT</td>
</tr>
<tr>
<td>-3</td>
<td>3</td>
<td>-0.02</td>
<td></td>
</tr>
<tr>
<td>-2</td>
<td>1</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>-5</td>
<td>2</td>
<td>-0.12</td>
<td></td>
</tr>
<tr>
<td>-10</td>
<td>1</td>
<td>-0.23</td>
<td></td>
</tr>
<tr>
<td>-16</td>
<td>1</td>
<td>-0.37</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1.** Collective sociogram

**CONCLUSIONS**

To make our students active partners in instructive and educational act, it is important to know and to make known, including intimate details of the group, how it is structured, informal relationships that are
occurring in the group, all of the relations group schema, to obtain information on isolates of team members, those who fail to adapt, those who are most approved and so on.

In summary, we highlight some aspects:

- top wanted partners changed significantly: the original agreed is out of „top 10”, instead came to be agreed other subjects, symmetrical aspect applies to unwanted partners, in fact there was a reversal of valuing;
- similarly, if initially the most „popular” subject was 38 with five adhesions, finally it fell below average, coming into focus other subjects considered „neutral”;
- did not change significantly „unsympathetic” subjects ranking, also the best organizers ranking;
- one important aspect is the knowledge and recognition sociometric's leadership, sense in which we can say that the initial locations 1, 2, 3, became 7, 3 and 4, and the final locations 1, 2, 3, came from the initial sites 9, 24 and 2;

Knowing the stage reached in forming cohesion by calculating cohesion index before an important step for the group and some period thereafter, we will show the effectiveness of the approaches. Index calculation at different stages, reveals the direction in which the group envolves: increased cohesion, stagnant or in decline (Havârneanu, 2000). Phenomena that can produce such changes are numerous, as such is not only desirable, but also necessary to conduct regular sociometric test application and thus to compare results and detect factors that caused these changes.

Acknowledgements
This article contains data from Doctoral Thesis of the first author.

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A STUDY ON THE MANAGEMENT AND THE FINANCIAL EFFICIENCY OF MANCHESTER UNITED FOOTBALL CLUB

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Abstract: The study was conducted from April 2010 to May 2011 and dealt with the financial and operational efficiency of Manchester United Football Club in three months (fourth semester), from April 1st to June 30th 2010. Data concerning similar facts were collected for the same time intervals of 2009 as well.

In brief, the following aspects were observed:
- The team’s high level performance on the field;
- Continuous investment in the team;
- A 2.9% increase in the annual revenues from 278.4 to 286.4 million pounds. Reason for choosing this subject: the strong impact football has on masses, the “passion” and controversies it has caused and my direct involvement in this phenomenon.

Hypothesis and purpose of the paper: this paper aims to demonstrate that international prestige, great success in large-scale competitions and the prosperity of a club like Manchester United is based on performance management. The purpose of the paper is to provide football specialists and the large public that loves this wonderful game with a concrete example of the organisation and activities of one of the world’s best clubs – Manchester United.

Key words: financial efficiency, management, revenues, expenditure, performance

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THE THEORETICAL AND PRACTICAL IMPORTANCE OF THE PRESENT THEME

The sports activity represents one of the major aspects of human life in today’s world. One can openly say that, due to the development of sport in the last decades, it became a religion for a large number of people. Sport has reached very high peaks when it comes to its development and this is an important aspect when it comes to gaining new supporters. When we talk about

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http://www.fefsoradea.ro/cercetare.html
Supporters we refer both to those who practice it as a performance sport activity and to those who do it for pleasure, be they fans of a particular branch of sport, persons in charge in a sports organization (the manager of a sports club) or those who work in the sports press, meaning all the people who have a connection with sport.[1-8]

Sports as a complex system, based on a relationship structure between cultural, political, economic and social phenomena, is based on a dynamic relationship between partners: clubs, federacy, local collectivities, the state, economic units, schools, the mass-media.[8-11]

The sports management represents another human activity which is highly important for the evolution of life and sport. These activities, the management and the sport itself, are tightly interconnected. Sports is one of the many domains which interest management and represents one of its branches. [12-13]

On the other hand sports involves many domains and branches. The present paper aims at studying the interdependence between the sporting management and a sports branch which is highly praised at a worldwide level, namely football.[14-15]

THE REASON FOR CHOOSING THE CURRENT SUBJECT

The choice of the theme was due to the high impact that this particular sport has on masses, the passions and the controversies which arise out of it and also due to my personal involvement in this phenomenon.

THE HYPOTHESIS AND THE PURPOSE OF THE PAPER

The present paper aims at demonstrating the fact the international prestige, the success in important competitions and the prosperity of a club like Manchester United are based on a performing management.

The aim of this paper is to present to specialists in this field, but also to the general public who loves this wonderful sporting activity, a specific example regarding the type of organization and the activity of one of the most performing clubs on a worldly level, namely Manchester United.

THE PHASES OF RESEARCH

According to the financial statistics (the financial department of the Manchester United club and the English audit) we have gathered the data for the 4th trimester (during 1st of April 2009 - 30th of June 2009), but also the results from the audit between the 1st of July 2008 - 30th of June 2009. [16-21]

Subsequently, we have gathered the financial data of the 4th trimester (the 1st of April 2010 - 30th June 2010), but also the results from the audit between the 1st of July 2009 – 30th of June 2010. [22-27]

INCOME STATEMENT

Matchday turnover

Matchday turnover for the quarter ended 30 June 2010 was £15.5 million, a decrease of £12.4 million or 44.4% over £27.9 million for the same period in 2009. This reduction is partially due to the progress the Club made in 2009 in the UCL resulting in matchday income for the semi-final and final. In addition, the Club had 2 less FAPL home games compared to the same period in 2009, resulting in lower revenue recognised in the current year period.

Matchday turnover for the year ended 30 June 2010 was £100.2 million, a decrease of £8.6 million or 7.9% over £108.8 million for the same period in 2009. This decrease was largely the result of the Club reaching the final of the 2009 UCL compared with the quarter-final in 2010. In addition, 1 less home domestic cup game and 3 less away domestic cup games were played in 2010 compared with 2009 due to the early FA Cup exit in 2010.

Media turnover

Media turnover for the quarter ended 30 June 2010 was £28.1 million, a decrease of £11.0 million or 28.1% over £39.1 million for the same period in 2009. This decrease reflects progress made in the 2009 UCL, reaching the final, compared with progression to the quarter-final in 2010. In addition, the Club had 2 less home FAPL matches and 2 less live televised matches compared to
A study on the management and the financial efficiency of Manchester United Football Club

the same period in 2009. Media turnover for the year ended 30 June 2010 was £104.8 million, an increase of £5.1 million or 5.1% over £99.7 million for the same period in 2009. This increase reflects the growth in the overall UCL distributions from UEFA for participants in the Champions League, offset by a reduction in the Club’s share of these distributions due to only reaching the quarter finals in 2010. Income from the FAPL washer higher due to an increase in the equal share and other FAPL distributions, partially offset by 1 less live TV game being shown during 2010 and a reduced merit payment due to finishing runners-up in 2010 compared with being winners in 2009.

**Staff costs**

Staff costs for the quarter ended 30 June 2010 were £37.1 million, an increase of £1.9 million or 5.4% over £35.2 million for the same period in 2009. This increase largely relates to growth in player compensation but is also due to a small increase in overall headcount in the business. The growth in player compensation was partially offset by a reduction in bonuses paid due to finishing as runners-up in the FAPL and quarter finalists in the UCL. Staff costs for the year ended 30 June 2010 were £131.7 million, an increase of £8.6 million or 7.0% over £123.1 million for the same period in 2009. This increase largely relates to player compensation but is also due to a small increase in overall headcount in the business. The growth in player compensation was partially offset by a reduction in bonuses paid due to finishing as runners-up in the FAPL and quarter finalists in the UCL.

**Commercial turnover**

Commercial turnover for the quarter ended 30 June 2010 was £23.5 million, an increase of £5.3 million or 29.1% over £18.2 million for the same period in 2009. This increase was a result of additional sponsorship revenues generated by an increase in the number and value of our global, regional, mobile and supplier sponsors. The 2010 commercial turnover figure also reflects a partial recognition of the cumulative profit share associated with the Nike partnership.

Commercial turnover for the year ended 30 June 2010 was £81.4 million, an increase of £11.5 million or 16.5% over £69.9 million for the same period in 2009. This increase was a result of additional sponsorship revenues generated by an increase in the number and value of our global, regional, mobile and supplier sponsors. The 2010 commercial turnover figure also reflects a partial recognition of the cumulative profit share associated with the Nike partnership.

**Amortisation of players’ registrations**

Amortisation of players’ registrations for the quarter ended 30 June 2010 was £9.8 million, broadly consistent with £9.9 million for the same period in 2009. Amortisation of players’ registrations for the year ended 30 June 2010 was £40.1 million, an increase of £2.5 million or 6.6% over £37.6 million for the same period in 2009. This increase was primarily due to the acquisitions of new players since January 2009, in particular Valencia, Diouf and Obertan. The increased amortisation associated with these acquisitions was partially offset by the disposals of Tevez and Ronaldo.

**Profit on disposal of players**

Profit on disposal of players for the quarter ended 30 June 2010 was £3.3 million, a decrease of £75.1 million over £78.4 million for the same period in 2009. The 2009 profit on disposal related to the sale of Ronaldo in June compared with the disposals of Foster and Tosic in the same period for 2010. Profit on disposal of players for the year ended 30 June 2010 was £12.7 million, a decrease of £68.0 million over £80.7 million for the same period in 2009. The 2009 profit on disposal related to the sale of Ronaldo in June, with the profit on disposal in 2010 being due to Martin and Campbell during the summer 2009 transfer window, Simpson in the January 2010 transfer window and Foster and Tosic during the summer 2010 window.

**Working capital**

Working capital for the quarter ended 30 June 2010 produced a cash inflow of £55.0 million, an increase of £16.2 million over £38.8 million cash inflow for the same period in 2009. The working capital movements during the three month period are principally a result of the Club receiving season ticket and seasonal hospitality monies prior to the start of the season, the income
from which is then deferred and recognised over the number of home games in a season resulting in income, with no associated cash inflows. The increase of £16.2m is the result of a greater portion of season ticket monies being received in the final quarter of 2010 compared to 2009 offset by an advance payment received in respect of a sponsorship agreement in May 2009.

Working capital for the year ended 30 June 2010 produced a cash inflow of £2.7 million, a decrease of £16.4 million over £19.1 million inflow for the same period in 2009. This decrease is largely a result of an advance payment we received in respect of a sponsorship agreement in May 2009, offset by an overall increase in other sponsorship monies received in the year to 30 June 2010 for the 2011 financial year.

**Shareholders’ funds**

Shareholders’ funds in the Group increased by £321.5m largely due to the £405.8m capital contribution referred to above.

The results:

According to the study we have gathered the following data:

Summarizing we can briefly present the following financial balance sheet of the club for the mentioned periods:

<table>
<thead>
<tr>
<th>INCOMES</th>
<th>EXPENSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>286.4 MIL. £</td>
<td>185.6 MIL. £</td>
</tr>
</tbody>
</table>

Making the difference between the two columns one can notice a net profit of 100.8 mil. £

**Conclusions and proposals**

Based on the current study and on the results we have obtained one can draw the following conclusions:

- The net profit of the Manchester United club demonstrates a performing management.
- There is a tight interdependence between the financial side of sport and the sporting performance, both of these factors being a necessary condition for the other. This fact was proven by the substantial lowering of the income when the team had not moved forward to the superior phases of the Champions League;
- The sporting performance is the main pillar of the management plan, the club making true financial efforts regarding the acquisition of valued players who can face the strict requirements of today’s football;
- The management of the Manchester United club represents a success model which should be studied and applied by Romanian clubs, but also taking into account its specificities;
- The hypothesis of the paper has been confirmed, the Manchester United club proving to have a performing management both due to the sporting performance along the years, but also when we refer to the financial aspects – which were always on the plus side.

**Proposals:**

- The urgent implementation of sports management to the sporting structures in our country
- Finding concrete ways to co-interest potential investors in this domain
- Creating in time true “club brands” capable of making profit
- Co-opting in the organization structures of the clubs of marketing and management professionals, who can apply the correct strategies for achieving high sporting performances.
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CONTRIBUTIONS TO THE ESTABLISHMENT OF RELEVANT INDICATORS TO DIVIDE THE LEARNING PROCESS IN THE CONTEXT OF EXERCISE AT THE FEMALE PERFORMANCE HANDBALL TEAM

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Abstract: The experimental research starts from the premise that only by using performance recording devices can determine the exact value of relevant indicators.

Experimental research objectives: identifying relevant indicators that underline the learning process; emphasizing the key role of the heart rate in directing the effort in the training lesson in the female handball game; identification of specific handball team effort in the training lesson compared with specific exercise areas in monitored matches; setting relevant comparisons according to the position in the team; setting max VO2 values; confirmation of the working hypotheses by statistical and mathematical processing of the relevant indicators identified by experiment and establishing the minimum reference models in the team and individual player based on the percentage values after the recordings made for the heart rate and the calorie consumption.

The inductive hypothesis refers to the efficient use of the relevant indicators, measured with modern electronics, in the preparation of the players of the performance handball to increase the exercise capacity.

The deductive assumptions are:
- If we monitor and operate with relevant indicators, measured with special applied electronics, we might succeed the optimization of the high performance training of the handball game.
- If we set during the training session the exact value of some indicators such as the heart rate and the calorie consumption and we differentiate the habitat areas of effort, then we might improve the exercise capacity.
- If we divide the training process using our tactical and technical structures of the handball game, rationalized on the basis of the measured values of the relevant indicators, then it might influence the exercise capacity and the motor exercise that may be at a higher level in the competition.

During the experiment the following relevant indicators confirmed the research hypothesis: energy consumption per minute; resting heart rate; average heart rate; supramaximal and maximal effort; submaximal effort; moderate effort and aerobic effort. The relevant indicators which have not confirmed the hypothesis of the research are: total energy consumption, total number of pulses and the maximum heart rate.

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http://www.fefsoradea.ro/cercetare.html
Contributions to the establishment of relevant indicators to divide the learning process in the context of exercise at the female performance handball team

The experimental studies emphasize through the results – the necessity to use for trainings the proper equipment to provide the significant physiological information to the coach and the player alike.

From the measurements made during the research we found out that the percentage of working with a certain intensity value given by the heart rate and the players is:

- 13.2 % for the pivot player - a participation to achieve the effort having maximum frequency
- 35.8% for the left wing player - a participation to achieve the effort having submaximum frequency
- 30.5 % for inside player - a participation to achieve the effort having a moderate heart rate

The participation percentage of energy resources - to achieve the efforts specific to the female handball game:

- 12% for maximal and supramaximal efforts - anaerobic-alactacide compared with 20%-value offered by specialists
- 34% for submaximal efforts - anaerobic-alactacide compared with 30%-mentioned by specialists
- 23% for mixed efforts
- 31% for anaerobic efforts compared with 50%-mentioned by specialists

Using equipment for recording the heart rate in real effort conditions may represent a valuable evidence of activity performed during the competitive year.

**Key words:** indicator, relevant, divide, exercise, learning process, team game, handball, sports performance

**INTRODUCTION** “Synthesis and culmination of life on earth”¹, man” is a living system, hipercomplex, endowed with body and spirit”², whose psychosocial and biological evolution is facilitated, synergistically, through: movement, attitude, behaviour—all being under the sign of aspiration to an ideal sphere that can be dressed in the tangible form of polysemous performance - in various fields-the broad realm echo enjoying hugely popular sport.

The polysemy notion of sports performance, reflected in the complexity of psycho-motor activity is identifiable, from our point of view, at the time, both in terms of the two coordinated likely to be segmented: diachronic division (T1, T2, ... Tn- diachronic split-phase accumulation: training) and synchronic division (T1 sau T2- split-ends synchronic : sports competitions), and the vision of establishing relevant indicators, both aspects being integrated- complementary- to a training process in the context of exercise. This training process envisages comprehensive strategy (related to sports steering) to exploit human resources (skills, attitudes, motor qualities), an important role being assumed to the workouts, approachable interdisciplinary, beneficial to the leading sportsman’s personality -as entity or as a social link (team)-in sports competitions.

**EXPERIMENTAL RESEARCH** The purpose of this research is to identify, through a performance recording device, relevant indicators underlying the learning process and on which this can be divided into the context of the specific training effort in a handball team from the National League.

**RESEARCH HYPOTHESES**

1. If you monitor and operate with relevant indicators, measured with special applied electronics, we can optimize the training of high performance in the handball game.

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² Id. ibid
2. If during the training we set the value of some indicators such as the heart rate and the calorie consumption and we differentiate the habitat areas, then we can improve the exercise capacity.

3. If we divide the training process using our tactical and technical structures of the handball game, rationalized on the basis of relevant indicators measured values, then we can influence the exercise capacity, and the motor expression may be at a higher level in the competition.

4. If there is a statistically significant correlation between the variables supported by the records lengthwise and the transverse analysis of the phenomenon, then the exercise capacity can be optimized.

5. By obtaining accurate values of relevant indicators and finding a record of their synergistically manifestations, then the effects should be significant with regard to the increase of the exercise capacity of high performance female handball.

**EXPERIMENTAL RESEARCH VARIABLES**

1. The dependent variable is represented by the values of heart rate which may be modified by the effort specific to the handball game. By the heart rate values depends the oxygen consumption value in the unit time.

2. The independent variable is represented by the specific performing effort of the female handball game using tactical and technical structures divided into attack and defense, each time on the phases separately and depending on the content elements of sports training. Anticipating that by using the chosen technical-tactical structures there will be a positive influence in relation to the optimization of the physiological exercise capacity.

**ADEQUACY OF THE METHODS AND TECHNIQUES APPLIED IN ACTUAL RESEARCH**

The methods used during the undertaken research are: the scientifically documentation, the pedagogical method of observation, the questionnaire method, the statistical methods, the pedagogical experiment method, the recording method, the logical method, the graphical method. Apart from these methods we shall do some considerations on the recording method:

The recording method is a symbiosis between modern and empiric designed to capture the concrete reality of the motric expressions of the female players of handball, depending on the position in the team, training, and competing. By means of an advanced electronic device The Team Polar System we have highlighted the relevant indicator: the heartbeat (figure 1).

![The Team Polar System](image)

*Figure 1. The Team Polar System used for recordings during the experiment undertaken to the CSM CETATE Devatrans team from the National Female Handball League*
Contributions to the establishment of relevant indicators to divide the learning process in the context of exercise at the female performance handball team

The records are unequivocal; they highlight the physically effort involved in the training or match of the player and can be stored in this form by being able to perform comparisons on exercise capacity evolution and its implications on performance capacity.

When the necessary interpretations were made after recording with the Team Polar System on the CSM CETATE Devatrans team we also used the existing specifications from the User’s Manual. These specifications refer to four fundamental benchmarks for objective assessment of physical effort: the zonal trend, the relative intensity of the effort to the maximum heart rate during the performed exercise and the effects that this type of effort has a stress on the body (table 1).

### Table 1. Indicative benchmarks for reporting information obtained from records using the Team Polar System

<table>
<thead>
<tr>
<th>Tendință zonală (Target zone)</th>
<th>Intensitate procentuală (Intensity % Of HRmax)</th>
<th>Durata efortului (Example durations)</th>
<th>Beneficii fiziologice/ Efectele antrenamentului (Physiological benefit/ Training effect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxim (Maximum)</td>
<td>90-100%</td>
<td>sub 5 min.</td>
<td>Creferea vitezei de sprint/ Obositor pentru respiratie și mănuși</td>
</tr>
<tr>
<td>Greu (Hard)</td>
<td>80-90%</td>
<td>2-10 min.</td>
<td>Creșterea capacității maxime de performanță/ Oboselă musculară și respirație greoaie</td>
</tr>
<tr>
<td>Moderat (Moderate)</td>
<td>70-80%</td>
<td>10-40 min.</td>
<td>Îmbunătățește fitness-ul aerob/ Oboselă ușoară a mușchilor, respirație ușoară, transpirație moderată</td>
</tr>
<tr>
<td>Ușor (Light)</td>
<td>60-70%</td>
<td>40-80 min.</td>
<td>Îmbunătățește rezistența, ajută recuperarea/ Respirație ușoară, confortabilă, transpirație ușoară</td>
</tr>
<tr>
<td>Foarte ușor (Very Light)</td>
<td>50-60%</td>
<td>20-40 min.</td>
<td>Îmbunătățește sănătatea și metabolismul/ Efectele sunt foarte mici pentru toate funcțiile corpului</td>
</tr>
</tbody>
</table>

**Assessment of Relevant Indicators During the Experiment**

The establish energy consumption patterns and areas of female handball specific effort depending on the post

Based on data collected, the average percentage was calculated for recordings made during the training lessons for getting the model value of the relevant indicator on each position to play in the team, which we present as following:

The model of the energetic consumption per minute in relation to the time of the training session

<table>
<thead>
<tr>
<th>Postul ocupat</th>
<th>Es</th>
<th>Is</th>
<th>Cj</th>
<th>Piv</th>
<th>Id</th>
<th>E</th>
<th>P</th>
<th>Consum energetic/ min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consum energetic total</td>
<td>5,3</td>
<td>5,7</td>
<td>4,0</td>
<td>5,5</td>
<td>4,0</td>
<td>3,8</td>
<td>4,7</td>
<td>451 505 315 496 369 357 401</td>
</tr>
</tbody>
</table>

The model of the total energetic consumption in relation to the time of the training session

<table>
<thead>
<tr>
<th>Postul ocupat</th>
<th>Es</th>
<th>Is</th>
<th>Cj</th>
<th>Piv</th>
<th>Id</th>
<th>E</th>
<th>Consum energetic total</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frecvența Cardiacă</td>
<td>9</td>
<td>5</td>
<td>9,4</td>
<td>13,2</td>
<td>9,2</td>
<td>5,0</td>
<td>0,4</td>
<td></td>
</tr>
</tbody>
</table>

The model of total energetic consumption during the game

<table>
<thead>
<tr>
<th>Postul ocupat</th>
<th>Es</th>
<th>Is</th>
<th>Cj</th>
<th>Piv</th>
<th>Id</th>
<th>Ed</th>
<th>P</th>
<th>Consum energetic total</th>
</tr>
</thead>
</table>

The percentage model of maximal h.r. during thge trening session

<table>
<thead>
<tr>
<th>Postul ocupat</th>
<th>Es</th>
<th>Is</th>
<th>Cj</th>
<th>Piv</th>
<th>Id</th>
<th>Ed</th>
<th>P</th>
<th>Consum energetic total</th>
</tr>
</thead>
</table>
The percentage model of submaximal h.r. during the training session

Postul ocupat | Es | Is | Cj | Piv | Id | Ed | P | Postul ocupat | Es | Is | Cj | Piv | Id | Ed | P
---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---
Frecvența cardiacă | 29.2 | 29 | 14.8 | 27.6 | 18.3 | 35.8 | 11.5 | Frecvența Cardiacă | 27.4 | 27.7 | 20.3 | 28.8 | 30.5 | 25.5 | 19.2

The percentage model of mixed h.r. during the training session

The patterns we presented above are taken as guidelines in relation to the handball players having the same level of training. The team players were actually accessing the training effort from range 139 bpm - 200 bpm as follows:

Postul ocupat | Es | Is | Cj | Piv | Id | Ed | P
---|---|---|---|---|---|---|---
Efort de antrenament (139-200bpm) | 67.7% | 64.9% | 49.9% | 74.5% | 67.7% | 70.7% | 30.8%

The model of the h.r. average during the training session

In terms of fructification of the exercise areas according to the position held in the team, or to the energy sources used by reference to the values obtained from the recordings made, we suggest the following classification of the areas effort:

- the anaerobic-alactacide efforts area is used by: piv. 2.7% cp. 2.2%, wing 1.8%, inside 2%, and the goalkeeper is not found in this area. The pivot was recorded in this area with 13.4%.
- the anaerobic-alactacide efforts area has three stages of access: superior where the f.c. is between 180-190 bpm; moderate with f.c. between 170-180 bpm; inferior with f.c. between 160-170 bpm;
- the mixed efforts area has two stages of access: superior where the f.c. is between 150-160 bpm and inferior with f.c. between 140-150 bpm;
- the aerobic efforts area has three stages of access: superior where the f.c. is between 130-140 bpm; moderate with f.c. between 120-130 bpm; inferior with f.c. between 110-120 bpm;
- area under f.c. heating

When we refer to the average value of f.c. during the experiment recorded for each female player, we have to state that the team is located at the lower limit of the mixed efforts performed during the training session.

Statistical analyses of relevant indicators recorded during the experiment itself based on the student test

Supramaximal and maximal effort (180-200 bpm)

EXPERIMENT

<table>
<thead>
<tr>
<th>TESTARE</th>
<th>Media aritmetică</th>
<th>Mediana</th>
<th>Abateria standard</th>
<th>Abateria medie</th>
<th>Dispersia</th>
<th>Amplitudine</th>
<th>Coeficient variație</th>
<th>Diferență medii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inițială</td>
<td>0,02</td>
<td>0,00</td>
<td>0,04</td>
<td>0,03</td>
<td>0</td>
<td>0,11</td>
<td>169,98%</td>
<td></td>
</tr>
<tr>
<td>Finală</td>
<td>0,09</td>
<td>0,06</td>
<td>0,10</td>
<td>0,08</td>
<td>0</td>
<td>0,28</td>
<td>109,95%</td>
<td>299,07%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TESTUL STUDENT</th>
<th>IPOTEZE</th>
<th>CONSTANTE</th>
<th>Valori CALCULATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₀</td>
<td>H₁</td>
<td>α</td>
<td>df</td>
</tr>
<tr>
<td>m₁ = m₂</td>
<td>m₁ ≠ m₂</td>
<td>0,05</td>
<td>8</td>
</tr>
</tbody>
</table>

CONCLUZIE | P <= 0.05. Statistic, rezultatele diferă semnificativ. Se respinge ipoteza nula.

In terms of fructification of the exercise areas according to the position held in the team, or to the energy sources used by reference to the values obtained from the recordings made, we suggest the following classification of the areas effort:

- the anaerobic-alactacide efforts area is used by: piv. 2.7% cp. 2.2%, wing 1.8%, inside 2%, and the goalkeeper is not found in this area. The pivot was recorded in this area with 13.4%.
- the anaerobic-alactacide efforts area has three stages of access: superior where the f.c. is between 180-190 bpm; moderate with f.c. between 170-180 bpm; inferior with f.c. between 160-170 bpm;
- the mixed efforts area has two stages of access: superior where the f.c. is between 150-160 bpm and inferior with f.c. between 140-150 bpm;
- the aerobic efforts area has three stages of access: superior where the f.c. is between 130-140 bpm; moderate with f.c. between 120-130 bpm; inferior with f.c. between 110-120 bpm;
- area under f.c. heating

When we refer to the average value of f.c. during the experiment recorded for each female player, we have to state that the team is located at the lower limit of the mixed efforts performed during the training session.

Statistical analyses of relevant indicators recorded during the experiment itself based on the student test

Supramaximal and maximal effort (180-200 bpm)
Contributions to the establishment of relevant indicators to divide the learning process in the context of exercise at the female performance handball team

COMPARATIVE ELEMENTS OF SYNCHRONISM BETWEEN HEART RATE, EXERCISE AREAS AND ENERGY CONSUMPTION –SPECIFIC TO THE HANDBALL GAME

We further present two reference images for the analysis we have made on the basis of the recordings.

Figure 2. Specific competitive effort in the female handball game
In Figure 2 we have a picture of the route blocker heart rate and the effort distribution areas (top right image), recording made in the test match held by the team Cetate Ddevatrans in the company of the team U. Jolidon Cluj Napoca.

The alternation of the heart rate during the training lessons differs substantially from the plateau of the heart rate recorded during school games or especially during the test games held in with the same company echelon teams. Recordings of the handball players in different classes with different content and level of effort were made each time using as reference the analysis made as plateau values of the heart rate from the recorded match (this recording is unique considering the fact that by the nature of this game the belts can be removed during technical-tactical actions, and the official rules forbid the use during matches of any object that may cause injury in certain game situations to the player involved in our approach recording of relevant indicators of the exercise).

![Figure 3. Reference image effort during the match Cetate Devatrans -U. Jolidon Cluj Napoca for the player CC](image)

We observe a clear demarcation of the two halves of the total recording time, or the specific heart rate plateau of the competitive effort.

Another approach to the analyses was the frequency synchronization for groups of 4-5 players with different specializations or identical. This overlapping frequencies recorded were made in order to obtain information on the effort accessed by specialization blocker for the same technical static means used and grafted onto the same type of lesson.

![Figure 4. Comparative study of f.c. for the player C.C. in relation to ir., lw., rw. and piv. (precompetitional period)](image)
Contribute to the establishment of relevant indicators to divide the learning process in the context of exercise at the female performance handball team.

Each synchronized picture contains 5 figures of the heart rate corresponding to the 5 players registered in that training or different workouts. The heart rate path is coloured differently for each player. The heart rate compared with the other 4 players is put into a box and is placed in “I” position in each graphic. The main background is white and corresponds to the compared player.

**Figure 5.** The percentage contribution of each player compared to maximum fc.

On the vertical axis (ordinate) is recorded the heart rate and on the horizontal axis (abcissa) is the last average heart rate, the record length and the time of day.

There are also recorded: the name of the player subjected to registration, the registration date, the average heart rate, the maximum heart rate, and the exercise areas bounded by heart rate value.

The graphic is the integration of the comparative study to the overview contribution which it is made to each player for achieving the goals from the lesson. Relating to the maximum f.c. there can be noticed that the training is placed between 60% and 80% from this and the players get a time contribution as follows: i.l. - 8min45sec, i.r. - 15sec, lw - 30min55sec, rw - 32min40sec and piv. 18min45sec.

The second example refers to a recording during the competition, a short lesson, but with high intensity work. There can be seen an access of the submaximal and maximal exercise / supramaximal areas throughout the lesson.

In the recordings made there can be noticed some variations of f.c. between the minimal value of working up – the preparation of the body for exercise (110-120 bpm) and the maximum value of 222 bpm.

Each comparative graphic has four horizontal coloured sections such as:
- light blue - the aerobic efforts area with values of f.c. between the individual heart rate and 140bpm;
- light green - the mixed efforts area -140-160bpm;
- light yellow - the submaximal efforts area-160-18-bpm
- light tile colour - the maximal and supramaximal efforts area-180-222 bpm.
CONCLUSIONS

1. The resting heart rate. Analysing through comparison the initial values with the final ones, we can observe that the 81.67% are related to the initial measurements, and in the end the percentage will be 75.67%. We can assume that there has been a adaptation of the body to the specific effort using some selected ways and utilized in the training process. The value of critical $t$ is 2.31 and calculated $t$ is 2.89. In conclusion $p<0.05$ ($p=0.02$) which means that $H_0$ is rejected and the work hypothesis is accepted.

2. The average heart rate. The work hypothesis is accepted following statistical calculation: critical $t$ is 2.31 and calculated $t$ is 4.54 ($p=0.00$) and $p \leq 0.05$.

3. The maximum heart rate. In this case the initial results do not differ greatly of the final ones even if a slight increase of the recording values was seen (3.39%). The null hypothesis was accepted and the work hypothesis was rejected. The values of the maximum heart rate are an assembly of top maximum recordings from the training session. This indicator is limited from a physiological standpoint depending on the systolic values that cannot be overcome (critical $t=2.31$; calculated $t=1.31$; $p=0.23$; $p>0.05$).

4. The maximal and supramaximal effort is a relevant indicator as the work hypothesis is accepted. We think that the largest values for the final measurements are indicating the fact that the density of the top maximum effort during the training sessions is higher in minor competitions periods and towards the end of the championship than the precompetitive values or the beginning of the championship. (critical $t=2.31$; calculated $t=2.58$; $p=0.03$; $p<0.05$). There are some significant differences between the initial recordings and the final ones.

5. The submaximal effort is another important indicator whose research hypothesis is accepted. The value of critical $t=2.31$; calculated $t=4.42$, $p=0.00$; and $p<0.05$ thus the null hypothesis is
rejected. This type of effort is the most accessed during the training sessions as shown by the differences between the final values and the initial ones.

6. **The moderate effort** has lower final values than the ones recorded at the beginning. Thus the percentage of the training sessions during competitions is lower in relation to the maximal and supramaximal effort (critical t=2.31; calculated t=3.41; p=0.01; p<0.05). The null hypothesis is rejected and the work hypothesis is accepted.

7. **The aerobic effort** has the final values lower than the initial ones. critical t=2.31; calculated t=3.45; p=0.01; p<0.05. The work hypothesis is accepted. Some significant differences may be noticed to the initial and final measurements.

8. **The energy consumption per minute** was recorded with lower initial values than the final values according to the statistical calculations made on a large number of date collected with the help of the Team Polar System. The energy consumption per minute is recording during the training lesson significant oscillations with increasing trends in the competition period. The null hypothesis is rejected (p=0.05).

9. **The total energy consumption** was recorded for establishing the caloric value of the food ration required by an energy balance specific to the handball game and for comparing the obtained values with the existing ones. This indicator depends greatly on the lengths of the training lesson and the intensity of the effort.

The value of total pulsation recorded during the training session has not shown significant differences, thus the null hypothesis was accepted. The number of pulsations measured is lower at the end of the experiment being in relation to the average lengths values of the lessons. There may be noticed that the learning process has led to a specific adaptation of the body to the effort made during the handball game revealing in this way a direct connection between the decreasing of the pulse in resting conditions for the final measurements. (critical t=2.31; calculated t=0.28; p=0.17; p>0.05).

REFERENCES

SUBJECTS WITH DOWN SYNDROME DISPLAY BODY TONICITY AND STABILITY IMPAIRMENTS AFTER LATE ADOLESCENCE

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Abstract: Down syndrome (DS) is the most common genetic cause of developmental disability, characterized by mental retardation and musculoskeletal disorders. As reported in the literature, individuals with Down syndrome display low muscle tone, or low stiffness. The purpose of this study was to study in a large cohort of DS subjects the static stabilometric characteristics as surrogate of body tonicity and stability assess the bone ultrasound properties in a cohort of subjects with DS with reference to age and body tonicity. One hundred ninety-three subjects with DS and 246 healthy subjects participated in this study. Stabilometric performances were obtained from a force platform. Subjects were divided into four age groups (mean age 10.8 yrs, 15.2 yrs, 20.5 yrs, 33.4 yrs respectively) using a decision tree procedure. Stabilometric performances of the controls were higher at each age group, showing an improvement of stability and tonicity with age. The stabilometric performances displayed by the controls were higher for age group 3 and 4, showing an improvement of stability and tonicity with age. These improvements correlated negatively with age. The present results demonstrated that body stability and balance continue to evolve until adulthood in ordinary people whereas they reach a plateau at adolescence in DS subjects.

Key words: Down syndrome, Muscle hypotonia, Tonicity, Stability.

* * * * *

BACKGROUND

Down syndrome (DS) is a genetic disabilities caused by the presence of all or part of an extra 21st chromosome (Lejeune, Turpin et al. 1959) which may be responsible for skeletal abnormalities, short stature and other mechanisms of premature aging (Roth, Sun et al. 1996) and generates physiological and physical developmental disorders. Down syndrome (DS) is the most common genetic cause of developmental disability, characterized by mental retardation and

* Mirela Gavriş Ștef

http://www.fefsoradea.ro/cercetare.html
Subjects with Down syndrome display body tonicity and stability impairments after late adolescence. Musculoskeletal disorders (Sago, Carlson et al. 2000) Expression of the DS phenotype includes cardiac malformations and hypotonia. Clinically, children with DS are described as having low tone, or low stiffness ("American Academy of Pediatrics: Health supervision for children with Down syndrome," 2001), which may affect muscle strength and motor skills (Apache 2005). Individuals with Down Syndrome have reduced resting metabolic rates, which contribute to a higher frequency of obesity than in other individuals (Rubin, Rimmer et al. 1998).

The significant increase in the life expectancy of this population may explain the onset of osteoporosis. Moreover, thyroid dysfunction, abnormalities of sexual development and musculoskeletal troubles (peripheral muscle strength) as well as poor calcium and vitamin D intakes, may contribute to the development of osteoporosis. Moreover, both pediatric and adult cohorts, display a lower level of physical fitness (Fernhall, Pitetti et al. 1996) than ordinary persons.

Usually the measures of the variance of speed by means of stabilometric platforms are able to characterize the tone of the muscular posterior chain. This measure could allow the assessment of body tonicity, because through this device, the lower the variance, the higher the tonicity.

Therefore, the purpose of this study was to study in a large cohort of DS subjects the static stabilometric characteristics as surrogate of body tonicity and stability.

**MATERIAL AND METHODS**

All active individuals with Down syndrome were eligible for recruitment into this study which was conducted with the same ambulatory devices in France and Romania. A group of 193 subjects with Down syndrome (104 males and 89 females) aged between 8 and 37 years participated in this study. Concomitantly, we measured a total of 246 healthy subjects (107 males and 139 females) aged between 10 and 61 years. Measurements were performed at special events with support of Special Olympics organization and French Federation of Adapted Sport. Written informed consent was obtained from all parents or subjects.

**Anthropometric measurements.** Body height was measured using a portable stadiometer calibrated to the nearest 0.1 cm. Body mass was measured with subjects wearing light clothing and without shoes, to the nearest 0.1 kg, using a digital scale calibrated daily. The body mass index (BMI) was calculated from the previous parameters.

**Stabilometric measures.** The measures were obtained in standard conditions, with subjects required to keep their eyes open and teeth clenched; conditions in which all the external afferences are active, the parameters measured reflecting the postural control of the subject under examination (Cultrera, Pratelli et al. 2010). Because we had no interest in the sensory input, we did not perform tests with “eyes closed”. Body sway area was recorded by means of a 3-strain gauge platform with automatic weight correction (Stabilotest, PostureWin – Platform V328). The forces acting on the platform were sampled at 40 Hz. Participants stood barefoot facing forwards at a target placed at 90 cm distance, respecting standard and validated conditions (Kapteyn, Bles et al. 1983; Hsu, Kuan et al. 2009). Feet were placed at an angle of 30°and the distance between the heels was 2 cm. Although the reference values for stabilometry testing are established at 51.2 s we ascertained a second measurement at 12.8 s because we postulated that a shorter period was more suitable for DS population (mental retardation). The analysis technique is based on the measurement of the centre of pressure (CoP) sway in a standing position. The following parameters were used to assess the balance: the postural sway area (in mm2, corresponding to the area of the 90% confidence intervals for the ellipse surface area which contains 90% of the CoP positions sampled - Area), the CoP”' s total path length over the time (in mm - Length), the variance of speed (VFY), the average sway velocity (aV) and the CoP”' s total path length per unit surface (LFS).
Statistics. All values were expressed as mean and standard deviation (SD). The Gaussian distribution of the variables was assessed using the Shapiro-Wilk test. In case of non Gaussian distribution, non parametric tests were used and for a complex statistical analysis, the data were logtransformed. Analyses were conducted for the whole group and separately for gender. Because the age range was not continuous, subjects were divided into age groups using a decision tree procedure. The Decision Tree procedure creates a tree-based classification model. The areas (AUC) under the receiver operating characteristic curves (ROC) were employed for Area, Length, VFY, aV and LFS (all measured at 51s) to evaluate their power to discriminate DS from healthy patients.

All analyses were conducted using SPSS software (PASW version 18). Significance was set at p<0.05. In order to preclude the outliers (out of range data), we excluded the data with values beyond plus or minus 2 standard deviations.

RESULTS

Subjects characteristics. As displayed in table 1, CTL total group and DS total group were similar in age and weight. DS subjects were smaller and had higher BMI than CTL group (P<.001). The classification obtained from the decision tree test is displayed figure 1. Four age groups were characterized by the relation age-BUA. The mean ages were for group 1: 10.8 ± 1 yrs old, group 2: 15.2 ± 1 yrs old, group 3: 20.5 ± 2.3 yrs old and group 4: 33.4 ± 7 yrs old. Characteristics of subjects per class of age are shown table 1. In this experimental design, no significant difference was observed in the distribution of gender within age groups (Pearson Chi-Square = 3.55, p >0.05).

| Table 1. Characteristics of the subjects |
|----------------------------------------|----------------------------------|---------|----------------------------------|---------|
|                                        | CTL (mean±SD)                  | DS (mean±SD) | Between groups | CTL (mean±SD) | DS (mean±SD) | Between groups |
| Age (yr)                               | 21.2±8                         | 20.8±6       | NS               | 10.8±0.7      | 10.8±1.4      | NS               |
|                                        | Group 1 10.8±0.7               | 10.8±1.4     | NS               | Group 1 14.9±1.2 | 14.9±1.2 | NS               |
|                                        | Group 2 15.4±0.7                | 14.9±1.2     | NS               | Group 2 20.0±1.7 | 21.1±2.7 | p<.01            |
|                                        | Group 3 20.0±1.7                | 21.1±2.7     | p<.01            | Group 3 36.6±8.5 | 30.1±3.2 | p<.001           |
|                                        | Group 4 36.6±8.5                | 30.1±3.2     | p<.001           |
| Height (cm)                            | 167.5±11                       | 151.0±13     | p<.001           | 145.6±7.0     | 144.4±14.5    | NS               |
|                                        | Group 1 145.6±7.0              | 144.4±14.5   | NS               | Group 2 169.1±8.3 | 150.0±12.9 | p<.001           |
|                                        | Group 2 169.1±8.3              | 150.0±12.9   | p<.001           | Group 3 169.9±9.2 | 152.3±14.6 | p<.001           |
|                                        | Group 3 169.9±9.2              | 152.3±14.6   | p<.001           | Group 4 168.4±9.8 | 153.2±11.1 | p<.001           |
|                                        | Group 4 168.4±9.8              | 153.2±11.1   | p<.001           |
| Weight (kg)                            | 61.7±14                        | 58.6±15      | NS               | 40.7±8.0      | 51.5±17.5     | p<.05            |
|                                        | Group 1 40.7±8.0               | 51.5±17.5    | p<.05            | Group 2 61.5±12.7 | 55.0±18.5 | NS               |
|                                        | Group 2 61.5±12.7              | 55.0±18.5    | NS               | Group 3 63.2±12.9 | 61.7±12.9 | NS               |
|                                        | Group 3 63.2±12.9              | 61.7±12.9    | NS               | Group 4 67.4±15.9 | 60.4±12.7 | NS               |
|                                        | Group 4 67.4±15.9              | 60.4±12.7    | NS               |
| BMI (kg/m²)                            | 21.9±3                         | 26.1±12      | p<.001           | 19.1±3.3      | 23.8±4.7      | p<.005           |
|                                        | Group 1 19.1±3.3               | 23.8±4.7     | p<.005           | Group 2 21.3±3.3 | 23.8±6.0 | NS               |
|                                        | Group 2 21.3±3.3               | 23.8±6.0     | NS               | Group 3 21.8±3.6 | 28.1±17.7 | p<.001           |
|                                        | Group 3 21.8±3.6               | 28.1±17.7    | p<.001           | Group 4 23.9±4.2 | 26.0±5.5 | p<.05            |
|                                        | Group 4 23.9±4.2               | 26.0±5.5     | p<.05            |

Stabilometric parameters

Because all statistical results was similar for the two duration tests (12.8 s and 51.2 s), we chose to present only the data corresponding to 51.2 s recording test. Independent of the parameter studied, DS values were consistently less efficient than CTL. Females presented better stabilometric values than males for CTL whereas there was not a gender difference for DS. The female CTL had higher stabilometric performance than female DS for all parameters. The same observation was apparent in males, with the exception of LFS and VFY, which not differ. Results for age categories are displayed figure 1. No differences existed at age group 1 and 2, whereas at
Subjects with down syndrome display body tonicity and stability impairments after late adolescence. Age group 3 and 4, CTL groups showed better a performance than DS. DS group displayed no difference in stabilometric values irrespective of age group. No difference was observed between age group for DS with the exception of LFS, which demonstrated a age-related decrease. Inter age performances increased for each parameter in CTL (figure 1). Negative correlation existed between age and all stabilometric parameters for CTL group: area (Spearman’s rho = -.396, p<0.001), length (Spearman’s rho = -.350, p<0.001), LFS (Spearman’s rho = -.276, p<0.001), aV (Spearman’s rho = -.351, p<0.001), and VFY (Spearman’s rho = -.445, p<0.001), whereas age did not correlate with values from the DS groups.

Figure 1. Comparison between DS (dark) and CTL (light) of stabilometric parameters in function of age group.

ROC results. The discriminatory ability of the stabilometric variables and BUA measurements is shown in figure 2. These parameters were able to discriminate between individuals with DS and healthy controls only for age groups 3 and 4 Among other, aV was one of the better discriminators between groups.
**DISCUSSION**

The present results point out that these values are linked to significantly poorer stabilometric values. It appears that the weakness observed in individuals with Down syndrome may result from the lower muscle tonicity and stability as assessed by the stabilometric tests. The fact that the speed of sound failed to differ between groups and was higher in the younger age group is difficult to explain.

The differences observed between our groups could be linked to one or more specificities of this pathology. Another explanation can be argued. Even if little work has been done to quantify this characteristic in this group of patients, hypotonia is routinely reported in describing the characteristics of Down syndrome.

The techniques commonly used to assess the muscle tone (palpation, passively moving the limb, etc.) are highly subjective and give limited information about the state of the neuromuscular system (Webber, Virji-Babul et al. 2004). We chose to use stabilometric parameters as indexes of muscular tonicity because this device provides objective measures of body stability and tonicity. What is remarkable is that, for all parameters the values expressed by the Down syndrome group were largely unaffected by age. Conversely, the stabilometric performances displayed by the controls were higher at each age group, showing an improvement of stability and tonicity with age. These improvements correlated negatively with age, suggesting that lower the values, the higher the performances. It is noteworthy that a previous study (Hsu, Kuan et al. 2009) suggested that a child at the age of 12 years is supposed to reach balance level of an adult. The present results demonstrated that body stability and balance continue to evolve until adulthood in ordinary people. For instance, VFY, a parameter usually associated with a hyper- or hypo- muscle tone of the posterior chain (Vallier 1985) suggesting an association between the body tonicity and the bone status. Among the stabilometric parameters studied, some appeared to be more sentence than others in discriminating between the differences between Down syndrome and non-Down syndrome subjects. In the study of Webber et al. (Webber, Virji-Babul et al. 2004) conducted in adults (30.8 ±6.2 yrs old), only the postural sway velocity was able to differentiate between the Down syndrome and non-Down syndrome groups. Our results are consistent with this statement. ROC analysis results showed that all stabilometric parameters were able to discriminate the two groups. Among other, aV was one of the better discriminators between groups.

Finally, if stabilometry is a method widely used by clinicians for measuring the balance and postural tonicity, it remains problematic as an instrument for measuring the muscle tone. Nevertheless, in the present study tends to support the use of stabilometric performance as a surrogate of total body tonicity.

**CONCLUSION**

The stabilometric performances displayed by the controls were higher for age group 3 and 4, showing an improvement of stability and tonicity with age. These improvements correlated negatively with age.

Concerning the DS subjects it is noteworthy that there was no improvement with age.

The present results demonstrated that body stability and balance continue to evolve until adulthood in ordinary people whereas they reach a plateau at adolescence in DS subjects.
Subjects with down syndrome display body tonicity and stability impairments after late adolescence

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