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THE INFLUENCE OF TARAHUMARA TECHNIQUE ON THE BIOMECHANICS OF RUNNING

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Abstract. People started to run long distances more than 2 million years ago. If, in the beginning, running was just a means of survival, nowadays this activity generates pleasure and a popular commitment that was unimaginable in the past years. But the last hundreds of years have also left their mark on the form (biomechanics) of running. The moccsins were invented about 50,000 years ago, while the first sports shoe was created only in the 1860s. The assumption of evolutionary or Darwinian medicine that the lower body is well adapted to barefoot long-distance running is obviously in contradiction with the sports shoe industry, because, if it is true that bare feet are more suitable for long-distance running, the sports shoe should no longer be equipped with a thick or soft sole or an elevated cushioned heel. This study brings to discussion how the use of running shoes has influenced the spot where the foot strikes the ground (lands) in the support phase and concludes that heel landing is not convenient, because the brutal shock affects the joints, mainly the knees in the first phase and subsequently the spine.

Keywords: running technique, foot strike, barefoot, sports shoe.

Introduction

Long run (marathon and ultra-marathon) is an increasingly addressed topic in specialised works, but most studies focus on physiological issues, which are probably considered to be more important than the (relatively stable) technique in decisively influencing performance.

Although the technique is individual for each athlete, the general characteristics are retained; specialists believe that the most economical way of running in long-distance and ultra-long-distance races requires a pre-heel strike, and only then the heel-to-toe running style (Stoica, 1999). But things are different with the Tarahumara tribe members, whose technical execution could revolutionise the modern world’s opinion: Mexican Indians are considered the best ultra-runners in the world, because “when it comes to going ultra-distances, nothing could beat a Tarahumara runner – not a racehorse, not a cheetah, not an Olympic marathoner” (McDougall, 2004).

We can assume that this success is the result of their extraordinary lung capacity, a consequence of living in high altitudes, but also of their running technique.

In more modern times, they have run non-stop in relay teams from Chihuahua City (Mexico) to El Paso (Texas, US), a distance of 230 miles (370.149 km), to open the Pan-American Road Races (Lenchek, 2000).

Purpose

This article draws attention to the fact that, in athletics, the technique in general and that of running in particular are fluid, perfectible, that modern does not necessarily mean better and that the ancient technique, supported by contemporary means, can lead to reaching the little credible performances predicted by the computer.

Methodology

This paper is the result of a systematic quantitative and qualitative literature review based on the narrative method. In addition, dozens of video analyses were made on the materials provided by YouTube and Goshen Film Production channels, and further references were brought by the particularly rich literature of recent years.

Current state of knowledge

The Tarahumara tribe

In the 1990s, the name “Tarahumara” was quite familiar among the ultra-marathon lovers. But this tribe of super-athletes was almost ignored until 2009, when the release of McDougall’s best-selling book Born to Run has brought them into prominence and made them famous by describing the disarming ease with which they achieve performance and their way of approaching the races.

The Tarahumaras consider themselves as an independent nation, despite being defeated by the Mexican armies. They represent the second largest indigenous group in Mexico and live in the northern mountains (Sierra Madre Occidental), a region similar to Switzerland, with high plateaus (1,500 to 1,800 metres) and deep canyons (500 to 1,800 metres).
The name “Raramuri”, as they call themselves, refers specifically to the men and means “those who run fast”. It hides a long tradition of covering hundreds of miles on foot over the course of several days in order to communicate, trade and hunt. The four secrets of their tremendously successful running are: they do not waste energy, work as a team, run with a contagious joy and embrace simplicity (Larkin, 2016). As regards running in a simple fashion, McDougall (2009) said: “The more you learn about moving your body lightly and efficiently, the closer you’ll be to running like the Tarahumara”.

The Tarahumara Indians are short and rather thin, but they have strong muscles and long limbs. Lieberman (2014) investigated the anthropometric and foot stiff differences between minimally shod (MS) and conventionally shod (CS) Tarahumara, the results being shown in Table 1 (adapted by us).

Table 1. *Anthropometric and foot stiff differences between MS and CS Tarahumara (mean ± SD)*

<table>
<thead>
<tr>
<th>Subjects measured (n = 32)</th>
<th>MS</th>
<th>CS</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>22</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Kinematic data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>34.6 ± 14.5</td>
<td>25.4 ± 12.1</td>
<td>0.09</td>
</tr>
<tr>
<td>Footwear history</td>
<td>3.90 ± 0.29</td>
<td>1.60 ± 0.29</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.65 ± 0.06</td>
<td>1.62 ± 0.07</td>
<td>0.12</td>
</tr>
<tr>
<td>Leg length (m)</td>
<td>0.86 ± 0.04</td>
<td>0.84 ± 0.05</td>
<td>0.1</td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>64.0 ± 8.23</td>
<td>59.2 ± 7.25</td>
<td>0.11</td>
</tr>
<tr>
<td>Anthropometric data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Navicular height (mm)</td>
<td>44.4 ± 4.51</td>
<td>41.5 ± 8.87</td>
<td>0.23</td>
</tr>
<tr>
<td>Navicular height/ truncated foot length</td>
<td>2.34 ± 0.55</td>
<td>2.28 ± 0.46</td>
<td>0.75</td>
</tr>
<tr>
<td>Arch height index standing</td>
<td>0.33 ± 0.03</td>
<td>0.31 ± 0.04</td>
<td>0.19</td>
</tr>
<tr>
<td>Arch stiffness index</td>
<td>1607.2 ± 744.1</td>
<td>823.6 ± 223.7</td>
<td>0.003</td>
</tr>
</tbody>
</table>

The obtained data support the hypothesis that foot stiffness and important aspects of running form, including foot strike, differ between runners who grow up using minimal sandals versus modern, conventional footwear.

Throughout history, the Tarahumaras have responded to outside aggression by quick withdrawal and regrouping in the remote Copper Canyon, where they are still living, tenaciously resisting civilisation. Voluntarily separated from the rest of the world, the tribe is defined by timidity and discretion, the Indians being visible when and if they decide to be; they are not even neighbours, in the true sense of the word, because they place their huts sufficiently far away for not seeing each other’s smoke. 50-year-old people can run faster than adolescents, and great-grandfathers aged 80 hike hallucinating distances across the mountains. According to historians, the Tarahumara champions worship the run; they travel without stopping around 500 kilometres, meaning about 12 marathons. Perhaps in correlation with this life on the run, the Tarahumara people do not suffer from heart disease, high blood pressure, diabetes, shin splint, obesity or depression. Besides, they know nothing about corruption, violence and cheating. In their land, there is no crime, war or theft, drug addiction, child abuse, chronic alcoholism or divorce (McDougall, 2009).

The Tarahumaras are full of contradictions: they avoid strangers, but are fascinated by the world beyond their land. Their prudent attitude has been generated by the Spanish silver seekers, who tortured and hunted them, bringing them into this last refuge, on the bottom of the earth, in canyons, given that their strategy of responding to outside aggression is fleeing.

It is said that the Tarahumara people “learn to run before they learn to walk” and that “from childhood, they are trained to survive in a difficult environment” (Duque Hernandez, 2015). Thus, accustomed to very long distances, the Mexican Indians were able to definitely won races such as the 100 miles (160.9344 m) in Leadville, Colorado, in 1993. They astonished by their pace (the second half of the race was only 20 minutes slower than the first one) and the age of the winner (55 years), but they really shocked with their footwear: sandals (“huaraches”) made of old tire scraps and leather bindings (Figure 1) (Healthy living, 2016).
Topic addressed

Foot strike dynamics

In running races, the foot-ground strike during the support phase occurs in the anteroposterior direction and generates a shock that is transmitted to the upper body in the form of a wave. Its value depends on several factors: quality of the ground (hard or soft), presence or absence of the shoes, the running technique, landing on the heel or the ball of the foot.

One of the roles of the foot is to cushion the shock wave, and the quality of the cushioning depends on the individual characteristics: morphology of the foot, strength of muscles supporting the arch, mobility of the ankle.

If, with regard to the sprint, all specialists agree to the landing on the ball of the foot, it is not the case for the long runs, where the opinions are (still) divergent.

In the maximum speed sprint, the strike is done exclusively on the ball of the foot so that the heel does not impact the ground, at a spot as close as possible to the projection of the centre of gravity of body weight on the ground, through a forward-to-back energetic “catching” motion (Stoica, 1999).

Regarding long runs, most theorists consider it beneficial to land on the heel, while others believe that, since the knee is stretched, the landing shock will not be absorbed, on the contrary, it will be amplified; the shock wave will propagate to the top of the head through the tibia-knee-hip-spine (Figure 2), and each heel support will produce micro-trauma in the joints, generating tendinitis, disc herniation, muscle and joint pain, inflammation etc. (Grand, 2013).

In an attempt to mediate this dispute, we think that it is normal for the running technique to vary according to speed and that there is no ideal stride, but the two are closely linked.

A slow, even very slow runner (7 min/km) gives the impression of keeping very close to the ground (the Tarahumara case). The impact force is almost zero and gives time the muscular and tendinous structures of the foot to relax through a brief rest at each stride. This short break reduces tension and allows the athlete a long run before feeling the fatigue and pain caused by an exhausting experience.

A faster runner (5-6 min/km) has a shorter strike located under the centre of gravity of body weight or very close to it, and as slightly higher impact force. The athlete is in an optimal position to cushion the shock through the...
triple absorption achieved by the muscular and tendinous structures of the foot, calf and thigh. Generally, the foot is placed on the ground in a flat or almost flat position, generating a gentle heel strike that will reduce tension in the calves and the Achilles tendon.

In fast runners (3-4 min/km), placing the foot on the ground occurs slightly on the forefoot, either on the flat or with a fugitive heel strike, without braking. For a runner who is speeding up, the strike on the ball of the foot is naturally required, but if a sprinter is asked to cover 5-10 km, he/she will probably not be able to preserve the same explosive technique.

On the other hand, there are few (or no) marathoners who run on the ball of the foot; however, if they were asked to do a sprint, they would do it similarly to a sprinter (Berube, 2017).

The sports shoe

In the 1970s, the run went through a real revolution, with the increase and diversification of the offer of special running shoes. Until then, the running shoes had been just thin-soled sneakers with no cushions or arch support. The traditional modern shoe must fulfil two objectives: to absorb the shock of the strike and to allow the medial-lateral control of the subtalar joint. This is why it is provided with stiffening elements that can contribute to correcting excessive supination and/or pronation, and the sole (the place of all inventions that make it possible to sell shoes faster) often has several density levels. For the modern runner, either a professional or recreational athlete, rivalry on the running shoe market has led to a new marketing concept, by personalising stability and cushioning, and even to a pseudo-individual gait correction.

Since the 2000s, a new type of footwear has emerged on the profile market: the minimalist running shoe, which spawned a generation of barefoot and minimalist runners (Team Mobiefit, 2016). These shoes allow the athlete to run more naturally than traditional shoes and even reduce or eliminate running injuries (Salzler et al., 2012). Although it has been established that the lower limb biomechanics can be modified by the type of footwear (Hamill, Gruber, & Miller, 2012), the concept of minimalist shoe caused intense debate, but little research.

The Tarahumaras, who wear “huaraches”, have a higher and more rigid arch than those wearing modern shoes. According to Lieberman (2014), the years of running in these sandals without any support have changed and strengthened the musculoskeletal structure of the foot (Figure 3).

The “huaraches” do not reduce the landing shock, do not allow any medial-lateral control of the subtalar joint, cannot correct excessive supination or pronation, and the sole is a trivial rubber sheet.

Figure 3. Musculoskeletal structure of the foot (Naturacoach, 2012)

Tarahumara vs. contemporary runners

Tarahumara is probably the last tribe to have preserved the ancient running technique, because, for these Indians, running is more than sport, running is literally life. They live in very rugged land, and therefore foot travel is the best option and the quickest way to get from one place to another. However, the Tarahumaras do not walk from one place to their destination, but run to perform everyday tasks. It is relatively common for a Tarahumara to travel between 80 and 130 km per day at a race pace. The motor quality on which they rely is not speed, but endurance, persistently trained by hunting practices: the tribesmen chase after the animal (such as deer, wild turkeys, rabbits) over very long distances, until it drops from exhaustion (Beauregard, 1996).

These people demonstrate “a level of endurance that seems superhuman and certainly greater than that of the best Olympic athletes” (Health & Fitness, 2012). “The greatest distance ever recorded from the Tarahumara in one
take is a staggering 435 miles (more than 700 km) in just over 48 hours”, and “it’s not just some of the tribe either to do this, it’s everyone: man, woman, old, young”, says Gray (2016).

After many scientific tests, doctors have concluded that the Tarahumara people’s endurance is based more on physical conditioning than on heredity. Diet also seems to play a significant role in their running: it is practically meatless and mostly consists of complex carbohydrates. Their eating habits are likely to contribute to lowering pulse rates and blood pressure. (Lutz & Lutz, 1989)

The main difference between the two categories of runners (Tarahumara vs. contemporary runners) is the foot area on which the strike is performed. For about 80% of contemporary athletes, it is the heel (Figure 2). During heal landing, the strike impact produces a high amplitude and almost instantaneous force, with a value ranging from 1.5 to 3 times the weight of the body, which will cross the skeletal system through a shock wave, represented in Figure 4 – the first peak (Lieberman et al., 2010). This force will cause a braking effect at each stride and the consequence will be a decrease in running efficiency.

The Tarahumaras run along narrow footpaths through the canyons, either without shoes or wearing rudimentary sandals that only protect their feet from injury. A Tarahumara initially strikes the ground with the toes or mid-foot, and never with the heel (Figure 5a). Striking the ground with the mid-foot (due to the plantar and knee flexion) leads to the disappearance of the first peak of force. The ground reaction force increases slowly, causing the kinetic energy to be stored in the calves and the Achilles tendon, with the possibility of returning more energy in the push-off phase. (Figure 5b) (Williams, 2017).

The arch supports the ricochet of a new stride, reducing the amount of energy required to run, which does not happen when the foot is squeezed in a shoe (the arch is compressed and loses its qualities). As a consequence, the impact on the lower extremities will be diminished, and the constraints on the runner will be reduced.

Several studies suggest that there is a link between these forces and the risk of injury to runners (Hreljac, 2004; Zadpoor & Nikooyan, 2011).
A heel-landing stride, even when using a cushioned sole shoe, causes a first brutal peak of force with traumatic potential, which does not happen when the stride is performed barefoot or with minimalist shoes.

Shortly, barefoot running helps the feet to act as natural absorbers, which provides several benefits to the runner, for instance: reduced impact injuries from landing on hard surfaces; reduced stride length promoting faster and more efficient travel; better feedback from the pain of improper landings allows for immediate adaptations to the running style (Bailey, 2016).

Conclusions

Whether barefoot running is better than running with minimalist or modern shoes, this is still a controversial topic. The consistency of scientific studies has clearly demonstrated that there is a significant difference between running with sports shoes and barefoot running, the latter being of interest for the performance level, since it lowers the energy cost. As a matter of fact, the Kenyans, indisputable champions in the middle-, long- and ultra-long-distance events, also have an extraordinary elasticity of the foot because they never run shod before the age of 17. If, a few years ago, the possibility of running barefoot was inconceivable, nowadays exactly the opposite is being promoted.

Analysing the run of Mexican Indians (now in danger of extinction), it is noticed that the old Taoist saying “The best runner leaves no trace” is not a simple figure of speech, but a training tip applicable to any runner. Contrary to modern style, the Tarahumara technique involves short and fast strides performed very close to the ground, as well as mid-foot strikes, which makes the impact force to be almost zero. This assertion is supported by Sinicki (2017) who believes that “correct running should use short strides, so that the impact can be absorbed by our ankles, knees and hips like a spring”. According to specialists, the running technique can be progressively and naturally changed during training, and even if the heel-sole transition takes long, it can be achieved.

Many scientists seem to promote disinterestedly the benefits of running with minimalist footwear. But their recommendations should be approached cautiously, because the studies of many of them have been funded by the manufacturers of such shoes. There are still many questions and few scientifically backed answers. No scientific study has demonstrated that the minimalist shoes have a major influence on reducing the classical injuries of the runner. However, although the advantages of Tarahumara run are obvious, the running shoe industry seems to receive new impetus through the emergence and exploitation of the 3-D printer; it is thus expected the production of customised models corresponding to the client’s type of gait, weight and stride. The customised footwear will take into account not only the anatomic conformation of the foot or the running style, but will be adapted for mountain or road running, at the user’s choice.

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ASPECTS IN THE PROPHYLAXIS AND TREATMENT OF OSTEOPOROSIS BY ADMINISTERING CA, VITAMIN D AND GEMMOTHERAPEUTIC DERIVATIVES IN THE CONTEXT OF ADEQUATE MOVEMENT AND NUTRITION

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Abstract: The purpose of this paper is to highlight the main aspects of the need for calcium and vitamin D in the prophylaxis and treatment of osteoporosis, along with gummitherapeutic derivatives, in the context of proper nutrition and an appropriate exercise program. After 35 years of age, the bone continuously loses its substance, a normal and natural phenomenon with the aging. However, this loss can become a serious problem if the initial “bone reserve” is too low or the bone loss occurs too quickly. The result is an increased risk of fracture either through a normal fall, like in the wrist or hip, or a moderate lifting effort, as in the case of the vertebrae. Osteoporosis is a disease that affects over 40 percent of women and 20 percent of men over the age of 50. Our study is conducted in an individual clinic. Thus, according to 36 haematological constants, individual data and food aversions, a nutrition program was designed and applied to a female patient aged 52 years, for a 6-month period. In addition, vitamin D and gummitherapeutic extracts were administered against the background of a proper movement program, according to the patient’s pathology. When food becomes a medicine and correct supplements are administered along with extracts of herbs (gummotherapy) that come in addition, there is a clear improvement in the quality of life. We mention that all procedures and experimental protocols are in compliance with the European Communities Council Directive of 24 November 1986 (86/609/EEC).

Keywords: vitamin D complex, gummotherapy, food, movement.

Introduction

Osteoporosis means “porous bone”. Until recently considered as a normal condition for the elderly, osteoporosis is currently thought to be a disease characterised by the reduction in bone mineral density associated with the compromise of the trabecular bone structure, which predisposes the bone to fracture due to low-intensity trauma or even in the absence of it.

At first, osteoporotic bones do not look different from normal bones. However, they are less dense by loss of bone, which is reflected in their internal structure that is deeply affected – like an old fabric with thinned and sometimes broken warp. (Osteoporoză, 2017)

Almost anyone may develop osteoporosis, but women are especially prone to it (about 80% of patients with osteoporosis are women), particularly if they are already in menopause and even more if they have had it before the age of 45 years.

Other risk factors:
- Age over 65 years;
- Chronic corticosteroid therapy;
- Inadequate intake of calcium;
- Lack of exposure to sunlight;
- Insufficient physical activity;
- Too little body weight. (Hainărăzie, 2010)

Calcium has a very important role, being the fifth element in the human body. It is an important component of bones and teeth, making them resistant. The bone matrix, mainly consisting of calcium phosphate, contains about 99% of the amount of calcium in the body. The normal blood calcium concentration is about 10 mg/100 ml, this level being constantly maintained by certain hormones (the parathyroid hormone).

The daily calcium requirement in the diet is about 1 gram, with dairy products being the main source. Its absorption in the body is facilitated by vitamin D, which is why a deficiency of this vitamin may lead to diseases such as rickets, osteoporosis or osteomalacia. A decrease in blood calcium causes the onset of tetanus. Calcium excess can be deposited in the body in the form of calculi, especially in the bladder and kidneys (Calciu, 2017).

Calcium is necessary for bone development. Generous calcium intake is not enough to prevent osteoporosis. Inadequate calcium intake may, however, increase the tendency to demineralise the bone. Calcium absorption and bone fixation requires vitamin D. An adult needs 1000-1500 mg of calcium and 400-800 IU vitamin D per day. Daily dietary intake of calcium and vitamin D indicates the use of a nutritional supplement. 1000 mg calcium/day for people under 50 years and 1200 mg calcium/day for people over 50 years are recommended. Vitamin D intake,
for those aged 51-70 years, is 400 IU/day, and for the elderly over 70 years, it is 600 IU/day. If absorption is ineffective, adjuvant therapy with bisphosphonates is administered (Egol, 2004).

Material and methods

**Participants**

Our case study involved a female patient aged 52 years. The subject gave her informed written consent.

**Procedure**

A nutrition plan based on 36 haematological constants, individual data and food aversions was designed and administered to D. M., aged 52 years, for 6 months. In addition, Ca, vitamin D and gemmotherapeutic extracts were administered in accordance with the patient’s pathology. The medical recommendation was made by a physician in a private clinic.

The diversified and balanced diet within a personalised nutritional plan, in a specific case of osteoporosis in a 52-year-old woman with serious decalcification in the spine, especially the lumbosacral column, was implemented for this patient in an individual treatment clinic.

The applied nutrition program was perfectly balanced in animal proteins (fish, dairy, eggs) and proteins of vegetable origin, carbohydrates and lipids, along with vitamins and minerals.

In addition, she was given Mena Q7:

- 1200 mg calcium/day (from soybean fermentation);
- vitamin K2;
- vitamin D – 400 IU/day;
- gemmotherapeutic derivatives from the category: walnut, hazelnut, rosehip, sequoia, juniper, black currant, cranberry etc.

The human body works on the “use it or lose it” principle (what is not used is damaged and lost). This is a reference for muscle and bone. Insufficient physical activity, sedentariness, obesity or low body weight, metabolic disorders with absorption deficits, all these lead to demineralisation and bone marrow scarring.

So, an appropriate exercise program under the auspices of resistance, posture and balance is a target that can activate osteoblasts in the process of deposition and collagen construction in the bone matrix.

A good exercise program in the prophylaxis and treatment of osteoporosis, consisting of exercise, posture and balance exercises designed for the upper and lower limbs, but also for the abdominal and pelvic girdles, was followed individually by the subject in a private clinic. We mention that all procedures and experimental protocols are in compliance with the European Communities Council Directive of 24 November 1986 (86/609/EEC).

Thus, our patient performed three times a day, in the first 33 days, the following program:

- push-up: wall, table or floor (3x10);
- shoulder press (3x10);
- lower limb press (3x15);
- squats with a straight back, knees not to exceed the toes (with difficulty): sitting on a chair with lateral support, hands on the chest, back to the wall, large elastic ball (3x15);
- free-standing support (3x10);
- walking options: free, on the slope, laterally, with elastic band (15 min);
- climb low stepper or stairs (15 min);
- exercises for shoulders, arms, thighs, calves, abdomen with elastic band or large ball with small and medium weights (3x10).

As difficulty, exercises started from simple to complex, from medium to difficult and from 5-7 reps to 15 reps per set in the coming months (Schrupp & Heineck, 2014).

The program continues to develop to the present day.

Not every type of physical activity is suitable for the prevention and treatment of osteoporosis – the work done at home or at work is usually ineffective. Physical activities appropriate to osteoporosis are those of the “bearing” or “impact” type. In addition, one can practice: basketball, volleyball, jogging, aerobics, climbing, fast walking. These exercises should be tailored to the individual’s possibilities and carried out systematically from simple to complex, from medium to difficult, according to the “primum non nocere” principle (Osteoporosis exercises, 2016; Smith, 2010).
Results

We choose to present a single test measurement for the subject – the Body Mass Index (BMI) to keep it simple. Initial, intermediate and final assessments were performed with the body mass analysis software for the BMI.

At the first BMI analysis of body weight, G = 54.1 kg, BMI = 20.4, adipose tissue = 33% (17.9 kg), muscle mass = 34.3 kg, bone mass = 1.9 kg.

At the intermediate BMI analysis of body weight after 33 days, G = 56.8 kg, BMI = 21.4, adipose tissue = 24% (13.6 kg), muscle mass = 41 kg, bone mass = 2.2 kg.

At the final BMI analysis of body weight after 6 months, G = 57 kg, BMI = 22, adipose tissue = 22% (11.6 kg), muscle mass = 43 kg, bone mass = 2.4 kg.

According to these data, it is noted that, after 33 days, real body remodelling has occurred, with a weight gain of 2.7 kg, but with a reduction of 4.3 kg in adipose tissue. What is truly spectacular is the increase of 6.7 kg (from 34.3 to 41 kg) in muscle mass and the increase of 300 grams (from 1.9 kg to 2.2 kg) in bone mass.

According to the general data, the following final results are observed: a weight gain of 2.9 kg, a reduction of 11% in adipose tissue, increase of 8.7 kg in muscle mass and an increase of 500 grams in bone mass.

In the figures below, we can see (in black, blue and red spots), the initial, intermediate and final measurements. In Figure 1, we can observe an accelerated increase in BMI in the first month, and then a slow increase up to a flat phase. This behaviour is also noted for the muscle mass increase. Figure 2 shows in percentage the same quality of fat loss, which is more accelerated in the first month, and then slower until the sixth month. Figure 3 shows the most important parameter for the osteoporosis treatment program, the bone gain, also accelerated in the first month and then continuously slower. We need further measurements on more than one subject to confirm the increase in BMI and bone mass.

![Figure 1. BMI, muscle and bone mass results](image-url)
Conclusions

By providing the body with certain nutrients that it urgently needs, the restoration of damaged body structures is triggered, according to the original DNA design. Through a diet rich in carefully selected nutrients, depending on the structural deficiencies of the body (reflected in blood tests), adequate administration of Ca, Vitamin D and gemmotherapeutic derivatives, supported by an appropriate exercise program, a superior qualitative leap occurs in the quality of life. In our subject, hip and spine pains have diminished to the point of extinction, allowing her to have a restful sleep at night, and during the day, to be able to carry out her activities. Besides, the patient’s physical and psycho-emotional tone is much better. The applied program is still ongoing, the patient leading a satisfying life.

When food becomes a medicine and herbal extracts (gemmotherapy) come in addition, there is an obvious improvement in osteoporosis due to the regain in bone and muscle mass. This is simple, natural and individual.
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CONSIDERATIONS ON THE SOCIAL CHALLENGES FOR YOUNG PEOPLE WITH TYPE 1 DIABETES MELLITUS

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Abstract. Insulin-dependent young people (children or youth) are considered to be a socially disadvantaged population, given that they are often placed in situations where they have to face labelling, rejection or isolation. Statistics show that there are more than 140,000 children with type 1 diabetes mellitus (T1DM) across Europe. In our country, there is no updated statistical evidence of young people diagnosed with this metabolic disease. Adolescents, young people and children with type 1 diabetes mellitus face discrimination and find themselves in situations of social exclusion, because Romanian citizens do not always have enough information to make the difference between type 1 diabetes mellitus and type 2 diabetes mellitus, disapproving injections administered at any time and in any conditions. Thus, young people with T1DM are at risk of socio-economic marginalisation, knowing that a solid budget is needed to manage this chronic condition and that they can interrupt anytime the activities in which they are engaged, depending on the fluctuations in blood glucose levels and the insulin therapy. In order to gradually remove social barriers for this category of disadvantaged population, it is important to reduce the impact of specific T1DM treatment on peers through educational approaches involving both people with and without diabetes, through actions aimed at raising the level of tolerance and awareness of citizens towards the individuals with health problems.

Keywords: diabetes mellitus, young people, social barriers.

Introduction

Type 1 diabetes mellitus (T1DM), once known as juvenile diabetes, is a chronic autoimmune disease involving insulin therapy as a treatment method (Vehik et al., 2007). The World Health Organization prefigures that, until 2030, diabetes will be the 7th cause of mortality in the world. Statistics show that there are more than 140,000 children with type 1 diabetes mellitus across Europe. And there would be as many or even more young people aged 15 to 25 years who have to face the challenge of living with a complex life-threatening chronic disease. Europe has one of the highest incidence rates of paediatric and juvenile type 1 diabetes, with an estimated 21,600 new cases per year. In our country, there is no updated statistical evidence of young people diagnosed with this metabolic disease. In 2008, Moraru et al. mentioned over 3 cases of juvenile diabetes per 100,000 people per year, besides others not officially reported.

Insulin-dependent young people (children or youth) are considered to be a socially disadvantaged population, given that they are often placed in situations where they have to face labelling, rejection or isolation. Children with type 1 diabetes mellitus are daily constrained to accept a large number of injections for measuring blood glucose levels, depending on how they feel (8-10/day for a child), but also for insulin administration (4-5/day). People with T1DM follow a strict daily schedule for meals, rest and injection treatment hours. Moreover, they can interrupt any time their activities (related to school, profession, leisure, sleep), depending on the fluctuations in blood glucose levels. The risks of future health complications (co-morbidities) are linked to unbalanced diabetes. The T1DM patient is at higher risk to develop co-morbidities such as peripheral and autonomic neuropathy, silent ischemia, cardiac arrhythmia and sudden death (Nathan, 1993). Nocturnal hypoglycaemia is recognized as one of the factors responsible for the “dead-in-bed” syndrome (Secrest et al., 2011), namely the sudden nocturnal death that accounts for 5-6% of all deaths among young people with T1DM. Any hypoglycaemic episode decreases psychological wellbeing, as well as the quality of life, knowing that repeated hypoglycaemic events generate powerlessness, anxiety, irritability, depression and limitations in mobility and daily activities for patients and their families (Alvarez-Guisasola et al., 2010).

Insulin therapy cannot be done in the absence of a strict diet, which is not always followed by patients. The feeding of T1DM young people involves cognitive and volitional processes, even if their nutrition does not differ radically from that of the person without diabetes. Food choices are based on the exact calculation of ingested nutrients and the time required for the metabolism process, depending on the effects induced on blood carbohydrate concentration (Dansinger, 2016). Over time, it may become a social problem for T1DM young people to go out with friends and always ask first about the nutrient values. This issue requires tolerance and acceptance from the social group to which they belong.

Another important factor in the management of diabetes is represented by physical exercise. Regular exercise is a recognized tool in the therapeutic approach to diabetes; it can improve health and wellbeing and can help individuals to achieve their glycaemic goals (American Diabetes Association, 2015). On the physician’s recommendation, young people with T1DM will get involved in physical exercise programs integrating distinctive
organizational and structural particularities such as: glucose measurement at the beginning of each activity, after every 30 minutes of practice and at the end of physical activity, carbohydrate administration before, during and after exercise, adaptation of exercise intensity to blood glucose levels, allowing sufficient recovery breaks and adjusting the contents to the patients’ functional reactions (Yardley & Sigal, 2015). However, T1DM people seem to be at least as inactive as the general population nowadays (Polsky & Ellis, 2015). The landscape of obesity and sedentary lifestyle tends to extend to young or adult patients with T1DM, changing their insulin demands and insulin sensitivity and adding the myriad of well-recognized cardiovascular risk factors derived from this metabolic syndrome.

The need for affiliation to a group leads the individual to internalise and comply with behavioural norms, to assimilate social values, to seek acceptance and recognition of others (Bota & Teodorescu, 2015, p. 6). The need for inclusion of T1DM teenagers is also felt by their parents, so they often prefer to join groups with members who are like them, in order to avoid stigma and blame (Urzeală & Teodorescu, 2015).

**Issues addressed**

In recent years, the tolerance level of society members regarding the diversity of individuals has been one of the specialists’ priorities, highlighting the need for a change in the attitude related to inclusion and adaptation of all persons, as active parts of the society. The Romanian society has often approached young people with T1DM as sick, handicapped or suffering individuals. Legally, T1DM adolescents and children are considered persons with severe handicaps (Parlamentul României, 2006). Adolescents, young people and children with type 1 diabetes mellitus face discrimination and find themselves in situations of social exclusion, because Romanian citizens do not always have enough information to make the difference between type 1 diabetes mellitus and type 2 diabetes mellitus, disapproving injections administered at any time and in any conditions. For example, in schools, teachers recommend that the blood drop for glucose monitoring should be taken only in the doctor’s office, the teaching and medical staff refusing to intervene in case of severe hypoglycaemia and requesting the ambulance support. Meanwhile, the blood glucose level may drop dramatically even to coma, putting the patient in great danger. Using the insulin pen in the classroom or any other social space generally causes anxiety and panic among other individuals. Thus, teenagers and young patients often hide themselves to do their treatments, being embarrassed of their health problem and its implications. Some of them declare that colleagues call them “junkies”, make bad jokes and argue with the teachers because they are allowed to eat during lessons.

Young people with T1DM are at risk of socio-economic marginalisation, knowing that a solid budget is needed to manage this chronic condition and that they can interrupt any time the activities in which they are engaged, depending on the fluctuations in blood glucose levels and the insulin therapy. The costs for glycaemic tests and the insulin pen are only partially covered by the Romanian National Department of Health Insurance. For example, after the age of 18, they receive only one glycaemic test/day. The glucagon injection needed in case of severe hypoglycaemia cannot be found on the Romanian pharmaceutical market. By comparison, T1DM patients in the United States and in various European countries use modern telemedicine devices as regular care standards. The Continuous Glucose Monitoring System (CGMS) stands for a useful tool in carrying out every day activities, recording the glucose level every 5 minutes and launching sound alarms that warn timely about the danger of hypoglycaemia or hyperglycaemia to prevent extreme variations in blood glucose and manage diabetes. In Romania, the reluctance to use these devices is explained by the high costs, the insufficient media coverage, the lack of specialised medical staff, the specialists’ low interest in scientific research and innovation. Thus, the poor popularisation of CGMS at a national level and the high costs involve dare an impediment to the good balance of diabetes, which has negative consequences on the patients’ social relationships and quality of life. In the case of juvenile diabetes, it is possible to get a wire insulin pump for free from the Romanian National Department of Health Insurance, but only after being registered on a waiting list, a procedure that may last more than one year. However, at an international level, wireless insulin pumps are used, but few Romanian people know about this.

In this context, the financial efforts become huge for the family of a person with T1DM. Constrained by the low interest of the authorities in this category of population, parents have joined their forces and created active NGOs (e.g. Support for Diabetes Association, Children and Youth with Diabetes Association) to raise funds for telemedicine devices that pass from one to the other, so that each member can benefit from them, even for a short time. The challenge of living with this chronic disease makes young people with T1DM a disadvantaged population, the treatment complexity exerting great pressure on their lifestyles. The risks of severe hypoglycaemia and coma keeps T1DM people away from sports activities and movement games, which will directly exclude them from different social groups. Too often these young patients decrease participation in physical education and
sports (PES) lessons, their parents requesting unjustified medical exemptions from PES lessons and thus creating a

gap between their child and his/her classmates.

On the other hand, specialists like Hains et al. (2006) examine the metabolic stress felt by T1DM adolescents
in the situation where they want to adhere to a particular social group, but face the fear of being rejected or
negatively assessed by others. The authors draw attention to this social integration difficulty in both sanogenetic
and emotional terms, as a result of losing an opportunity to make new friends and rely on their support.

For the curricular sports activities, it is the PES teacher’s responsibility to manage this kind of manifestations
and develop the adolescents’ motor skills in order to enable them to successfully take part in any collective motor
task. Even if physical exercise is part of the diabetes challenge and there are many sports performance athletes
worldwide (in skiing, boxing, American football, hockey, baseball, bodybuilding), Romanian young people with
T1DM have difficulties in pursuing a career in the physical education and sports field.

Starting from the fact that the educational intervention since the earliest ages is meant to shape behaviour and
create lifelong habits, we consider that, in the case of a T1DM person, education is the key to acquire an
appropriate lifestyle. It is necessary to promote a positive attitude, an active lifestyle, a healthy diet, social
tolerance and openness towards the diversity of people. This goal is achieved by a complex juvenile diabetes care
network based on a solid collaboration between family, physicians, educators, medical and social stakeholders.
School education is the first step to be taken in order to raise social awareness linked to the inclusion of people
with health-related challenges and disabilities. Extra-school education is also necessary to create equal
development opportunities for all members of the society.

The role of the family is crucial to the T1DM young patient’s quality of life, the adults having to change many
of their habits, use physical exercise in their daily activities and show permanent interest in interacting with the
diabetes physician. The strict lifestyle and the insulin therapy make T1DM teenagers dependent on their parents or
tutors, and consequently they are unable to participate in all activities specific to their age. Young people with
T1DM have fewer opportunities compared to their peers, because of their education, their parents’ overprotection,
the reluctance of others. For example, there are many cases of T1DM adolescents and children that do not sleep
over to a friend’s house and do not go on trips or camps without being accompanied by a parent. Regarding the
needs of families caring for a T1DM child, Lawton et al. (2014) highlight the issue of their emotional support
when facing this chronic disease. Furthermore, during primary school, many mothers use to wait for their T1DM
children in the schoolyard or school halls all day long, always being prepared to intervene if the child feels sick
because of his/her diabetes. There are also many mothers who quit their jobs to care for the T1DM child 24 hours
a day and legally work as a personal assistant for their child until he/she is 18 years old (Guvernul României,
2017).

Conclusions

In order to gradually remove social barriers for this category of disadvantaged population, it is important to
reduce the impact of specific T1DM treatment on people without diabetes by engaging young people in joint
activities and to increase the level of tolerance towards patients with T1DM by raising the citizens’ awareness
through various educational approaches. It becomes a priority to strengthen the knowledge, skills and behaviours
needed to fully accept, support and promote differences in our society regarding the health-related issues and
disabilities. There can be identified the actual gaps between social requirements and education providers, besides
the people’s need for developing new social skills in order to cope with diversity in terms of respect, recognition
and acceptance. Sport is considered a valuable instrument to meet this need, and therefore PES educators must
promote positive interactions between individuals, regardless of their motor skills, ethnicity, (dis)ability, religion,
gender, skin colour, socio-economic possibilities, somatic appearance etc. Supporting a positive response to
diversity will ultimately be to the benefit of T1DM young people with fewer opportunities of inclusion in the
society; as such, an appropriate educational approach will enable them to manage blood glucose levels during
physical effort.

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IDENTITY AND ADOLESCENCE. A PERSPECTIVE ON SCIENTIFIC STUDIES

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Abstract. Over time, adolescence has been recognized as a particularly difficult time for this category of population, being full of uncertainties and vulnerable feelings. Identity is often characterised as one’s interpersonal characteristics (such as self-definition or personality traits), roles and relationships assumed in different interactions, personal values or moral beliefs. In this research stage, there were introduced original studies identified in international databases, which brought to discussion the two investigated variables: identity and adolescence. The qualitative assessment of scientific articles published in reference journals or presented at international conferences was achieved relying on the PICO process, a technique mainly used in evidence-based practice to answer a research question. The purpose of literature review was to identify scientific studies addressing the role of identity in adolescent formation and development, and also to determine the causal relationships between identity and self-esteem, identity and anxiety, identity and ego development, cultural identity during adolescence. This analyse on scientific studies reveals the depth and complexity of identity processes and areas, and presents views from several different studies and theoretical schools, as well as empirical approaches. Some studies suggest that girls’ self-esteem tend to decrease in adolescence, more recent research does not bring arguments in this respect. The relationships of adolescents with their families are not always comfortable, their rebellions being something common in this period of life.

Keywords: personality, identity, adolescence, self-esteem, cultural identity, moral identity.

Introduction

Modern society, defined by consumerism, globalisation, media explosion, advanced technology, entails strong socio cultural changes which are also reflected in adolescent behaviour and attitude. The diversity of alternatives available to teenagers and the high level of expectations put on them by the social environment cause uncertainty, anxiety, worry, the emergence of complexes, which may culminate with the inability to define one’s identity and/or the inability to overcome the identity crisis specific to this age (however, it is worth mentioning that not all adolescents go through the identity crisis) (Clerget, 2008, pp. 12-15).

Adolescence, defined as the period comprised between puberty and adulthood, has been recognized as a particularly difficult time for this category of population, being full of uncertainties and vulnerable feelings. Teenagers are faced with self-awareness and constantly fight to discover and reinvent themselves in accordance with the social system (Păunescu et al., 2016). From a psychological point of view, adolescence is marked by the emergence of identity crises, the expression of alternative behavioural states, exaggerated attention to body perception and fluctuations in self-esteem. During this period, teenagers also express their own gestures, values, aspirations and vocations.

An important part of identity is gender identity, because it greatly determines the way in which a person sees himself or herself as both an individual and a social being. From a social perspective, the adolescent wants to show independence from parents, the influence of the group of friends occurs, as well as the beginning of a new schooling cycle, all these being premises for identity formation. In a world full of tensions and conflicts, in a world dominated by rapid and multiple changes (economic, social, political, psychological ones), fostering personal identity becomes absolutely necessary. From a scientific point of view, one cannot talk about identity without addressing personality and the factors involved in the psychosocial processes that intervene in structuring personal identity. Given the social nature of man, human personality can be assessed only at a social level and is validated through constant reference to others and revaluation. Because the social is a mirror reflecting the real image of man, who cannot exist outside of society, but only within and through it, this one can be analysed only as a social being, whose mental development is always impregnated by his or her relationships with society.

In the light of psychology, the term identity is correlated with concepts such as self-image, self-esteem and individuality. In cognitive psychology, this term refers to the introspective ability and self-awareness of an individual (Leary & Tangney, 2003, p. 3).

From the perspective of sociology, the term identity is correlated with the concepts of behaviour and social role. Social sciences use it to describe the conception and expression of a person’s individuality, also determined by their affiliations to different groups (which involves group identity: cultural, national, social identity etc.) (Benedict, 1983). The negotiation of identity arises from the process of learning social roles through personal
experiences (by interacting with other members of the society, the individual establishes his or her identity status, which is recognized and accepted by others).

Psychologists use the term identity to designate the uniqueness of an individual based on each one’s idiosyncrasies. Instead, sociologists use the term with the meaning of social identity, which involves the group traits that define an individual. However, when analysing a person’s identity, each discipline can use any meaning of the concept, according to their needs (Identitate – științe sociale, 2015). Identity is often characterised as one’s interpersonal characteristics (such as self-definition or personality traits), roles and relationships assumed in different interactions, personal values or moral beliefs (Calvert, 2002, p. 57).

Identity also involves a sense of continuity of self-image over time, but this continuity can be disrupted when puberty produces radical changes in someone’s physical appearance. Sexual maturation brings changes in the roles that a person is expected to assume in the relationship with opposite-gender partners, this assumption of gender identity being a marker of mature identity (Grotevant, 1998).

Personal identity is a dynamic construction of the unity of self-awareness through inter-subjective relationships, verbal communications and social experiences. Jenkins (1996) asserts that identity refers to the ways in which individuals and groups distinguish in their social relationships with other individuals and other groups. Consequently, identity is social and involves interaction and comparison. According to the author, identity, whether individual or collective, is always symbolically constructed; it would be enough to mention clothing, accessories, gestures, language and behaviours to show that all these contribute to what an individual is through the associated social meanings.

The search for identity, defined by Erikson (1950) as a coherent concept about self, made up of the goals, values and beliefs to which the person has a firm commitment, comes to the forefront during adolescence. Cognitive development allows teenagers to build a “theory about self”. The author thinks that the adolescent’s attempt to understand himself or herself is not a kind of anxiety related to maturity, but is part of a healthy, vital process relying on the achievements gained in previous stages (confidence, autonomy, initiative, diligence) and the required background for coping with the challenges of adulthood.

However, the identity crisis is rarely fully resolved in adolescence; the identity-related problems occur repeatedly throughout the adult lifespan (Papalia, Olds, & Feldman, 2010, p. 390).

A systematic review of scientific studies

In this research stage, there were introduced original studies identified in international databases, which brought to discussion the two investigated variables: identity and adolescence. The qualitative assessment of scientific articles published in reference journals or presented at international conferences was achieved relying on the PICO process, a technique mainly used in evidence-based practice to answer a research question (Huang, Lin, & Demmer-Fushman, 2006). The PICO process is also used to develop search strategies in the literature, whose elements are necessary in an assessment protocol. PICO is an acronym standing for: P – patient, problem or population; I – intervention; C – comparison; O – outcome(s) (Straus et al., 2005).

Purpose of literature review: to identify scientific studies addressing the role of identity in adolescent formation and development, and also to determine the causal relationships between identity and self-esteem, identity and anxiety, identity and ego development, cultural identity during adolescence.

Participants: adolescents

Interventions: any type of instrument (questionnaire, interview) for assessing the causal relationships between the research variables identified in theoretical articles, empirical studies etc.

Results: all results reported by the studies included in this systematic review.

Design of studies included in the analysis: theoretical studies, case studies, longitudinal studies, cross-sectional studies etc., as related by their authors.

Inclusion criteria. The review of studies aimed to highlight the relationships between the research variables: identity and adolescence. The review included articles published in journals indexed in international databases (Web of Science, SPORTDiscus, PubMed, Medline), papers presented at specialised international conferences (for instance, European Child and Adolescent Psychiatry) and books from many specialised fields.

Search results

Identity is one of the most studied constructs in social sciences. However, despite the wealth of findings across many disciplines, identity researchers remain divided as regards some fundamental questions such as: What
exactly is identity? How do identity processes work? Do people have one identity or multiple identities? Is identity oriented individually or collectively? Is it constructed personally or socially? Is it stable or constant in its flow? (Schwartz, Vignoles, & Luyckx, 2011, p. 993)

This comprehensive perspective on scientific studies reveals the depth and complexity of identity processes and areas, and presents views from several different studies and theoretical schools, as well as empirical approaches. Most often, a theory is the starting point. The only question is whether there are or not multiple meanings of the identity status.

**Identity and late adolescence**

The psychosocial crisis of late adolescence has been postulated to be identity versus identity diffusion (or confusion, in Erikson’s writings). Faced with the imminence of adult tasks (for example, getting a job, becoming a citizen, planning marriage), the late adolescent must relinquish the childhood position of being given to and prepare to be the giver. The approach involves changing one’s worldview and projecting oneself imaginatively into the future through a possible occupational path. This self-reconstructive process is assumed to strengthen overall ego processes as the individual becomes able to handle a wider range of developmental tasks. Ego strengthening occurs on both an internal level (e.g. delay of impulses) and an external level (e.g. adaptation to societal demands). The psychosocial task of ego identity development is essentially one of integration. Ego identity achievement involves a synthesis of childhood identifications on the individual’s own terms, so that he or she establishes a mutual relationship with society and maintains a feeling of continuity with himself or herself. It is about a concentrated reformulation of all that the individual is to become. (Kroger & Marcia, 2011, pp. 32-33)

Previous research has shown that late adolescence is associated with developmental changes in identity formation, which leads to individual differences in identity statuses. Special attention was given to the identification and study of the four identity statuses, namely identity diffusion, foreclosure, moratorium and achievement. In this respect, Cooper and Grotevant (1980) conducted a survey to assess both the predictive usefulness of measures for family connection and individuality in differentiating between the four identity statuses. Data obtained from late adolescents of both genders and their parents aimed at teenagers’ perception of independence (individuality), communication and emotional feelings (connection). Differences between adolescents grouped according to the four identity statuses were assessed through the technical variance analysis, by comparing the gender and identity statuses regarding the measures of connection and individuality within a parent-adolescent relationship. Results have shown that a combination of emotional attachment to parents and the encouragement of independence by parents is associated with healthy identity development in adolescents (Luyckx et al., 2008).

The study of identity, under its different aspects, has revealed a tendency to confuse identity (as a phenomenon and a notion) with self-image or group image. The confusion between these associated (but not identical) notions makes the identity theory of Krappmann (1992, p. 173) to be useful in clarifying the mentioned relationship. The author states that identity represents the performance achieved by an individual for getting involved in joint social actions and also in communication, specifying that identity is something dynamic and should not be confused with the individual’s “rigid” image about self. He proposes an analysis of the relationships between those skills that enable and mediate internalisation and characteristics of the social system. The starting premise is that social identity is closely related to social behaviour.

Table 1 provides an overview of scientific studies aimed to investigate adolescent identity.

Table 1. An overview of scientific studies on identity development in adolescents

<table>
<thead>
<tr>
<th>Study</th>
<th>No. subjects</th>
<th>Age</th>
<th>Study design</th>
<th>Assessment tool</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goth et al. (2012)</td>
<td>357 adolescents</td>
<td>Mean age: 15 years</td>
<td>Assessment of Identity Development in Adolescence (AIDA); Junior Temperament and Character Inventory (JTCI)</td>
<td>Dimensionality of JTCI characters. Self-directedness, an indicator of self-related personality functioning, has strong negative correlations with the levels of identity, discontinuity and incoherence measured by AIDA.</td>
<td></td>
</tr>
<tr>
<td>Author(s)</td>
<td>Sample Size and Characteristics</td>
<td>Study Design</td>
<td>Instruments</td>
<td>Findings</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Ganiere &amp; Enright (1988)</td>
<td>57 high school adolescents</td>
<td>Tests before and after</td>
<td>Rasmussen Scale of Ego Identity; Self-Identity Social-Similarity Grid</td>
<td>Significant differences in change were demonstrated on the grid between the experimental and control groups.</td>
<td></td>
</tr>
<tr>
<td>Meeus et al. (1999)</td>
<td>-</td>
<td>Reviews of empirical studies</td>
<td>-</td>
<td>Reviews of empirical studies on identity development support the first assumption of the fundamental developmental hypothesis, but not the second, because of the lack of research.</td>
<td></td>
</tr>
<tr>
<td>Kinney (1993)</td>
<td>240 adolescents</td>
<td>Qualitative study</td>
<td>Observation; Interview</td>
<td>Adolescents who were unpopular in middle school, but got involved in activities and friendship groups in high school, were able to recover by becoming self-confident and reconstructing themselves.</td>
<td></td>
</tr>
</tbody>
</table>

Based on the psychodynamic and social-cognitive theories, Goth et al. (2012) developed 58 items of the self-report questionnaire AIDA (Assessment of Identity Development in Adolescence), intended for healthy adolescents, but also for those with mental disorders. The psychometric properties of AIDA questionnaire were examined in a sample made up of 357 adolescents, 305 from two public schools (148 boys and 157 girls aged 12 to 18 years, mean age =15 years, SD = 2.01), and 52 psychiatric patients diagnosed with personality (N = 20) or other mental disorders (N = 32). Scale reliability was assessed by Cronbach’s Alpha, content validity was examined by correlating AIDA with JTCI (Junior Temperament and Character Inventory), and criterion validity was measured by the differences in identity development between adolescents with personality disorders, other mental disorders or no disorder. Results from AIDA questionnaire have provided a reliable and valid assessment of normal identity development and can be used as an instrument for early detection of personality disorders.

According to Ganiere and Enright (1988), identifications from the past, current feedback from social relationships and one’s own priorities combine to create the identity of an individual. These insights were incorporated into three distinct identity development programs that were administered to 57 high school seniors. Tests included the Rasmussen Scale of Ego Identity and a Self-Identity Social-Similarity Grid. Significant differences in change were demonstrated on the grid between the experimental and control groups. That there were no significant changes in Rasmussen scores emphasises the various attempts to operationalise many aspects of Erikson’s theory. Suggestions are made for administering and assessing future identity development programs.

A systematic review of scientific articles, achieved by Meeus et al. (1999), demonstrates that the theoretical claims of the identity status model have been significantly moderated in the past 30 years. Development does not have an established final target, a fixed achievement, and is not unidirectional, i.e. always proceeding from lower to higher statuses, but a reverse developmental pathway is also possible. Moderation does not mean that a dominant direction in development must be denied, nor does it conflict with the fundamental developmental hypothesis of the identity status model that involves a decrease in diffusion and foreclosure and an increase in achievement during the course of development, but specifies a pattern of identity status transitions underpinning this progressive development.

The same authors analyse the relationship between identity status and psychological well-being in a longitudinal study exploring relational and societal identity, conducted on a sample made up of 1,538 Dutch adolescents. Four new identity statuses are used in this study: diffusion, foreclosing, moratorium, and achieving commitment. Findings support the first assumption of the developmental hypothesis, although not completely; for relational identity, it has been found a decrease in diffusion and an increase in achievement, and for societal identity, a decrease in diffusion and an increase in foreclosure. This means that a direction can be indicated in the development of identity, but also that foreclosure can serve as the end-point of development, especially for societal identity. Generally, the domain of societal identity reveals a less pronounced development than relational identity, and this difference can be interpreted in terms of the distinction between open and closed domains of identity. To test the second assumption of the developmental hypothesis, the identity development patterns were investigated.
for the first time using log-linear analysis. No indications have been found that identity development occurs faster in a certain period of adolescence than in other periods. However, the stability of relational identity mainly increases in post-adolescence, and a slower development of identity results in a lower level of psychological well-being.

Kinney (1993) states that extensive attention has been paid to understanding the nature of adolescent identity, but little consideration has been given to everyday social experiences and processes by which the content of teenagers' self-perceptions are formed and remain stable or change within educational settings. Because studies have focused on members of “popular” groups or “deviant” subcultures, it is important to examine the daily life of adolescents whose schoolmates have labelled them as unpopular “nerds”, in order to document how these adolescents manage to overcome the stigma of such labelling. Using intensive interviews and observations, this study delimited the impact of school activities, school social structure and peer culture on the self-perceptions of nerds. Results show that adolescents who were unpopular in middle school, but got involved in activities and friendship groups in high school, were able to recover by becoming self-confident and reconstructing themselves as “normal” within a constantly changing school social system.

Erik Erikson built a life cycle theory including eight stages, each one representing a certain period in the human development. The psychologist states that the development of an individual is based on three processes: the biological process of the hierarchic organization of organ systems constituting a body (soma); the psychic process organizing individual experience by ego synthesis (psyche); the communal process of the cultural organization of the interdependence of persons (ethos). A developing body, a developing mind and a dynamic sociocultural environment are the three primary processes underlying the identity formation and psychosocial development of a person (Erikson & Erikson, 1998).

According to Waterman (1999), the identity status paradigm is grounded in Erikson’s psychosocial theory; the content domains covered in the Identity Status Interview are areas on which Erikson focused in his writings; identity status theorists and Erikson share a substantial number of theoretical propositions, although notable differences exist as well; while all operational definitions of identity represent only a portion of Erikson’s conceptualisation of identity, the operational definition of identity in terms of exploration and commitment represents the construct at least as well as other available operational definitions; using generally accepted definitions of construct validity, identity statuses have been largely validated as elements of a broader identity construct. There are presented six propositions within the theory of identity status development and also research studies that support these propositions. The literature is re-examined in order to see to what extent the studies incorporate better design elements for assessing identity status development. Substantial support for developmental hypotheses is provided by the literature as a whole, but especially by those studies containing better design features.

Identity and ego development

Kroger and Marcia (2011) stated that, in the first studies on the identity status, a “close” primary relationship was established between new identity statuses and the global measure of ego identity, EI-ISB (Ego Identity Incomplete Sentences Blank). Although addressing a concurrent form of validity, EI-ISB had not been previously established as a measure of ego identity. The positive relationship found between this measure and identity statuses suggests that these statuses have provided an appropriate representation of Erikson’s extended theory. A second measure was authoritarianism, where foreclosure recorded the highest score of all statuses. The fact that persons who followed directions indisputably set for them by important childhood figures would adopt values of “law and order”, would prefer a strong leader and would be suspicious towards people who are not like them was considered evidence confirming the validity of the term foreclosure. If the individual fails to fulfill this task, he or she remains in the stage of non-reconstructed superego formed in childhood, when the internalised paternal figures are fabulous characters in the child’s life. The suggestion arising from the relationship often found between foreclosure and authoritarianism is that people with this identity status remain fixed in the values of childhood, and in their adult life they seek for authoritarian persons who can guide them. Clinically, they would be expected to depend on strict internal (parental) standards that they have never reformulated on their own terms. To avoid guilt and anxiety, it would be important for these individuals to remain in a life situation as closer as possible to that experienced in childhood, because any other context may represent a serious threat for their rigid structure of values. A third measure involved the participants’ sensitivity to positive or negative feedback from the researcher, who was observing them in the execution of a conceptually difficult task. It has been found that participants in foreclosure and diffusion states changed estimations on their own abilities after receiving external feedback more than after achievements and moratoriums. These results contributed to differentiating between those who had built
or were in the process of building identity on their own terms and those who either had adopted assigned identities or did not have firm identities. (pp. 36-37)

As regards the basic psychoanalytic theory, it is proposed that the formation of an ideal ego (final development of superego) should occur during adolescence (Blos, 1974). Table 2 provides an overview of scientific studies addressing identity and ego development in adolescence (Petrescu & Petrescu, 2016).

Table 2. An overview of scientific studies on identity and ego development

<table>
<thead>
<tr>
<th>Study</th>
<th>No. subjects</th>
<th>Age</th>
<th>Study design</th>
<th>Assessment tool</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marcia (1993)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Theoretical study</td>
<td>Identity can be compared to those mental structures postulated by cognitive developmental theorists.</td>
</tr>
<tr>
<td>Kumru &amp; Thompson (2003)</td>
<td>476 adolescents</td>
<td>15-22 years</td>
<td>-</td>
<td>Extended Version of the Objective Measure of Ego Identity Status; Self-Monitoring Scale</td>
<td>Significant increases in identity achievement and moratorium with age; no gender differences in identity status.</td>
</tr>
<tr>
<td>Weinmann &amp; Newcombe (1990)</td>
<td>100 adolescents</td>
<td>-</td>
<td>Retrospective study</td>
<td>Extended Objective Measure of Ego Identity Status</td>
<td>A significant quadratic trend in identity committed subjects’ ratings of the amount of love they felt for mother across the five age periods; a significant linear trend of increasing love for mother.</td>
</tr>
<tr>
<td>LaVoie (1976)</td>
<td>High school students (girls and boys)</td>
<td>-</td>
<td>Marcia Ego Identity Status Scale; Measures of gender-role identification</td>
<td>The gender differences which emerged were congruent with the identity literature.</td>
<td></td>
</tr>
<tr>
<td>Kroger &amp; Haslett (1988)</td>
<td>76 subjects (41 women and 35 men)</td>
<td>-</td>
<td>Longitudinal study</td>
<td>Marcia Ego Identity Status Scale; Separation Anxiety Test (SAT)</td>
<td>Strong links between attachment style and identity status in 1986, and between identity statuses in 1984 and 1986; only an indirect connexion existed between attachment styles in 1984 and 1986, as measured by SAT.</td>
</tr>
<tr>
<td>Grotevant &amp; Adams (1984)</td>
<td>3 studies</td>
<td>-</td>
<td>Comparative studies</td>
<td>Extended Version of the Objective Measure of Ego Identity Status</td>
<td>The identity measure was found to have acceptable reliability (both internal consistency and test-retest) and validity.</td>
</tr>
</tbody>
</table>

Ego identity formation is a major event in personality development. Identity consolidation, which occurs in late adolescence, marks the end of childhood and the beginning of adulthood. Identity formation involves a synthesis of skills, beliefs and childhood identifications in a more or less coherent but unique whole, which gives the young adult both a sense of continuity with the past and a direction for the future. In terms of internal organization, identity can be compared with those mental structures postulated by cognitive developmental theorists, particularly Piaget. However, identity differs from Piaget’s structures by the fact that it is both content- and process-based. While Piaget’s structures are primarily experience-based operating procedures, identity includes both procedure styles and content elements. Shortly, identity as a structure refers to how experience is treated and what experiences are considered important (Marcia, 1993, p. 3).

Kumru and Thompson (2003) conducted a research to analyse the association between identity status and self-monitoring behaviour (including age and gender differences), on a sample of 476 adolescents (aged 15 to 22 years) from Turkey – a non-Western society characterised by traditional and modernist cultural elements. Identity was
assessed using the Extended Version of the Objective Measure of Ego Identity Status, and self-monitoring was measured by the Self-Monitoring Scale. Identity and self-monitoring were significantly associated, for ideological identity, with adolescents having the lowest identity achievement and the highest diffusion in self-monitoring. The authors reported that there were no associations for interpersonal or general identity status. Consistent with other research conducted in North America, this study also revealed significant increases in identity achievement and moratorium with age, and no gender differences in identity status. Males obtained significantly higher scores than women for self-monitoring, with no age differences. These findings are discussed in relation to cultural influences on identity formation in adolescents from Turkey.

Weinmann and Newcombe (1990) analysed the connection between identity status in late adolescents and their memories of the relationships with parents. The study included 100 male and female adolescents who completed two questionnaires: the former assessed the retrospective perceptions of subjects’ affective relationships with parents across five age periods: from 1 to 5 years, 5 to 10 years, 10 to 15 years, 15 to 20 years, and the present; the latter, the Extended Version of the Objective Measure of Ego Identity Status, assessed the subjects’ current identity status. Analysis revealed a significant quadratic trend in identity committed subjects’ ratings of the amount of love they felt for mother across the five age periods and also a significant linear trend of increasing love for mother. In contrast, uncommitted subjects showed significant linear trends of decreasing love both for and from their mothers. The research results are interpreted as evidence of the importance of solving the identity issues to the establishment of feelings of intimacy between late adolescents and their parents.

The ego determinants were investigated by LaVoie (1976) in a study conducted on high school students (males and females). Subjects were administered the Marcia Ego Identity Status Scale and measures of gender-role identification, personality development, psychological functioning, self-concept and parental socialisation practices. Data analysis has shown that adolescents with high-identity levels have more positive scores for gender-role identification, personality development, psychological adjustment and self-concept than adolescents with low-identity levels. The identified gender differences were congruent with the identity literature. Generally, the study data supported Erikson’s theory of ego identity development.

Interested in clarifying the connection between the structure of intra-psychic relationships and ego identity status in late adolescence, Kroger and Haslett (1988) conducted a longitudinal study on 76 subjects (41 women and 35 men). The study purpose was to examine the possible predictive relationship between initial attachment style and later identity status. The research subjects were administered, in 1984, the Marcia Ego Identity Status Scale and Hamburg Separation Anxiety Test (SAT), and after 2 years, in 1986, they were assessed again. Log-linear models indicated strong links between attachment style and identity status in 1986, and between identity statuses in 1984 and 1986; only an indirect connexion existed between attachment styles in 1984 and 1986, as measured by SAT. According to the study results, when there were known the identity statuses of 1984 and 1986, it was possible to predict the attachment style of 1986, without knowing the attachment style of 1984; but only the attachment style of 1984 could not predict exactly the later identity status.

As mentioned by Kroger and Marcia (2011, pp. 43-44), Loevinger’s measure of ego development (1976) is an instrument designed to assess different levels of complexity relating to how an individual gives sense to life and life experiences. The lower end of the continuum (pre-conformist stages) is marked by a self-organization where the significance mainly derives from the implications that others and life events have on the self. Achievements and moratoriums, in terms of their solving or the proximity to solving a problem in the psychosocial stage, are supposed to have the highest score for this measure, and foreclosures, but especially diffusions, a lower score. Although moratoriums might occur in a period where the individual has bad feelings about self or is experiencing anxiety, they are expected to have a relatively high score for this measure assessing the complexity of significance construction rather than emotional states.

Jesperens, Kroger and Martinussen (2013) performed a meta-analysis of the relationship between identity status and ego development level. A total of 12 out of 14 studies contained sufficient data to be included in the two analyses. The results from 8 studies indicated a poor to moderate relationship between identity achievement and post-conformist levels of ego development (probability rate = 2.15). However, no relationship was found between foreclosure and the conformist levels of ego development. Moreover, the results from 6 studies showed a moderate correlation (r = 0.35) between continuous measures of identity status and ego development. Although some relationships emerged between identity achievement and post-conformist levels of ego development, and also between continuous measures of identity status and ego development, these ones were not as strong as expected.
Identity and self-esteem

Several studies on identity in relation with self-esteem have been achieved in recent decades, some of them being presented in Table 3.

Table 3. An overview of scientific studies on the relationship between identity and self-esteem

<table>
<thead>
<tr>
<th>Study</th>
<th>No. subjects</th>
<th>Age</th>
<th>Study design</th>
<th>Assessment tool</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patton, Bartrum &amp; Creed (2004)</td>
<td>467 high school students</td>
<td>14-18 years</td>
<td>Comparative study</td>
<td>Social-Cognitive Carrier Theory (SCCT); Cognitive-Motivational-Relational Theory (CMR)</td>
<td>Self-esteem predicted career expectations, which then directly influenced career planning and exploration by bypassing career goals.</td>
</tr>
<tr>
<td>Young &amp; Bagley (1982)</td>
<td>-</td>
<td>-</td>
<td>Theoretical study</td>
<td>-</td>
<td>Adequate self-esteem is a necessary, but not a sufficient condition of adequate identity.</td>
</tr>
<tr>
<td>Bayard et al. (2014)</td>
<td>Cohort</td>
<td>15, 16 and 18 years</td>
<td>Longitudinal study</td>
<td>Swiss Survey of Children and Youth (COCON)</td>
<td>Evidence suggests that women’s self-development is more affected by the educational level compared to men’s.</td>
</tr>
<tr>
<td>Lo Cascio et al (2013)</td>
<td>350 adolescents</td>
<td>13-16 years</td>
<td>Self-report measures on indecisiveness, quality of family communication, trait anxiety and self-esteem</td>
<td>-</td>
<td>Students’ indecisiveness is predicted by family communication mediated by anxiety and self-esteem.</td>
</tr>
<tr>
<td>Brown &amp; Lohr (1987)</td>
<td>221 students and 106 adolescents</td>
<td>7th to 12th graders and outsider adolescents</td>
<td>Comparative study</td>
<td>-</td>
<td>Outsiders’ self-esteem differed in both the accuracy of their reflected appraisals and the salience they attached to crowd affiliation.</td>
</tr>
<tr>
<td>Usmiani &amp; Daniluk (1997)</td>
<td>82 mothers and their pubertal daughters, and 31 mothers and their prepubertal daughters</td>
<td>-</td>
<td>Comparative study</td>
<td>The relationship between self-esteem and gender-role identity, and the criterion measure of body image</td>
<td>Results indicate a complex relationship between age, physical maturation and mother/daughter dynamics in contributing to the development of a positive body image for adolescent girls during puberty.</td>
</tr>
<tr>
<td>Cooper (1984)</td>
<td>22 adolescent school refusers and 45 adolescent disruptive truants</td>
<td>-</td>
<td>Comparative study</td>
<td>-</td>
<td>Self-perceptions are closely related to the objective assessments of school refusers and truants, as reported in the literature.</td>
</tr>
</tbody>
</table>

Patton, Bartrum and Creed (2004) conducted a study on a group of Australian high school students (N = 467), who were administered a scale measuring optimism, self-esteem, carrier expectations, carrier goals, carrier planning and carrier exploration. The study tested a carrier meditational model based on the Social-Cognitive Carrier Theory (SCCT) and Cognitive-Motivational-Relational Theory (CMR). The researchers hypothesised that, in the case of a stable person, the inputs of optimism and self-esteem would predict carrier planning and carrier
exploration through the variables of carrier expectations and carrier goals differentially for young males and females. The study results highlighted that, for males, optimism and self-esteem influenced carrier expectations, sequentially predicting carrier goals, carrier planning and carrier exploration. For females, a different pathway was identified, with optimism directly influencing carrier goals, which subsequently predicted carrier planning and carrier exploration.

Young and Bagley (1982) presented some of the most important theories on how children could acquire a sense of their identity, as individuals having attributes and qualities of different kinds. The authors tried to correlate the ideas of self-esteem, self-concept and identity, and concluded that self-esteem should be subsumed under and incorporated within the notion of global self-concept, which is equivalent to Erikson’s idea of identity. Adequate self-esteem is a necessary, but not a sufficient condition of adequate identity. What is important is the way in which global identity integrates past and present experiences, particularly in adolescence, so that the individual potential can be maximised. Obviously, social structure is an important enhancer of identity. (p. 41)

We consider it appropriate to bring to discussion the opinion of Bayard et al. (2014), who emphasise that adolescents’ self-esteem is an important indicator of their successful development and their well-being (p. 20). The authors investigated the impact of educational pathways on the development of self-esteem in girls and boys from Switzerland, starting with middle adolescence until late adolescence. They state that cooling-out processes after educational failure, which lead to a decrease in self-esteem, are more frequent among women than men and can be attributed to particular institutional characteristics of the stratified educational system in Switzerland and gender differences in the salience of social comparisons. In this cohort survey of children and youth, the first three research stages (2006-2009) were conducted when the respondents were 15, 16 and 18 years old. Self-esteem development was examined by using latent growth-curve models, and analyses showed an increase in self-esteem at both the mean and intra-individual levels, for all adolescents. However, the impact of educational success or failure in the years following the transition to post-compulsory education differs by gender. Evidence suggests that women’s self-esteem development is more affected by educational achievement than men’s.

The study conducted by Lo Cascio et al. (2013) on a total of 350 students aged 13 to 16 years explored the unique and common contributions of anxiety, self-esteem and family communication on indecisiveness among adolescents. The participating subjects completed self-report measures on indecisiveness, quality of family communication, trait anxiety and self-esteem. The study findings show that adolescents’ indecisiveness is predicted by family communication mediated by anxiety and self-esteem. These results have particular implications for practice, because they highlight the importance of anxiety and self-esteem. According to the authors, the counsellors could also focus on enhancing relationship-building skills by introducing the adolescents’ carrier formation as an adolescent-parent joint project.

Brown and Lohr (1987) examined the self-esteem of 221 students in grades 7-12 associated by peers with one of the five major school crowds and 106 adolescents relatively unknown by classmates and not associated with any school crowd. Among crowd members, self-esteem was directly related to the position of one’s crowd in the peer-group status hierarchy (based on peer-rated and self-perceived crowd affiliation). Outsiders’ self-esteem differed in both the accuracy of their reflected appraisals and the salience they attached to crowd affiliation. Crowd members, as a whole, exhibited higher self-esteem than outsiders, as a whole. However, differences were mediated by crowd status, salience of crowd affiliation and the accuracy of reflected appraisals.

To analyse the relationship between the predictive variables of self-esteem and gender-role identity, as well as the criterion measure of body image, Usmani and Daniluk (1997) examined 82 mothers and their pubertal daughters and 31 mothers and their prepubertal daughters. Regression analysis indicated that higher self-esteem was significantly related to positive body image scores for pubertal girls and both groups of mothers, but not for the prepubertal participants. The role of gender identity in contributing to body image was more complex, greater femininity being correlated with more positive body image for the prepubertal girls and the mothers of pubertal girls, and greater masculinity being correlated with more positive body image scores for the pubertal girls in the study. Mothers’ body image scores were positively correlated with their daughters’ body image scores for the mother/pubertal daughter pairs, but not for the mother/prepubertal daughter pairs in the study. Results indicate a complex relationship between age, physical maturation and mother/daughter dynamics in contributing to the development of a positive body image for adolescent girls during puberty.

The study conducted by Cooper (1984) describes and compares self-identity dimensions of 22 adolescent school refusers and 45 adolescent disruptive truants. The author has found that self-perceptions are closely related to objective evaluations of school refusers and truants reported in the literature. What is important is the way in which these absenteees perceive parents and teachers, and more importantly, how they feel these individuals relate to others. Such perceptions may influence any successful management of school absenteeism.
Identity and anxiety

The meta-analysis performed by Lillevoll, Kroger and Martinussen (2013) aimed to examine the relationship between identity status and anxiety. The research included 565 empirical identity status studies conducted between 1966 and 2005, of which 27 addressed the relationship between identity status and general anxiety; only 12 of these 27 investigations (N = 1,124 participants, mainly university students) provided data that could be examined through techniques of meta-analysis. The authors also determined the effect size differences in anxiety scores for each pair of identity statuses, by gender. Results showed that anxiety scores for identity statuses were in the generally predicted directions, although some gender differences occurred.

From the same perspective, after reviewing descriptive epidemiological studies, Hankin and Abramson (2001) have stated that the female preponderance in depression begins to emerge around the age of 13. The authors propose a cognitive vulnerability-transactional stress model of depression to explain the gender difference in the onset of depression. The causal chain postulates that negative events contribute to initial elevations of general negative affect. Generic cognitive vulnerability factors subsequently moderate the probability that the initial negative affect will progress to full depression. Increases in depression can lead transactionally to more self-generated negative life events, and thus the causal chain begins again. Evidence proves preliminary support for the model, as an explanation for the gender difference in depression during adolescence.

Cultural identity in adolescents

Cultural identity refers to the sense of belonging to a group or culture. The process also involves knowing and accepting traditions, heritage, language, religion, aesthetics, patterns of thought and social structures of a culture. People internalise the beliefs, values, social norms and practices of a particular culture, identifying with it. Culture becomes thus a part of the self-concept. (Lastig & Koester, 2013, p. 133)

Other researchers state that cultural identity refers to the content of values as guiding principles, the significant symbols and the lifestyles that individuals share with others, although not necessarily within recognizable groups (Boski, Strus, & Tiaga, 2004, p. 522).

Thomas (2015) analysed the relationship between dance and cultural identity among adolescent girls to create a performance piece centred on the question: What does it mean to be a girl in the twenty-first century? The three reasons for using dance in this project were: (a) to facilitate understanding of one’s identity through movement as narrative; (b) to collect and analyse qualitative data through movement; (c) to disseminate the project findings in an informative and easily accessed performance format. The method used to collect and analyse data was Community-based-participatory-research (CBPR). The results echoed the tenets of third-wave feminism, demonstrating an era of “girl power”, choice and gender equality. Although the method is not without flows and limitations, CBPR facilitates the use of research as a method for improving community structures, by employing community members as active participants who are involved in most research processes.

Guided by a risk and resilience framework, the study of Umaña-Taylor and Updegraff (2007) used cross-sectional data to examine the degree to which self-esteem, ethnic identity and cultural orientations of Latino adolescents (N = 274; mean age = 16.3; 47.1% women) mediated and moderated the relationship between perceived discrimination and depressive symptoms. Using a multiple-group comparative approach, analyses indicated that higher levels of ethnic identity exploration and resolution significantly predicted higher levels of self-esteem for both boys and girls. Moreover, self-esteem partially mediated the relationship between perceived discrimination and depressive symptoms in adolescents. Additional analyses revealed that boys’ cultural orientations moderated the relationship between perceived discrimination and both self-esteem and depressive symptoms. Overall, findings indicated that various aspects of the self (self-esteem, ethnic identity, cultural orientations) can reduce the risks associated with discrimination.

Moral identity

According to Frankfurt (1971, 1988), a person (but not a wanton) possesses the self-reflexive ability in order to examine his or her desires and form judgments on them. A person cares about the desirability of his or her desires (“second-order desires”) and wants to act in accordance with them (“second-order volitions”).

Similarly, Taylor (1989) argues that a person is the one who engages in strong evaluation, making thus careful ethical discriminations about what is better and worse, higher and lower, worthy and unworthy; and these discriminations are made against a “horizon of significance”, which frames and constitutes our self-understanding. From this perspective, our identity is defined by reference to things that have significance for us. Furthermore, it is a basic human aspiration to be connected to something of crucial importance, to something considered good,
worthy and of fundamental value; and this orientation to the good “is essential to being a functional moral agent” (p. 42).

While several early studies and theoretical articles have emphasised the role of moral reasoning, criticism has suggested that it failed to function properly as a predictor of moral motivation, and more recent morality models have shown that identity is the source of moral motivation. Empirical studies have indicated that moral identity develops through moral action, while theoretical studies have highlighted that moral identity develops through the concepts of moral knowledge, moral reasoning and moral functioning. When morality is an important factor for the individual, it intensifies the responsibility to constantly live a moral life.

In this regard, Hardy and Carlo (2005) raise critical questions for future research, such as: What is the causal nature of relations between moral identity and moral behaviour? What mechanisms link moral identity to moral action? What factors might mediate or moderate links between moral identity and moral action? How does moral identity develop? What factors influence moral identity development? The authors believe that more attention should be paid to the operationalisation and measurement of moral identity, that more methodological diversity and sophistication, and also more applied research, are needed in the studies on moral identity.

Discussions and conclusions

Adolescence is a social construct. In preindustrial societies, such a concept did not exist, children being considered adults with the onset of physical maturation and the beginning of apprenticeship to learn a trade. Only in the early 20th century, adolescence was defined, in the Western world, as a distinct stage of life. Adolescence provides growth opportunities in terms of physical size, but also relating to cognitive and social skills, autonomy, self-esteem and intimacy. (Papalia, Olds, & Feldman, 2010, pp. 354-355)

It has been noted that young people who have support from parents and school tend to have a positive development. In highly modern societies, the transition from childhood to adulthood is not marked by a singular event, but by a longer period called “transition adolescence”, which involves physical, cognitive, emotional and social changes that take several forms in the current different types of social, economic and cultural contexts (Crețu, 2009, pp. 309-312). The reduced social experience of adolescents may lead to identifications with inappropriate models (whether it is about traits or the models are adopted globally and uncritically, with all their qualities and defects), the creation of inaccessible ideals (beyond the real possibilities of the adolescent) or even the identification with false ideals (full of non-values or qualities inappropriate to social requirements) (Dumitrescu, 1978, p. 85).

A permanent concern during adolescence is the search for identity, which has occupational, sexual and axiological components. Erikson (1968) described the psychosocial conflict of adolescence as identity versus identity confusion; the virtue that is supposed to arise from this conflict is fidelity. In his research based on Erikson’s theory, Marcia (1966) talks about four identity statuses: identity achievement, moratorium, foreclosure and diffusion. As regards the idea that boys and girls follow different pathways in identity formation, researchers have diverse opinions.

Identity is an essential part of human experience, which marks a milestone in adolescent development (Calvert, 2002). In previous studies, identity had been addressed with a view to the relations in the inner world (such as personality and self-definition) and outer world (such as joint social actions). The Internet has created a new context to explore identity, virtual world providing a space for exploring a complex set of relationships, which is flexible and potentially anonymous. The language used on the Internet represents a new kind of discourse that creates opportunities for creativity and innovation, and thus the communities of users can express their identity (Crystal, 2001).

Although some studies suggest that girls’ self-esteem tend to decrease in adolescence, more recent research does not bring arguments in this respect. Previous research has proven that late adolescence is associated with developmental changes in identity formation, which leads to individual differences in identity statuses. Special attention was given to the identification and study of the four identity statuses, namely identity diffusion, foreclosure, moratorium and achievement.

Ego identity formation is a major event in personality development. Identity consolidation, which occurs in late adolescence, marks the end of childhood and the beginning of adulthood. Identity formation involves a synthesis of skills, beliefs and childhood identifications in a more or less coherent but unique whole, which gives the young adult both a sense of continuity with the past and a direction for the future. Closely related to the concept of identity, the concept of ego appears in numerous works, being sometimes replaced with that of identity. However, the concept of identity is much closer to that of self-image. Designed or not as a structure of knowledge, the ego
has always been regarded as something mysterious, unusual, as an entity that dominates the individual’s mental life and is exclusively responsible for his or her behaviour. (Heyman, 2005, p. 86)

In search of identity, of their place in the world and the group of belonging, the adolescent completes a life stage strongly imbued emotionally and intellectually. Adolescence is a period intensively lived, being a continuous search for one’s own self across social egos. The relationships of adolescents with their families are not always comfortable, their rebellions being something common in this period of life. According to studies, adolescents spend more time with peers, but their relationships with parents continue to be influential. The conflict with parents tends to be stronger in early adolescence. The effects of family structure and parents’ occupational status on adolescent development may depend on factors such as economic resources, quality of home environment and the attention paid by parents to child monitoring outside the home.

As to the conception of each society about ethnic and cultural identity, personal identity results from the individual’s own experience concretised in the feeling of existence and self-recognition by relating to others. Personal identity is a dynamic construction of the unity of self-awareness through inter-subjective relationships, verbal communications and social experiences.

According to Jenkins (1996), identity refers to the ways in which individuals and groups distinguish in their social relationships with other individuals and other groups. Therefore, identity is social and involves interaction and comparison. Identity is always symbolically constructed; it would be enough to mention clothing, accessories, gestures, language and behaviours to show that all these contribute to what an individual is through the associated social meanings.

References

STUDY ON PUPILS’ MOTIVATION FOR CHOOSING EXTRACURRICULAR ACTIVITIES – CHEERLEADING TEAM

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Abstract. The present paper shows our interest in the study of extracurricular activities, especially the cheerleading teams in schools. In our opinion, the cheerleading activity has its contribution to the development of important abilities at the physical, mental and personality levels, as well as at the behavioural level. We argue that, in the lower secondary school, extracurricular activities must play an important role, and therefore we picked, as a target group, girls in this schooling phase. The main goal of the study is to highlight and build a clear opinion on the motivation for practicing extracurricular activities – cheerleading teams for middle school girls. The questionnaire survey method was used for collecting the data, and the mathematical and statistical method was used for calculating and interpreting the results. We applied a questionnaire to 112 pupils, namely the Opinion questionnaire regarding the motivation for choosing the cheerleading team as an extracurricular activity (CHEV code). It comprises 11 items. The items need 11 responses ranging from 1 (= the least) to 5 (= the most). The results showed the pupils’ motivations for extracurricular activities, in our case, the cheerleading team.

Keywords: extracurricular activities, motivation, cheerleading team.

Introduction

The Law of National Education specifies that “the National Curriculum is used in secondary school and was designed in accordance with the specific needs of personal development and labour market requirements of each community” (Legea Educaţiei Naţionale nr. 1, 2011). According to this law, the National Curriculum is “the sum of learning experiences through which the institution ensures the fulfilling of educational purposes and the schooling outcome”. “Physical education is a component of general education, which is conducted in an organized manner or independently, and its content and specific concept aim at optimising the biomotor potential of the individual, as well as the cognitive, affective and social components that improve the quality of life” (Dragnea & Teodorescu, 2002).

Sports in general and particularly school sports represent a dynamic, pleasant and useful activity performed with the aim of perfecting the human being from all points of view. So, the range of extracurricular activities will be as differentiated as possible in order to ensure the complete functionality of leisure: information and formation, leisure, pleasure and fun. The content of specific formation of these extracurricular activities resembles the sports training. Extracurricular sports activities were authorised by the Ministry of Education Order 5718/22.12.2005 (Ordinul Ministerului Educaţiei, 2005) regarding the general planning in lower secondary schools. All extracurricular activities have positive effects on the harmonious physical development of the body through the development of abilities for the chosen sports activity and the improvement of biomotor indices, as well as on the mental level, because they are fun and provide determination, concentration ability, good movement control, emotional control and coping with stress in day-to-day life.

Thus, in the latest decades, the school sport has been a constant and increasingly popular social phenomenon. “During lower secondary school, there are some easy-to-accomplish objectives, because the way physical education classes are conducted is very pleasant and diversified and also because, at this age, children are characterised by an acute need for physical activity” (Raţă & Raţă, 2008, p 16).

In this respect, classes for school teams represent opportunities for socialisation and communication between students, with the aim of harmonising and modelling their behaviour. In our opinion, the cheerleading activity has its contribution to the development of important abilities at the physical, mental, personality and behavioural levels. At the end of the training, it is aimed that certain abilities required by the curricula are learnt. We argue with the PhD research achieved by Armanu (2010), who describes and proposes the main aspects of cheerleading teams’ activity, as an extracurricular activity.

This study intends to provide a clear picture of the motivation for practicing extracurricular activities – cheerleading teams among middle school pupils. To reach this goal, we aim to collect objective and relevant information regarding the opinions of pupils and some specialists in physical education field, with respect to practicing exercises and specific combinations for cheerleading teams.

Purpose of the research: determining the motivations of middle school pupils, in accordance with their preferences for extracurricular sport activities, for choosing the cheerleading teams.
Tasks of the research: building the sample of participants; establishing the methods, instruments, procedure and corresponding frame of the research; collecting, processing and interpreting the data; showing the opinions of pupils from Middle School no. 7 in Resita; drawing conclusions.

Material and methods

The methods used in this research were: study of the documents related to the research topic; the questionnaire survey method; mathematical and statistical method for data processing.

The research was conducted at Middle School no. 7 in Resita. A total number of 112 pupils in the 5th and 6th grades took part in the research.

We used a special questionnaire designed for pupils, namely the Opinion questionnaire regarding the motivation for choosing the cheerleading team as an extracurricular activity (CHEV code). This questionnaire consists of 11 items. The items require 11 responses for 11 reasons related to the option for the cheerleading activity. The total number of responses was distributed on a 5-level scale ranging from 1 (= the least) to 5 (= the most).

The questionnaire was applied during the sport classes, in similar conditions.

Results

The responses were put in the tables below (Tables 1-3). They were processed both quantitatively and qualitatively, corresponding to their distribution on the 5-level scale of the questionnaire.

The 5 levels of CHEV regarding the pupils’ responses, from a qualitative point of view, are: 1 = the least, 2 = little, 3 = much, 4 = very much, 5 = the most.

Table 1. Numerically expressed CHEV results

<table>
<thead>
<tr>
<th>Items</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>The option for school cheerleading teams is because you want to:</td>
<td></td>
</tr>
<tr>
<td>- have good health</td>
<td>0</td>
</tr>
<tr>
<td>- have a nice harmoniously developed body</td>
<td>0</td>
</tr>
<tr>
<td>- improve your motor abilities (strength, speed, mobility, endurance)</td>
<td>6</td>
</tr>
<tr>
<td>- learn new movements and perform them on music</td>
<td>2</td>
</tr>
<tr>
<td>- improve your coordination, space orientation and distance estimation,</td>
<td>2</td>
</tr>
<tr>
<td>balance, rhythm sense and ambidexterity</td>
<td>8</td>
</tr>
<tr>
<td>- spend your spare time pleasantly</td>
<td>0</td>
</tr>
<tr>
<td>- be with your colleagues</td>
<td>0</td>
</tr>
<tr>
<td>- make new friends</td>
<td>0</td>
</tr>
<tr>
<td>- participate in competitions</td>
<td>1</td>
</tr>
<tr>
<td>- represent the school</td>
<td>0</td>
</tr>
<tr>
<td>- relax</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2. CHEV results expressed in percentile

<table>
<thead>
<tr>
<th>Items</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>The option for school cheerleading teams is because you want to:</td>
<td></td>
</tr>
<tr>
<td>- have good health</td>
<td>0</td>
</tr>
<tr>
<td>- have a nice harmoniously developed body</td>
<td>0</td>
</tr>
<tr>
<td>- improve your motor abilities (strength, speed, mobility, endurance)</td>
<td>5.3</td>
</tr>
<tr>
<td>- learn new movements and perform them on music</td>
<td>1.78</td>
</tr>
<tr>
<td>- improve your coordination, space orientation and distance estimation,</td>
<td>1.78</td>
</tr>
<tr>
<td>balance, rhythm sense and ambidexterity</td>
<td>7.14</td>
</tr>
<tr>
<td>- spend your spare time pleasantly</td>
<td>0</td>
</tr>
<tr>
<td>- be with your colleagues</td>
<td>0</td>
</tr>
<tr>
<td>- make new friends</td>
<td>0</td>
</tr>
<tr>
<td>- participate in competitions</td>
<td>0.89</td>
</tr>
</tbody>
</table>
Table 3. Minimal and maximal values of the results/options

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Option</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min. value</td>
</tr>
<tr>
<td>1</td>
<td>to have good health</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>to have a nice harmoniously developed body</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>to improve your motor abilities (strength, speed, mobility, endurance)</td>
<td>4 (3.57%)</td>
</tr>
<tr>
<td>4</td>
<td>to learn new movements and perform them on music</td>
<td>1 (0.89%)</td>
</tr>
<tr>
<td>5</td>
<td>to improve your coordination, space orientation and distance estimation, balance, rhythm sense and ambidexterity</td>
<td>2 (1.78%)</td>
</tr>
<tr>
<td>6</td>
<td>to spend your spare time pleasantly</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>to be with your colleagues</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>to make new friends</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>to participate in competitions</td>
<td>1 (0.89)</td>
</tr>
<tr>
<td>10</td>
<td>to represent the school</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>to relax</td>
<td>0</td>
</tr>
</tbody>
</table>

Discussions and conclusions

The data analysis was performed both quantitatively and qualitatively. The analysis of the responses of the 112 pupils to the questionnaire items gives interesting information that allows us to build a general picture of their motivations for choosing the school cheerleading team as an extracurricular activity.

At first sight, one can notice responses for all levels of the range, from minimum 0 to maximum 86 responses. The responses represent the basis of the option for the cheerleading team. They indicate the health status, the beauty of the body, motor abilities, psychomotor abilities, spare time, the desire to be with colleagues and building new friendships, the desire to participate in competitions or to represent the school in specific competitions and, not least, the wish for relaxation.

The analysis of results regarding the “need for a good health state” shows that there are no responses on the whole scale. There is no response for levels 1 and 2. According to the scale, the distribution of responses was the following: 44 (39.28%) for level 3; 51 (45.53%) for level 4; 17 (15.17%) for level 5.

The analysis of results for the option “to have a nice body” shows that there are no responses on the whole scale. There is no response for level 1. According to the scale, the distribution of responses was the following: 2 (1.78%) for level 2; 10 (8.92%) for level 3; 36 (32.14%) for level 4; 64 (57.17%) for level 5.

The analysis of results regarding the “desire to improve motor abilities (strength, speed, mobility, endurance)” shows that there are results on the whole scale, which proves different opinions. We believe that the 6 responses for level 1 and the 4 responses for level 5 prove a certain misunderstanding of the item. According to the ranging, the distribution of responses was the following: 6 (5.35%) for level 1; 31 (27.67%) for level 2; 36 (32.14%) for level 3; 51 (45.53%) for level 4; 4 (3.57%) for level 5.

The analysis of results regarding the “desire to learn new movements” shows that there are responses on the whole scale, which means that there are different opinions of the pupils. We think that the 2 responses for level 1 and 1 for level 5, having most of the responses at the middle of the scale, prove the benefit of music for the well-being and the pleasure of executing movements on the preferred music. According to the scale, the distribution of responses was the following: 2 (1.78%) for level 1; 7 (6.25%) for level 2; 83 (74.10%) for level 3; 19 (16.96%) for level 4; 1 (0.89%) for level 5.

The analysis of results regarding the “desire to improve certain components of psychomotority (coordination, space orientation and distance appreciation, balance, rhythm sense and ambidexterity)” shows that there are results on the whole scale, which proves the different opinions of pupils. We consider that the 2 responses for level 1 and 5, leaving the majority of responses for the middle of the range, prove that pupils perceive correctly the importance of the psychomotority components and put them accordingly in relation to choreography and pompon handling. According to the scale, the distribution of responses was the following: 2 (1.78%) for level 1; 8 (7.14%) for level 2; 76 (67.85%) for level 3; 21 (18.75%) for level 4; 5 (4.46%) for level 5.

The analysis of results regarding the “desire to spend spare time pleasantly” shows that there are no responses on the whole scale. There is no response for levels 1 and 2. The high number of responses, 105, representing 93.75% for levels 4 and 5 together, proves that this aspect is one of those that determine the option. According to
the scale, the distribution of responses was the following: 2 (1.78%) for level 1; 8 (7.14%) for level 2; 76 (67.85%) for level 3; 21 (18.75%) for level 4; 5 (4.46%) for level 5.

The analysis of results regarding the “desire to be with colleagues” shows that there are no responses on the whole scale. There are no responses for levels 1 and 2. The small number of responses for level 3, 7 (6.25%), and the 105 responses representing 93.75%, show the importance of practicing sport (specific cheerleading exercises, in our case) with colleagues and spending spare time together. The 86 (76.78%) responses for level 5 prove a very important aspect that determines the pupils’ options for extracurricular activities – the cheerleading team. According to the scale, the distribution of responses was the following: 7 (6.25%) for level 3; 19 (16.96%) for level 4; 86 (76.78%) for level 5.

The analysis of results regarding the option “to make new friends” shows that there are no responses on the whole scale. There was no response for level 1. The majority of responses are at the middle of the range (93 – 83.03%), which shows that building new friendships within the activity performed together (cheerleading teams) is important and appreciated by the pupils. According to the scale, the distribution of responses was the following: 2 (1.78%) for level 2; 15 (13.39%) for level 3; 78 (69.64%) for level 4; 17 (15.17%) for level 5.

The analysis of results regarding the “desire to participate in competitions” shows that there are responses on the whole scale, which proves that pupils have different opinions. We believe that 1 response for level 1 and more responses at the middle of the range prove that pupils perceive correctly the importance of competition in their life and put it in relation with other aspects on which their option for the cheerleading team is based. According to the scale, the distribution of responses was the following: 1 (0.89%) for level; 3 (2.67%) for level 2; 37 (33.03%) for level 3; 66 (58.92%) for level 4; 5 (4.46%) for level 5.

The analysis of results regarding the “desire to represent the school” shows that there are no responses on the whole scale. There is no response for level 1. The majority of responses are at the middle of the scale (108 – 96.42%), which proves that representing school by the cheerleading team’s activity is interesting for the pupils. According to the scale, the distribution of responses was the following: 2 (1.78%) for level 2; 48 (42.85%) for level 3; 60 (53.57%) for level 4; 2 (1.78%) for level 5.

The analysis of results regarding the “need for relaxation” shows that there are no responses on the whole scale. There is no response for level 1 and level 5. The majority of responses are at the middle of the scale (105 – 93.75%), which proves that, together with the above aspects, the pupils need relaxation and believe that they can achieve this by participating in extracurricular cheerleading activities. According to the scale, the distribution of responses was the following: 7 (6.25%) for level 2; 47 (41.96%) for level 3; 58 (51.78%) for level 4.

To conclude, we consider that the purpose and objectives of this paper have been achieved, the pupils having distinct motivations for their options, motivations that are presented in the conducted research.

References

SIMULATING THE PHYSIOLOGY OF SHORT-DISTANCE MAXIMAL EFFORT IN ELITE ROWERS THROUGH ENERGY METABOLISM CONVERSION

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Abstract. Functional changes, such as high energy costs, increased acidity produced during effort and changes regarding body composition impose reduced economy and the athlete’s performance during maximal effort. The physiological variability through increased aerobic capacity requires high glycolytic capacity, which will generate high-energy demand during maximal effort, an improvement being possible by increasing power and cardiopulmonary adaptation. An observational study was conducted on 30 elite rowers with national and international results in competitions. A VO₂max test was performed over the distance of 1250 m using the Cosmed Quark CPET equipment and the specific Concept 2 ergometer. A maximal test was performed during the general training period, associated with the first training stages in the 2016-2017 competitive season. VO₂max testing results were associated with a total effort time of 207.3±7.92 seconds. The evolution of aerobic metabolism was monitored in a proportion of 79.26±5.09%, along with 19.62±5.02% anaerobic metabolism. The estimated energy consumption reached the value 88.14±5.35 kcal by dividing non-protein macronutrients, such as carbohydrates, and fat consumption during maximal effort. Energy demands during the effort were associated with a consumption of 92.48±2.87% carbohydrates and 7.59±3.92% lipids. Increased strength was linked to increased energy density use, associated with an increased contribution of muscle glycogen. In the 1250 m maximal effort, the aerobic metabolism contribution was increased, while anaerobic metabolism had a smaller proportion of energy distribution. The energy density was influenced by cardiopulmonary adaptation through tidal volume, ventilation and VO₂ value, along with the respiratory exchange ratio.

Keywords: rowing, metabolism, aerobic capacity, anaerobic capacity, VO₂

Introduction

Body adaptation and cardiopulmonary improvement following training stages increase athletic performance. Functional changes, such as low energy costs, increased acidity production during effort, along with several changes regarding the body composition, lead to reduced economy and performance during maximal effort. Lowering energy substrate availability causes a reduction in the athlete’s evolution during efforts that exceed 5,000 m (Woods et al., 2017). During maximal effort, the activity will be dependent on the evolution and the body’s ability to maintain homeostasis. Also, in practice, reducing carbon dioxide production (CO₂), associated with high carbohydrate consumption and produced acidity, as a result of the specific effort, will be monitored.

Limiting external factors in the development of athlete’s aerobic capacity during cold periods has led to an increase in indoor work through specialised ergometers, in order to generate significant progress and performance in relation to controlled training conditions (Benson et al., 2011; Smith & Hopkins, 2012; Nevill et al., 2010). The development of energy metabolism, according to literature, emphasises the contribution of aerobic metabolism in a proportion of 65-75% and 20-30% anaerobic metabolism (Akça, 2014) during maximal effort. Therefore, it should be considered that efficiency, economy and performance during maximal effort depend on the anaerobic metabolism energy distribution. At the same time, the reduced amount of adenosine triphosphate (ATP) stored in the body requires the use of variable energy systems in order to maintain muscle contraction during several minutes of effort. VO₂ progress during the season will influence carbohydrate and lipid metabolism in association with the specific effort (de Campos Mello et al., 2009; Gastin, 2001). Glycolytic capacity reduction was reported within groups of athletes of older age and with increased fat metabolism during maximal effort through ATP phosphorylation via phosphocreatine (Heydenreich et al., 2017).

In association with the effort, a number of parameters can be included in the analysis proposed by recent studies. Thus, gas exchange will take place at cellular level, where both oxygen consumption and carbon dioxide production will influence the mitochondria level depending on the exchange and quality of the products, an aspect which will influence the respiratory exchange ratio and the final amount of energy required during effort (Qureshi, 2014). Such changes will be associated with lactic acid accumulation, muscle pH reduction, an increased end-tidal oxygen tension (PetO₂) and a reduction in end-tidal carbon dioxide tension (PetCO₂). Also, conducting a prolonged effort at a respiratory exchange ratio (RER) value of ≥1.10 is associated with significant increases in lactic acid, which may compromise the effectiveness of the action and effort continuity through acid-base imbalances (Martin & Tomescu, 2016).
Hypothesis

Monitoring the effort adaption during maximal effort can create different profiles to support the athlete’s training program. Meanwhile, the physiological variability, by increasing aerobic capacity, will impose an increased metabolic adaptation, which can improve total force (W) along with cardiopulmonary and energy metabolism adaptation. This action will be associated with improved effort adaptation and performance by reducing CO2exp, and increasing lipid metabolism through ATP+CP fraction, leading to the enhancement of the 1250 m performance.

Material and methods

A transverse observational study was conducted after obtaining the written consent to use the data from the federal management and after obtaining the athlete’s agreement to participate in the research. An observational study was conducted in November 2016 in Bucharest, Romania, representing the training centre of the athletes. The study group comprised 30 male rowers with national and international results in elite rowing competitions.

Inclusion criteria were the acceptance to participate in the research stages and the presence of the athlete in the main training group with national/international performance, alongside the clinical medical health condition. Exclusion criteria were based on medical and functional condition confirmed by the medical visa given to athletes involved in the study, along with the presence within the study group, the acceptance to participate in the study and the progress of athletes during the 2016-2017 competitive season.

A VO2max test was conducted indoors over a distance of 1250 m, using the Cosmed Quark CPET equipment and the specific Concept 2 ergometer. The maximal test was performed during the general training period, representing the first training stage in the 2016-2017 competitive season. The conducted VO2max test was performed indoors in order to limit the influence of external factors, such as temperature, wind and humidity. Thus, the methodology development was based on a rectangular, maximal activity protocol, without imposing intensity in several stages during exercise. During performance, we quantified the shortest time (seconds - s) obtained on the ergometer over the 1250 m distance imposed for this research activity. Thus, the test was performed using the Cosmed Quark CPET equipment (Rome, Italy) and the Concept 2 ergometer (USA). Heart rate was monitored through ANT+/Bluetooth heart rate monitor marketed by Cosmed. The Cosmed Quark CPET equipment was calibrated at the start of each test with known gas concentrations, such as O2 concentration of 16%, and 2% CO2 concentration. The turbine was calibrated with a specialised 3-L Cosmed syringe after each test.

The athletes’ preparation for maximal effort was achieved through kinaesthetic exercise performed for 25 minutes, along with specific functional adaptation and growth potential activity, by simulating a specific effort on ergometers at a heart rate range between 120-180 b/min, representing 80-85% of the theoretical HRmax. The main parameters studied were: inactive mass (%), 1250 m completion time (s), evolution meters/second (m/s), power (W), force (N), work (J), speed (km/h), respiratory frequency (RF), ventilation (VE). Oxygen volume consumption (VO2), HR (heart rate), % of maximum heart rate (% HRmax), ventilatory equivalent ratio for oxygen (VE/VO2), ventilatory equivalent ratio for carbon dioxide (VE/VCO2), metabolic equivalent (METS), tidal volume (VT), oxygen consumption (O2exp), carbon dioxide production (CO2exp), respiratory exchange ratio (RER), respiratory quotient (RQ), fraction of oxygen in the expired air (FeO2%), fraction of carbon dioxide in the expired air (FeCO2%), fraction of inspired oxygen (FiO2%), fraction of inspired carbon dioxide (FiCO2%), end-tidal oxygen (PetO2), end-tidal carbon dioxide (PetCO2), alveolar oxygen tension (PaO2), alveolar carbon dioxide (PaCO2), dead space (VD), the ratio of dead space over tidal volume (VD/VT), carbohydrate consumption (CHO%/ kcal), fat consumption (fat%/ kcal), energy consumption (kcal/min). With the use of the mentioned parameters, we monitored the energy metabolism through ATP (adenosine triphosphate), ATP+CP (ATP phosphorylation through phosphocreatine) and muscle glycogen.

Measuring the percentage of inactive mass was done using the specialised Cosmed Skinfold Calliper, basal and pre-maximal tests. The percentage of inactive mass was calculated and assessed through the Durnin/Womersley measuring method, including the following skinfold measurements: Biceps, Triceps, Subscapular and Suprailiac, reported in millimetres.

GraphPad Prism 5.0 software was used for statistical data evaluation. The proposed indicators in data analysis and interpretation were: standard deviation (SD), standard error (SE), coefficient of variation (CV), mean and median values. The level of significance was set at α<0.05, with a confidence interval of 95%. Data illustration was done by exposing the average value ± standard deviation (Mean±SD) and median value (median).
Results

Mean age in the study group reached 20±2.08 years, with reported anthropometric data equivalent to 193.9±4.98 cm height, 95.64±9.06 kg body weight and 15.05±3.08% inactive mass. The VO_{2}\text{max} testing results recorded in the early stage of the training season were equivalent to a total completion time on the ergometer of 207.3±7.92 s. On average, the athletes completed 6.03±0.21 m/s, a value associated with a relative power of 469.3±56.43 W (CV=12.02%), at a travelling speed of 21.73±0.78 km/h. By targeting the athlete’s progress through 1250 m completion time, we obtained statistically significant differences within the determined ratio of force (N) and work (J). (Figure 1)

![Figure 1](image1.png)

Figure 1. The relationship regarding time evolution and force (N) (p = 0.0005, r = -0.597, CI 95% = -0792 to -0292), along with work (J) (p = 0.0005, r = -0.597, CI 95% = -0792 to -0292)

Thus, the estimated energy consumption during the test reached a value of 88.14±5.35 kcal by dividing non-protein macronutrients, such as carbohydrates 20.48±1.79 g, and fat 1.02±0.27 g, representing a total energy consumption of 92.48±3.87% carbohydrates and 7.59±3.92% fat during the effort. The evolution of aerobic metabolism during maximal effort was estimated to 79.26±5.09%, along with the anaerobic metabolism, which had the value 19.62±5.02%, as shown in Figure 2.

![Figure 2](image2.png)

Figure 2. Energy metabolism evolution highlighted through: ATP (2.03±1.01%), ATP+CP (17.59±5.02%) and muscle glycogen (79.26±5.09%) (Mean±SD)

The energy metabolism evolution monitored during testing emphasises the variability regarding effort adaptation per time unit in the study group. Energy distribution through ATP was monitored in the primary activity for 10.7±4.94 s, along with ATP+CP for 44.04±12.48 s, and an increased muscle glycogen fraction, confirmed by the RER value 1.0 for 152.6±12.42 s.

During maximal testing, through a direct relationship with the athletes’ performance, we identified an increased speed evolution (21.73±0.78 km/h) in association with a VE maximum reached point (253 L/min) and a reported high value of VO_{2} (5.8 L/min). At the same time, the increased speed during maximal effort imposed an adaptation of FiCO_{2} along with the energy density used during the effort, both of them being increased. Increasing speed during the test was associated with increased energy distribution from ATP+CP fraction and muscle glycogen, as shown in Table 1.
Table 1. The association of speed (km/h) with the athlete’s cardiopulmonary adaptation

<table>
<thead>
<tr>
<th>Proposed parameters</th>
<th>Statistical results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter 1</td>
<td>Parameter 2</td>
</tr>
<tr>
<td>Force</td>
<td></td>
</tr>
<tr>
<td>Work</td>
<td></td>
</tr>
<tr>
<td>VE_{max}</td>
<td></td>
</tr>
<tr>
<td>VO_{2}</td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>21.73±0.78 km/h</td>
</tr>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

Force (N) parameter has imposed a series of results which indicate that increased evolution is associated with increased VO_{2} (p = 0.0001, r = 0.729, CI 95% = 0500 to 0862), VT (p = 0.0129, r = 0.448, CI 95% = 0105-0696) imposing a reduction in FeO_{2}. As a result, increasing the force on the ergometer was associated with increased energy density used by the athlete during effort (p = 0.0001, r = 0.710, CI 95% = 0471 to 0852). This action was associated with a proportionate increase in energy density obtained through muscle glycogen, confirmed by the RER value 1.0. (Figure 3).

Figure 3. Energy density evolution (p = 0.0001, r = 0.748, CI 95% = 0531 to 0873) and FeO_{2} (p = 0.0400, r = -0.377, CI 95% = -0649 to -0019) in a direct relationship with the force (N) generated during maximal effort.

The most elevated values in CO_{2} production were monitored in association with increased power or force during the test. Increasing Rf imposed a reduction in CO_{2} through increased VT and VO_{2} values. The energy provided during the effort through ATP fraction was higher in the case of younger athletes, whose maximum heart rate reached an increased value, along with an increase in VE/VO_{2} and FeO_{2}. The association of low ATP fraction level was achieved with increased VO_{2}/HR ratio, while increased aerobic threshold was associated with an increased energy supply through ATP+CP during maximal effort (Table 2).
Table 2. The association of CO₂ exp production along with ATP production with cardiopulmonary parameters

<table>
<thead>
<tr>
<th>Proposed parameters</th>
<th>Statistical results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter 1 Mean±SD</td>
<td>Parameter 2 Mean±SD</td>
</tr>
<tr>
<td>CO₂ exp 115.4±14.43 ml/min</td>
<td>Rf 60.65±5.04 b/min</td>
</tr>
<tr>
<td></td>
<td>VT 2.88±0.28 l/min</td>
</tr>
<tr>
<td></td>
<td>VO₂ 4895±356.4 ml/min</td>
</tr>
<tr>
<td></td>
<td>VO₂/HR 26.68±1.99 ml/b/min</td>
</tr>
<tr>
<td></td>
<td>HR 181.8±5.88 b/min</td>
</tr>
<tr>
<td>ATP 10.70±4.94 s</td>
<td>VE/VO₂ 36.19±3.00</td>
</tr>
<tr>
<td></td>
<td>FeO₂ 17.38±0.25%</td>
</tr>
<tr>
<td></td>
<td>VO₂/HR 26.68±1.99 ml/b/min</td>
</tr>
</tbody>
</table>

ATP energy fraction was linked with the maximum heart rate monitored in the study group, which stated that increased average age might impose a higher ATP+CP fraction during maximal effort. ATP+CP reduction during the effort was associated with increased VE/VO₂, PaO₂ (Table 3) and a reduction in respiratory exchange ratio during exercise, being related to an increased RQ 1.0 point (p = 0.0001, r = 0.903, CI 95% = 0.806 to 0.953).

Table 3. Main cardiopulmonary parameters which influenced the energy metabolism

<table>
<thead>
<tr>
<th>Proposed parameters</th>
<th>Statistical results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter 1 Mean±SD</td>
<td>Parameter 2 Mean±SD</td>
</tr>
<tr>
<td>HR max 200.7±2.08 b/min</td>
<td>VE/VO₂ 36.19±3.00</td>
</tr>
<tr>
<td></td>
<td>RER 1.15±0.06</td>
</tr>
<tr>
<td></td>
<td>RQ 54.4±11.29 s</td>
</tr>
<tr>
<td></td>
<td>FeO₂ 17.38±0.25%</td>
</tr>
<tr>
<td></td>
<td>PaO₂ 116±2.44%</td>
</tr>
</tbody>
</table>

Increasing the energy fraction from muscle glycogen was associated with an elevated HR max, a younger mean age in the study group, along with a longer 1250 m completion time. Through the conducted analysis, the increased contribution of the aerobic metabolism during VO₂ max testing was associated with increased VO₂, PetO₂, PaO₂, along with the VE/VO₂ and RER values (Table 3).
The general evolution regarding $\text{VO}_2$, $\text{VCO}_2$ and energy consumption during the VO$_2$max testing imposed in the study is related to the cardiopulmonary performance obtained during the 1250 m maximal effort test (Figure 5).

### Discussions

Energy distribution during specific effort is reported from two different general energy systems known as the anaerobic and aerobic systems, according to the literature. Thus, the proportions of aerobic and anaerobic systems are in a position similar to those determined in other studies (De Campo Mello et al., 2009; Beneke et al., 2004), at a value of 79.26±5.09% aerobic metabolism and 19.62±5.02% anaerobic metabolism. The methodology of the study will impose differences in results in various articles. It is believed that the use of Concept 2 ergometer will lead to much stronger associations and effort specificity description, an assumption also described by Benson et al. (2011) and confirmed by the completion time (207.3±7.92 s), and power (469.3±56.43 W) evolution from our study compared to other papers. However, stable measuring functions through the equipment used, such as data filtering and average time recording, will not impose significant relevance, given the distance of 1250 m and the related short-time effort.

Energy sources used at the beginning of the effort for a short period of time, due to low concentrations, was associated with adenosine triphosphate hydrolysis (ATP). The action described by Gastin (2001) during specific maximal activity as being the first energy fraction involved during the effort was reported in our study at a value of 2.03±1.01% energy distribution. Along with the activity, energy distribution was based on the use of phosphates, phosphocreatine and ATP to provide energy during the effort (De Feo et al., 2003). The body’s inability to support the effort carried out by the athletes imposed an aerobic degradation of carbohydrates, pyruvic acid and lactic acid via glycolysis, as described by Duffield, Dawson and Goodman (2005), and was associated in our study to 17.59±5.02% of the energy distribution during VO$_2$max testing. However, an increased number of athletes seem to maintain this stage in order to supply ATP+CP energy for a longer period of time, which, in our study, translates into a statistical relationship between RER and RQ values ($p = 0.0001$, $r = 0.903$, CI 95% = 0.806 to 0.953). Most papers state that both power and force are dependent on the neuromuscular relationship and muscle fibre distribution (Artioli et al. 2012), physiological functions that could not be monitored through the
methodology proposed in this paper. Furthermore, the athlete’s age appears to influence this important stage of energy fraction at the start of the effort (p = 0.0265, r = -0.404, CI 95% = -0.667 to -0.052). Athletes in the younger age group (≤20 years) have a higher glycolytic capacity, which is most often associated with a significant increase in respiratory exchange ratio during exercise (RER ≥1.10), as against older age groups (Bertuzzi et al., 2013; Lepers & Stapley, 2016).

All of the adaptations mentioned may be dictated by the VO$_2$ value and energy metabolism evolution, statistically related in our paper (p = 0.0140, r = 0.444, CI 95% = 0.693 to 0.099). Adaptation, which was also identified by Bishop, Bonetti and Dawson (2002), requires an improvement in the body’s ability to use different energy sources during exercise by involving cardiopulmonary adaptation. Thus, conducting gas exchange at cellular level, where both O$_2$exp and CO$_2$exp will be related to mitochondria depending on the exchange and quality of the products (Poole & Jones, 2012), will influence the respiratory exchange ratio and the final amount of energy required during maximal effort. Evolution was stated through CO$_2$ (115.4±14.43 ml/min) evolution and related to Rf, VT, VO$_2$ and O$_2$ (507.2±49.95 ml/min) parameters.

The third fraction of energy distribution is associated with aerobic energy, known as different stages of oxidative metabolic state involving the carbohydrate source and protein in the presence of oxygen, reported over a period of 152.6±12.42 s in our study, is similar to that reported by de Lucas et al. (2014). This energy system, through the papers proposed in the literature, is important during both maximal effort and different stages of rowing training. Aerobic training is considered one of the most important forms of influencing oxygen consumption, which will be related, at the beginning of the effort, to oxygen transport along with metabolic development (Stöggl & Sperlich, 2015; Sousa et al. 2014). As a result, the contribution of the aerobic system is significantly increased during the specific effort that exceeds 60 seconds, stated in our paper to a proportion of 79.26±5.09%. A reduction was reported in association with maximal short-distance effort characterised by the anaerobic system adaptation, as related in the papers of Spencer and Gastin (2001) and de Campos Mello et al. (2009).

Conclusions

Energy metabolism variability is related to the level of training. An increase in aerobic capacity and an improvement in the maximum VO$_2$ value will impose a proportional increase in the energy density used during maximal exercise. O$_2$exp consumption growth, in this case, imposed an increase in energy distribution from fat, limiting the fraction of carbohydrates. In the specific rowing effort, during the VO$_2$max testing over 1250 m, the proportion of aerobic metabolism had an increased energy distribution ratio, reporting a reduction in anaerobic metabolism. Thus, the energy density of the VO$_2$max testing reached a value of 25.54±1.81kcal/min, influenced by cardiopulmonary adaptation through tidal volume, ventilation and VO$_2$ value, along with the respiratory exchange ratio.

References


SATISFACTION LEVEL OF THE SPECTATORS INTERESTED IN HANDBALL MATCHES IN BACAU

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Abstract. Handball is a sports team with large spectator interest due to its dynamic character, but also to its relatively simple rules, which are easy to understand. In Bacau, handball teams, both male and female ones, have recorded over time important national and international results, which determined the growth in popularity of this sport. Thus, these teams have been supported by an important amount of spectators, but it is nowadays noticed a decrease in the public interest on a local level. This represents the motivation of our study, considering that the interested handball viewers’ level of satisfaction could be a determinant factor for the decrease in the number of spectators at the local handball matches. This paper represents a study about the level of satisfaction for handball spectators. Hypothesis: The accomplishment of a study concerning the level of satisfaction of spectators in Bacau regarding the evolution of handball games leads to identifying the means of promoting the games to their diversification. Research methods: The questionnaire survey as a main research method, the study of literature and the mathematical and statistical method for data processing and interpretation. The results allowed us to make a synthetic picture of the spectators’ satisfaction and to identify new and diverse ways of promoting handball matches.

Keywords: handball, popularity, promotion.

Introduction

Handball is a very popular and attractive sport, with a simple set of rules which are easily understood by the audience. It is also a very spectacular and entertaining sport. A handball match played between two good teams can offer an adrenaline rush for both players and spectators and keep all parties involved in the event.

In Bacau, handball teams, both male and female ones, obtained significant results in the internal and international championships, winning the Vice-champion title in the season 2014-2015. It was through their endeavours rewarded by this excellent result that they succeeded in promoting the team and bringing fans and spectators in the sports hall.

The referential power of communication assumes that “the receiver identifies him/herself with the transmitter; a person or a prestigious group may be a reference model with whom he/she tries to identify, who adopts their attitudes” (Negulescu, 2007, p. 33). This is a principle underlying our interpretations, and thus we infer that the players can become role models through the values they promote.

The theme for this research was chosen because we observed that, locally, there is a continuous decrease in the number of spectators. We have been informed by the Stiinta Municipal Dedeman Bacau team members that the public support is extremely important, acting as “the seventh player” through their enthusiasm and psychological support given to those who are effectively on the court. Due to the financial problems the team is facing, the number of players has diminished considerably and the results on the court no longer measure up to the spectators’ expectations. The disappointment felt with the team has influenced the number of spectators, who gave up coming to matches to support their favourite team. In an attempt to solve this problem, the players launched a campaign called “Science will not die”, in which the players made small videos to encourage the spectators to come to matches. “Now, there’s only us and you. Come to the sports hall” (Tamaș Răducu Andrei). Unfortunately, this campaign did not have the expected success.

Through this research, we want to outline the weak points of the team’s promotion campaign in order to improve the public relations strategy that already exists. “Socialising is the process through which people can acquire different attitudes, values and behaviours that make them able to participate as members of the society they live in” (Freedson, 1991).

Anshel (2007) describes this field as “the study of psychological factors underlying participation and adherence to physical activity programs”.

Through its social and cultural dimensions, playing a sport is a unique opportunity to know other people, communicate with them, assume different roles and acquire moral attitudes (such as tolerance, respect for other people etc.). It contributes to personal development, offers the player and the viewer intense emotions and gives all parties involved a clear view of some positive lifestyle elements.

The advantage of sport is based on its influence on the mind and the body. This way, it contributes to socialising through movement. Through the effect of movement and the nature of social contacts, the sport leads to personal development.
According to Stancu (2008), the structure of public relations (PR) contains groups, official and nonofficial institutions that develop public relations and/or image influence (p. 11). The term refers to public relations institutions and presidential staffs. A PR system has a very complex structure meant to withstand the exerted pressures. The strategy (communication plan) is structured by the public relations image managers, along with the objectives and available resources for a public relations campaign. According to Tran and Stângiucelu (2003), “communication has been perceived as a fundamental element of the human existence since the Antiquity” (p. 12). In fact, the word “communication” comes from the Latin communis, which means to accord with, to be connected to, to be in touch with, although the term is now used for transmitting to others, sharing something with others.

**Material and methods**

This research has started from the hypothesis according to which the satisfaction level of spectators in Bacau concerning handball games can determine the diversification of the promotion means and implicitly the growth in the number of spectators.

The following research methods were used in this paper:
- The investigation method – using a satisfaction survey as a work instrument conceived for this research;
- The documentation method – by studying the literature on the topic addressed;
- The statistical method – to process and analyse the data.

The main objective of the research is to establish the satisfaction level of spectators and local handball teams’ supporters concerning the promotion of teams, games and the results they have obtained.

Among the tasks of the paper, we recall: developing a satisfaction-level survey and applying it to handball spectators in Bacau, in order to collect, process and interpret the data, and draw relevant conclusions for our study.

This research was achieved in various stages, as follows: documentation, developing the survey called “Survey on the satisfaction level of the handball game spectators in Bacau”, applying the survey to the spectators in Bacau, collecting, processing and interpreting the data, and disseminating the information.

This research was developed during the national handball league play-off, in March-April 2015. We applied 50 questionnaires to a representative sample aged between 14 and 60 years (Figure 1), 18 women and 32 men, 11 with high-school studies, 26 people who graduated from a university and 13 with a Master’s degree.

Figure 1. The respondents’ age balance

The survey applied to spectators contained a number of 15 items with closed responses. The questions aim to establish the spectators’ satisfaction level concerning the strategies to promote the team and the handball matches in Bacau, the information sources that the spectators use and trust (Figure 2) and the people’s intention to come back to matches.
Where do you get informed about the handball matches and results?

![Pie chart showing information sources](chart.png)

Figure 2. The spectators’ information sources

**Results**

Applying the survey has led us to the following results (Table 1):

Table 1. Survey results

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Question/Response</th>
<th>Yes</th>
<th>No</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Are you a supporter of the local handball team?</td>
<td>38</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Do you think the team’s financial problems have had an influence on the number of spectators at the matches?</td>
<td>38</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Do you think that a large number of spectators can influence the playing level and implicitly the result of the game?</td>
<td>44</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Do you think that a closer relationship of the players with the public can bring more spectators to the games?</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Do you think that a better promotion campaign of the players and games in the championship can increase the number of spectators?</td>
<td>46</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Do you think that the price of a ticket is an impediment for the spectators to come to handball games?</td>
<td>12</td>
<td>34</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Do you intend to come back to the matches of the local handball team?</td>
<td>48</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Do you intend to recommend to your friends and acquaintances to come to the sports hall to watch handball matches?</td>
<td>48</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Where do you get your information about the handball matches (dates, location, results)?</td>
<td>26</td>
<td>28</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>How often do you come to watch the handball matches of Stiinta Municipal Bacau?</td>
<td>22</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>At the matches in Bacau</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>At every match</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-5 times a season</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Once a month</td>
<td></td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>2-3 games a season</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Why do you choose to come to handball matches?</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For socialising</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To view a sports show</td>
<td>20</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>To support your favorite team</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Are you pleased with the level of information you get when regarding the handball matches in Bacau?</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very pleased</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pleased</td>
<td>24</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not pleased</td>
<td></td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>
According to these results, 38 out of 50 respondents are team supporters who come on a regular basis to watch handball matches. Also 38 respondents think that the team’s financial problems have affected the number of spectators at the handball matches in Bacau.

All respondents think that a closer relationship of the players with the supporters will increase the number of spectators at the handball matches in Bacau.

Mostly, the respondents use the internet, social media pages and the team’s official website to get information about the results of the matches, the dates and times of the matches, and all the information they need about the team and players.

48 out of 50 respondents intend to come to the local handball team’s future matches and to recommend them to friends/acquaintances.

Most respondents do not think that paying an entrance ticket for the match is an impediment for the spectators to come to matches.

60% of respondents come to handball matches to support their favourite team, while only 2% come to matches for socialising.

Conclusions

After applying the survey and processing the data, the hypothesis of the research has been confirmed. The diversification of the public relations campaign on more layers can stimulate the spectators’ presence at the handball matches.

A closer relationship of the players with the fans and spectators will lead to an increase in the number of spectators at the handball matches.

Better information on all communication levels, better promotion in the written press, radio and television would increase the awareness of the handball team’s events.

40% of respondents are not pleased with the information level concerning the handball matches in Bacau.

A good psychological support from the fans and spectators can influence a match result.

A better promotion campaign of the players and games in the championship can increase the spectators’ number.

The results have been handed to the Public Relations Department of Stiinta Municipal Bacau in order to improve their PR strategy.

Acknowledgements

This research was accomplished with the help of the spectators interested in handball matches in Bacau, who accepted to participate in our survey.

References

STUDY ON IMPROVING TECHNICAL BEHAVIOUR IN 11-12-YEAR-OLD SOCCER PLAYERS

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Abstract. In training children, one of the determining factors is the need to identify certain technical motor adaptations in the player’s behaviour, in order to optimise their reactions in the unpredictable soccer game situations. Together with the formation of a broad technical-tactical kit by using the learning algorithms, young soccer players are able to improve their motor behaviour, execution capability and precision of movements, which are necessary to solve various situations during the game. The aim of the study is to highlight the improvement of the technical level of children using an operational training program based on the strengthening of the execution technique. This operational program was applied for 8 months on a sample of 20 players aged 11-12. Their progress was measured by the technical evaluation (keeping the ball in the air in place, driving the ball on a square track, 5 successive passes to 5 small soccer goals – rapidity and precision and the complex shuttle event) performed at the beginning and the end of the training program. The experimental research took place at the sports centre of the “Mircea Eliade” Sports High School. Applying the problem-solving technique in training requires the player’s deduction and discovery skills, with positive effects on the dynamic and solid acquisition of knowledge, while stimulating the young athlete to think and make a quick technical decision at a time.

Keywords: improvement, behaviour, technique, soccer.

Introduction

Any activity performed by a human requires the acquisition of knowledge and skills assimilated over time, which allows manifesting a certain type of behaviour. If the activities carried out pursue a technical acquisition, they must be different and should enable one to change the role of an athlete from the passive role of memorising and literally learning to “an active discovery, interpretation and involvement role” (Cojocaru & Secară, 2005, p. 28). Starting from this explanation, we can define the sports motor behaviour as the human ability to perform practical activities specific to a sport based on the profound and diverse control of the types of movement. The motor behaviour of an athlete/pupil depends on their level of acquisition of the movement technique consisting in the “rational structure of the motor act corresponding to the intended purpose” and “involves, among other things, its adaptation to the performer’s individual particularities” (Teodorescu, 1973, p. 168). The athlete’s motor ability to do what they have assimilated, learnt and practiced is formed and developed over a long period of time, following a specific and repetitive systematic practical activity, which forms their “own control system” (Platonov, 2015, p. 207).

Coaching for the training of a soccer player (even from childhood) is mostly done through an inductive process based on the excessive use of explanatory and exemplary methods, the coach’s intervention consisting in presenting their own solutions for the moments of the game, without giving the children the opportunity to expose their logic or variants to solve the situation by discovery, through their physical and psychological efforts. In sports games, performance requires “intelligent motor behaviour that implies speed, swiftness, coordination and efficiency, based on the awareness of the kinaesthetic impulses, the control of the body and of various segments” (Tudor, 2013, p. 63), or all these aspects are formed and perfected through technical and tactical training, as well as through physical and psychological training. The implementation of soccer as a “live movement is not just a response to the action of the external environment, but also a purpose-oriented action controlled while performing it and in interaction with the external environment, which represents not only a chain of details, but also a unitary structure differentiated in a multitude of elements with a wide variety of interaction forms between them” (Bernstein, 1947, p. 255), so learning the movement technique is a complex process, which is difficult to achieve without good knowledge of the individual characteristics and peculiarities. These aspects have led us to carry out a scientific inquiry that focuses on applying the problem-solving in terms of improving the technical behaviour of young soccer players. David (2001) considers problem-solving as “the method with the most heuristic and activating potential” (p. 158). In other words, this is the method by which the greatest amount of knowledge is accumulated and, at the same time, it calls for a decision to be made by analysing one or more possibilities for the motor or cognitive response, which requires memory, speed of analysis and decision. The problematic situation that arises in training, competition and learning “is a surprise, even a novelty factor with which the athlete gets in contact, but also a factor requesting creative thinking” (Jinga, 2001, p. 117).
Raţă (2008) considers that, in sports training, “the exercise through deduction and creative thinking, resulting from the analysis and comparison of the situations that have appeared freely or intentionally, caused by the discovery of the relations between the knowledge, skills and knowledge already acquired” (p. 74), is the basic direction of the training process.

Material and methods

This research aims to verify the hypothesis according to which the use of technical exercises in different ways, twice a week, for 11-12-year-old soccer players contributes to the improvement of their technical and motor levels. It took place between 01.09.2016 and 30.04.2017 at the sports centre of the “Mircea Eliade” Sports High School in Bucharest, on a sample of 20 children aged 11-12 years belonging to the FCSB Soccer Club.

As research methods, we used: bibliography, quasi-experimental study, pedagogical observation, mathematical and statistical processing, data analysis and interpretation, graphical representation. The evaluation activity comprised an initial and final test.

In order to assess the technical and motor levels of the soccer players, we chose the following specific events:

- keeping the ball in the air in place (without touching the ground) for 30 seconds with one foot. The ball is held in the air by repeated strikes with the foot. The test highlights the sense and control of the ball, as well as the motor reaction of the lower limbs to its ascending or descending trajectory. We tested the potential of both the right leg and the left leg for the number of executions (repetitions);
- driving the ball on a square track (measured in seconds), where the route consists of four canes arranged in the shape of a square with the side of 8 m, and a fifth cane is positioned in the centre. The player moves at maximum speed to the centre cane with the ball at his foot, then to the right corner of the square, on its side up to the left corner, then again to the centre cane, then to the fourth corner and again on the side, ending the track in the same corner of the square where he left from. The timer starts at the first touch of the ball and stops after the ball player has passed the finish line. The test highlights the agility of the player to control the ball on a predetermined track;
- 5 successive passes to 5 small soccer goals (speed and precision), where the player sends the balls within 15 seconds to 5 small goals of 1 m/1 m in line, at a distance of 5 m from each other. The balls are placed at 10 m and perpendicular to the line of each goal. The person being tested will pass to the goal next to the ball, the timer starting at the first touch of the first ball with the leg and stopping when the 15 seconds have passed or the player has completed the 5 executions. Account will be taken of the success or failure. The test highlights the level of technical mastery under pressure, in the affective context of the success or failure.
- complex shuttle event with 8 balls placed face to face at a distance of 5 m from each other (measured in seconds). The balls, of 8 different colours, are placed on two front lines, two balls each. The distance between the parallel lines is 6 m. Each ball is placed in a square of a different colour from that of the ball, and the player must drive the ball in the square corresponding to its colour. For each tested player, the balls are placed similarly in the respective squares. The timer starts when the player touches the first ball and stops when the ball is stopped in the square corresponding to the ball colour. The test highlights the reaction, execution and movement speed, the player’s reaction to visual stimuli, as well as his space-time orientation as he controls the ball on a predetermined track.

Between the two evaluations, we applied an operational training program for 8 months, at the same sports centre. This program comprised a total of 48 action systems divided into three categories: soccer-specific technical procedures, preparatory games under adversity conditions (1 against 1, 2 against 1, 2 against 2, 3 against 3, 4 against 3, 4 against 4) and collective technical and tactical actions. The action systems were used in the three weekly training sessions, with two systems in a training session.

The purpose of the study is to highlight the efficiency of using technical training exercises in an operational training program aimed at improving the technical level of 11-12-year-old soccer players. The 20 children of the FCSB Soccer Club performed the 4 technical tests during both the initial and final testing, in order to see the progress of their technical and motor levels when performing with both the right foot and the left foot.

Results

The descriptive and statistical significance tests for the differences between the group means (between the initial and final testing for the 8 technical events) are presented in Table 1.
The event for keeping the ball in the air in place (without touching the ground) for 30 seconds with the right foot significantly increased statistically between the two tests. The average of the group recorded an increase from 31.80 repetitions to 37.70 repetitions (according to Table 1 and Figure 1). The increase of the average with 5.90 is statistically significant, the p value being less than 0.05 (by applying Student’s dependent test).

The calculated t-value is 5.640 and p = 0.000. This increase highlights the fact that the 8-month training process has resulted in improvements in the action of keeping the soccer ball in the air with the right foot.

Table 1. Results of technical testing – Initial test vs. Final test

<table>
<thead>
<tr>
<th>Technical events</th>
<th>Gr</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Coefficient of variation</th>
<th>Min.</th>
<th>Max.</th>
<th>Student’s dependent test t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keeping the ball in the air in place for 30 seconds with the right foot (no. repetitions)</td>
<td>IT</td>
<td>20</td>
<td>31.80</td>
<td>7.41</td>
<td>23.3%</td>
<td>19.00</td>
<td>45.00</td>
<td>5.640</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FT</td>
<td>20</td>
<td>37.70</td>
<td>5.92</td>
<td>15.7%</td>
<td>26.00</td>
<td>45.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving the ball on a square track (sec.)</td>
<td>IT</td>
<td>20</td>
<td>15.49</td>
<td>0.99</td>
<td>6.4%</td>
<td>14.08</td>
<td>17.39</td>
<td>9.142</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FT</td>
<td>20</td>
<td>13.96</td>
<td>0.70</td>
<td>5.0%</td>
<td>12.85</td>
<td>15.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 successive passes to 5 small soccer goals with the right foot, speed (15 sec.)</td>
<td>IT</td>
<td>20</td>
<td>6.79</td>
<td>3.69</td>
<td>54.3%</td>
<td>2.17</td>
<td>14.36</td>
<td>4.254</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FT</td>
<td>20</td>
<td>3.05</td>
<td>1.01</td>
<td>33.1%</td>
<td>2.23</td>
<td>5.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 successive passes to 5 small soccer goals with the right foot, precision (no. successes)</td>
<td>IT</td>
<td>20</td>
<td>2.40</td>
<td>1.10</td>
<td>45.6%</td>
<td>1.00</td>
<td>5.00</td>
<td>5.808</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FT</td>
<td>20</td>
<td>4.25</td>
<td>0.97</td>
<td>22.7%</td>
<td>2.00</td>
<td>5.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 successive passes to 5 small soccer goals with the left foot, speed (15 sec.)</td>
<td>IT</td>
<td>20</td>
<td>7.41</td>
<td>3.98</td>
<td>53.7%</td>
<td>2.78</td>
<td>14.37</td>
<td>4.230</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FT</td>
<td>20</td>
<td>3.63</td>
<td>0.96</td>
<td>26.5%</td>
<td>2.57</td>
<td>6.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complex shuttle event with 8 balls (seconds)</td>
<td>IT</td>
<td>20</td>
<td>37.64</td>
<td>6.58</td>
<td>17.5%</td>
<td>25.03</td>
<td>49.56</td>
<td>5.616</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FT</td>
<td>20</td>
<td>32.96</td>
<td>6.39</td>
<td>19.4%</td>
<td>21.87</td>
<td>42.73</td>
<td>16.16</td>
<td>0.000</td>
</tr>
</tbody>
</table>
In the sports event of keeping the ball in the air in place (without touching the ground) for 30 seconds with the left foot, the average number of repetitions increased between the two tests, from 28.15 repetitions to 33.15 repetitions (according to Table 1 and Figure 2). The evolution of this event, represented by a statistically significant average increase of 5.00 (the calculated t-value is 9.050 and p = 0.000), is an aspect that emphasises the improvement of the technique, precision and self-control.

The time for the sports event for driving the ball on a square track dropped between the two tests, from 15.49 seconds to 13.96 seconds (according to Table 1 and Figure 3). The average decrease of 1.52 seconds is statistically significant, the value of p being less than 0.05. The calculated t-value is 9.142 and p = 0.000. These values demonstrate an improvement in the action of driving the ball with both the right and the left foot on the predefined track and thus an improvement in the execution technique.
The sport’s event of 5 successive passes to 5 small soccer goals (second per success) with the right foot shows that the timing has dropped between the two tests, so the accuracy of the pass and the motor reaction have improved. The group average recorded a significant decrease of 3.74 seconds, from 6.79 seconds to 3.05 seconds (according to Table 1 and Figure 4). The statistically significant progress is also highlighted by the fact that the calculated t-value is 4.254 and p = 0.000. This development shows an improvement in the technique, expressed by the decrease in the working time, but also by the increase of the attention capacity and the speed of thinking.

The data presented in Table 1 also highlights:

- The sports event of 5 successive passes to 5 small soccer goals shows that the speed and accuracy of the pass have increased between the two tests, from 2.40 to 4.25. The evolution of this sports event, proven by the increase of 1.85 in the average success rate, is statistically significant and emphasises the improvement of the technique and execution precision.
- The group average for the 5 successive passes to 5 small soccer goals with the left foot (measured in seconds), between the two tests, decreased from 7.41 seconds to 3.63 seconds. The evolution of this sports event, highlighted by an average decrease of 3.78 seconds, is statistically significant (t = 4.230; p = 0.000 – the speed and accuracy of the pass with the left foot) and emphasises the improvement of the attention capacity and speed of thinking.
- The sports event of 5 successive passes to 5 small soccer goals with the left foot (measured by the number of successes) shows that the speed and accuracy of the pass has increased between the two tests, from 2.20 to 3.75. The evolution of this sports event, proven by an average increase of 1.55 successes, is
statistically significant \( (t = 5.618; p = 0.000) \), demonstrating the improvement of the technique and execution precision.

- The timed sports event of complex shuttle with 8 balls shows that it has dropped between the two tests. The group average recorded a significant decrease, from 37.64 seconds to 32.96 seconds. The average decrease of 4.68 seconds is statistically significant \( (t = 16.169; p = 0.000) \) and highlights the increase in the focus capacity, attention and the improvement of the technique (Figure 5).

![Figure 5. The average time in the sports event of the complex 8-ball shuttle test (seconds)](image)

**Discussions and conclusions**

A player’s performance is rated according to “the technical executions depending on the competitive conditions, especially the technical and tactical ones, on the opponent’s opposition and on the opposing team” (Manno, Beccarini, & D’Ottavio, 1992), and the training process is of particular importance in the efficiency of technical training.

Analysing the results obtained by the athletes in the investigated group, we found statistically significant improvements in the 8 evaluated sports events, the p-value, by applying the Student’s dependent t-test, being less than 0.05 in all 8 cases:

- keeping the ball in the air in place (without touching the ground) for 30 seconds with the right foot: \( t \) calculated = 5.640, \( p < 0.05 \);
- keeping the ball in the air in place (without touching the ground) for 30 seconds with the left foot: \( t \) calculated = 9.050, \( p < 0.05 \);
- driving the ball on a predetermined square track: \( t \) calculated = 9.142, \( p < 0.05 \);
- the sports event of 5 successive passes to 5 small soccer goals with the right foot (sec. per success): \( t \) calculated = 4.254, \( p < 0.05 \);
- the sports event of 5 successive passes to 5 small soccer goals with the right foot (number of successes): \( t \) calculated = 5.808, \( p < 0.05 \);
- the sports event of 5 successive passes to 5 small soccer goals with the left foot (sec. per success): \( t \) calculated = 4.230, \( p < 0.05 \);
- the sports event of 5 successive passes to 5 small soccer goals with the left foot (number of successes): \( t \) calculated = 5.616, \( p < 0.05 \);
- the complex 8-ball shuttle event: \( t \) calculated = 16.169, \( p < 0.05 \).

At the age of 11-12, “a player’s intelligence and creativity, their biological and mental availability, the physical and technical-tactical characteristics of the opponent, require and favour the approach of the technical game techniques” (D’Ottavio, 1998, p. 81) and is the central focus of the training, an objective that can be achieved by pursuing the consolidation of the execution techniques. The improvements are the result of “multiple demands (muscular, cardiorespiratory, endocrine-metabolic, psychological ones etc.) to which the human body is subjected while performing sports activities” and the demands “lead to effect phenomena (body reactions)” (Colibaba-Evuleț & Bota, 1998, p. 63), which ensures the improvement of motor behaviour.
After interpreting the results, we found that the level of technical behaviour has improved significantly in children aged 11-12 years following the implementation of the 8-month operational training program, which was followed, on the one hand, by the possibilities of consolidating the technical procedures dealt with during the training, and on the other hand, by the special skills of the players at this age, in accordance with the exigencies demanded by the development of the game.

In conclusion, the whole scientific approach falls within the logic of soccer training for children and juniors in order to improve their performance level regarding the physical, motor and psychological training aspects. Following the application of the research methods and the initial and final tests, their analysis and interpretation, the hypothesis that the use of technical exercises in different ways, twice a week, for the 11-12-year-old soccer players contributes to the improvement of their technical and motor levels has been confirmed.

References

OPTIMISATION OF PSYCHOMOTOR SPEED AND COORDINATION THROUGH PHYSICAL EDUCATION CLASSES FOR THE PRETEEN PERIOD

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Abstract. In physical education (PE) classes, psychomotor skills arouse curiosity for both teachers and students. The PE lesson is a perfect pretext for educating psychomotor ability and socialising with other students. According to the literature, psychomotor skills represent the acquisition with which human beings are endowed and which manifests in acts and actions relying on indexes of speed, strength, endurance, flexibility and coordination, based on psychological, physiological and biochemical mechanisms. The preadolescence period is a stage which accommodates the optimal development of psychomotor skills. The purpose of the present study is to monitor and optimise two psychomotor skills: the speed of execution and the coordination of upper limbs through PE classes. We believe the differentiated treatment method supports our theme and provides the opportunity to highlight the level of skills. In order to reach the social-affective, cognitive and dynamic objectives, we used the “Touch the Plates” Test (Eurofit Battery) prior to initiating the learning unit and after having undergone all pre-established activities based on the psychodynamic perspective. The study involved a mixed group (18 boys and 12 girls aged 12 years) from “Sfintii Constantin si Elena” School, sector 6, Bucharest. Hypothesis of the research: Using action systems as a constant variable based on individual features will lead to the optimisation of psychodynamic skills, such as speed and coordination of upper limbs.

Keywords: physical education class, speed of execution, coordination of upper limbs, preteens.

Introduction

In physical education (PE) classes, psychomotor skills arouse curiosity for both teachers and students. The PE lesson is a perfect pretext for educating psychomotor ability and socialising with other students. Psychomotor skills represent the acquisition with which human beings are endowed and which manifests in acts and actions relying on indexes of speed, strength, endurance, flexibility and coordination, based on psychological, physiological and biochemical mechanisms” (Rață & Rață, 2006, p. 18). “Preadolescence is an important stage of human development following early childhood and preceding adolescence” (Șchiopu & Verza, 1995, pp. 209-210). “During the preadolescence period, the pupil ceases to be a child, thinks and pretends to be treated as an adult, but cannot be named as such” (Epuran & Horghidan, 1994, p. 47). “From a dynamic point of view, dynamic skills are remarkable. However, the ability of stabilising movements is quite limited.” (Dragnea et al., 2006, pp. 46-47) According to the literature, the preadolescence period is a stage which accommodates the optimal development of psychomotor skills.

The purpose of the present study is to monitor and optimise two psychomotor skills: the speed of execution and the coordination of upper limbs through PE classes. We believe the differentiated treatment method supports our theme and provides the opportunity to highlight the level of skills.

Hypothesis of the research: Using action systems as a constant variable based on individual features leads to the optimisation of psychodynamic skills, such as speed and coordination of upper limbs.

Material and methods

In order to reach the social-affective, cognitive and dynamic objectives, we used the test. According to Chaplin, “the test is a set of standard items created with the purpose of measuring the skills of one or more individuals” (Gagea, 2010, pp. 140-141). Our research used the Touch Board Test (Eurofit Battery) prior to initiating the learning unit and after having undergone all pre-established activities based on the psychodynamic perspective. “Eurofit Battery tests consist of 6 anthropometric measurements (height, weight, 4 skinfold measures of body fat), 8 dynamic tests and 2 cardiorespiratory endurance tests” (Epuran, 2005, p. 385).

The study involved a mixed group (18 boys and 12 girls aged 12 years) from “Sfintii Constantin si Elena” School, sector 6, Bucharest. All 60 students in our research are 12 years old, are medically fit and constantly participate in physical education lessons on Tuesdays and Thursdays, for 50 minutes. The test was applied to both classes and set the best repetition as validation. The initial results set grade 6B as the experimental group and grade 6A as the control group. In the case of the experimental group, the study uses the Group Value Tests based on gender: group 1 – girls; group 2 – boys. The proposed program was conducted over 3 months (September 2016-December 2016).
This study used the psycho-pedagogical experiment meant to compare the obtained data based on two variables: the independent variable (IV), represented by the suggested program according to the group values of each experimental unit; the dependent variable (DV), referring to two psychomotor skills, namely speed and coordination.

For the data analysis, processing and interpretation, we used the computerised graphical method and the t-test (Figure 2).

*Touch Board Test (Eurofit Battery)*

Value testing: Evaluating execution – speed and coordination of upper limbs

Necessary conditions: gym; assistant; timer; table/bench; board (Figure 1)

![Touch Board diagram](image)

**The test**

The subject is asked to stand in front of the table/bench, with the feet slightly apart, holding his/her hand in the centre of the rectangular board (C) between the two circles, without moving the hand during the test. The subject will use the other hand with a fast come-and-go movement between the two circles above the stable hand. Upon starting the test, the subject will undergo 25 cycles of fast hand movement while touching spaces A and B. The test will be repeated. The best time will be recorded. It is highly important that the height of the bench does not exceed the umbilical area of the participant. It is interesting to analyse the reactions of the subject when the right hand is used and the movement starts from the left hand. Supplementary movements will be enforced when the board is not touched.

*Evaluation (scoring)*

The assistant records the best time of the two tests for each participant.

**Results**

After the initial test, on 15 September 2016, the two classes have the following values:

<table>
<thead>
<tr>
<th></th>
<th>Control groups</th>
<th>Experimental groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>9.71 s</td>
<td>Girls 9.03 s</td>
</tr>
<tr>
<td>Boys</td>
<td>9.26 s</td>
<td>Boys 8.96 s</td>
</tr>
</tbody>
</table>
In Table 1, we observe the parameters of the values for the two groups and the difference between them in both girls and boys.

In Table 2, we present the program of exercises proposed for the experimental group, which was carried out between September and December 2016, at the level of psychomotor skills training units.

### Table 2. Exercises for the experimental group

<table>
<thead>
<tr>
<th>Action</th>
<th>Dosage</th>
<th>Groups</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dribbling with the left/right hand using a basketball or handball</td>
<td>2x/ active break of 30 s</td>
<td>5 rows x 6 students</td>
<td>At signal</td>
</tr>
<tr>
<td>over a distance of 15 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Multiple dribbling with a basketball or handball over a distance</td>
<td>2x/ active break of 30 s</td>
<td>5 rows x 6 students</td>
<td>At signal</td>
</tr>
<tr>
<td>of 15 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Dribbling with a basketball using the dominant hand and dribbling</td>
<td>2x/ active break of 30 s</td>
<td>5 rows x 6 students</td>
<td>At signal</td>
</tr>
<tr>
<td>with a football using the non-dominant foot over a distance of 10 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Dribbling with a basketball using the non-dominant hand and</td>
<td>2x/ active break of 30 s</td>
<td>5 rows x 6 students</td>
<td>At signal</td>
</tr>
<tr>
<td>dribbling with a football using the dominant foot over a distance of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Line touch running and tennis ball drills using both hands</td>
<td>2x/ active break of 30 s</td>
<td>Individually</td>
<td>One student after</td>
</tr>
<tr>
<td>over a distance of 10 m (in the gym)</td>
<td></td>
<td></td>
<td>the other</td>
</tr>
<tr>
<td>6. Line touch running (1 out of 2) and tennis ball drills using both</td>
<td>2x/ active break of 30 s</td>
<td>Individually</td>
<td>One student after</td>
</tr>
<tr>
<td>hands over a distance of 10 m (in the gym)</td>
<td></td>
<td></td>
<td>the other</td>
</tr>
<tr>
<td>7. High knee drills using tennis balls in both hands over a</td>
<td>2x/ active break of 30 s</td>
<td>Individually</td>
<td>One student after</td>
</tr>
<tr>
<td>distance of 10 m (in the gym)</td>
<td></td>
<td></td>
<td>the other</td>
</tr>
<tr>
<td>8. Relay race over a distance of 10 m, stair climbing with tennis</td>
<td>2x/ active break of 30 s</td>
<td>2 groups x 15 students</td>
<td>At signal</td>
</tr>
<tr>
<td>balls in both hands</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following actions were conducted as complementary training to the list above, for a maximum period of 6 minutes, with 1-minute break, in each session: *Mine Field, Big Jump Challenge* and *Fire Balls*.

In Table 3, we present the final results obtained on 15 December 2016.

### Table 3. Final results in the Touch Board Test

<table>
<thead>
<tr>
<th>Control groups</th>
<th>Experimental groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls 9.65 s (a difference of 0.06 s)</td>
<td>Girls 8.94 s (a difference of 0.09 s)</td>
</tr>
<tr>
<td>Boys 9.21 s (a difference of 0.05 s)</td>
<td>Boys 8.78 s (a difference of 0.19 s)</td>
</tr>
</tbody>
</table>

Table 3 shows the final results for both groups and their rates of progress:
1. Control group: girls with a progress rate of 0.06 s, and boys with a progress rate of 0.05 s;
2. Experimental group: girls with a progress rate of 0.09 s, and boys with a progress rate of 0.19 s.

As mentioned above, in order to support the validation of the assumption, we used the *t* test (Figure 2), which describes inferentially the results obtained at the level of both groups.
**Touch Board Test**

According to Figure 2, the medium time recorded for the psychomotricity test “Touch the Plates” is higher by 0.50 seconds (5.6%) in the control group, the averages being 8.89 seconds in the experimental group and 9.39 seconds in the control group.

**Table 4. Statistical interpretation of the t test**

<table>
<thead>
<tr>
<th><strong>t test – Individual bilateral</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Levene's Sig. (p)</td>
<td>0.525</td>
</tr>
<tr>
<td>t</td>
<td>3.439</td>
</tr>
<tr>
<td>p</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Effect size</td>
<td>0.89</td>
</tr>
</tbody>
</table>

The means of the two groups are significantly different. According to the t test for equal dispersions, the significance threshold p < 0.05 for t = 3.439 and df = 58. The effect size index (0.89) shows a large difference between groups.

In Table 4, we observe the threshold of statistical significance, the value of t is 3.439 and the effect size, 0.89. These data show the large difference between the two groups.

**Conclusions**

Based on the final results (Table 3) and the statistical interpretation of the data (using the t test), we notice that the value group process applied to the experimental group has contributed to the improvement of the obtained results. The proposed program performed for 3 months has led to an increase in the psychomotor performance parameters, execution speed and coordination of upper limbs. There is a breakthrough of 8% for girls and 3.9% for boys.

As a result of the statistical interpretation of the t test (Table 4), the means of the two groups are significantly different. Even if there are differences between the results obtained by the control group and the experimental group in the Touch Board Test, in the initial part of the study, we can observe a higher progress in the case of the experimental group. We can argue that the use of constant action systems according to individual particularities will lead to the optimisation of psychomotor skills, namely execution speed and upper limb coordination.

**References**


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**Examples:**

- According to Suchilin (2010), the biomechanical criteria are used for dividing the gymnastics elements into parts (p. 5).

- The Publication Manual of the American Psychological Association was first published in 1929 as a seven-page standard of procedure (Bentley et al., 1929, p. 57).

Check each source cited to appear in both the body text and the reference list, while the author and the year are to be identified in terms of spelling. The list of references at the end of the scientific article provides information needed to identify each source. It will mention: **author(s), year, title, city, publisher, pages,** depending on the source of citation (book, journal article, website).

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http://www.unefs.ro/revistadiscobolul.html