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THE EFFICIENCY OF COMPUTERISED DYNAMOMETRY IN THE RECOVERY OF MEDIAL MENISCUS SURGERY

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Abstract. Nowadays, more and more patients limit their recovery period due to lack of time or pain disappearance. But the disappearance of pain is not the end of the recovery program. After a medial meniscus surgery, the time to complete recovery is at least 6 months. Reducing this period can be beneficial to the patient. Purpose: Through our study, we want to highlight the utility and efficiency of the computerised BIODEX System 4 PRO dynamometry in the recovery of medial meniscus surgery, with the significant reduction of recovery time. Subjects and methods: 5 patients aged between 30 and 45 years who underwent medial meniscal surgery were studied. The recovery program was performed using the BIODEX System 4 PRO computer dynamometer for a period of 5 months, with 3 weekly sessions of 90 minutes/session. Results: At the final evaluation, the subjects achieved a 2 to 1 force ratio in favour of extensors and an absolute force of at least 1500 J for the knee extension, indicating the end of the recovery program. It also highlights a reduction in recovery time of at least 20% and the knee stabilisation at optimal parameters. Conclusions: Computerised dynamometer is effectively used in both muscle strength testing and rehabilitation after surgery, reducing the risk of relapse to zero in the case of daily demands.

Keywords: rehabilitation, computerised dynamometer, medial meniscus.

Introduction

Meniscus injury is one of the most common injuries in the knee joint. In general, men are more frequently affected than women. Thus, for a population of 10,000 people, the incidence of meniscal lesions is 9% for males and 4.2% for women (Andrews, Ronsky, & Shrive, 2011). The injuries occur, in 68% to 75% of cases, following a trauma, and 38% to 50% of these traumas occur in sports. The highest frequency of these injuries occurs in football, followed by rugby, handball, basketball, volleyball, athletics, gymnastics and skiing (Birrer, O’Connor, & Kane, 2015). Current statistics show that 75% of internal knee disorders are meniscal, and between 60%-74% of these lesions impair the medial meniscus. This condition is explained by the much larger diameter, the much thinner periphery and the much narrower body compared to the lateral meniscus (Baratz, Fu, & Mengato, 1986).

Meniscus injury is manifested by joint swelling, quadriceps muscle atrophy, localised pain and tenderness. Among them, the presence of localised tenderness in the internal and lateral space is the most frequent symptom (Shi et al., 2018). Nowadays, more and more patients limit their recovery period due to lack of time or pain disappearance. But the disappearance of pain is not the end of the recovery program.

After a medial meniscus surgery, the time to complete recovery is at least 6 months. Reducing this period can be beneficial to the patient. Because we live in the age of speed, when patients no longer feel pain, they are always looking for pretexts not to continue the recovery process to fully stabilise the joint after such an intervention. This is why the risk of relapse is increased. A meta-analysis investigating outcomes at least 5 years after meniscal repair showed a pooled failure rate of 23.1% (Spang III et al., 2018).

We believe that, if it is possible to measure the deficit in range of motion (ROM) but also strength in the healthy limb, this might be motivating for the patient to continue until the end of the recovery process. Moreover, by constantly monitoring the patient’s progress and reminding him/her of the goal to be achieved, he/she will be 100% involved in the recovery process.

Purpose

Through our study, we want to highlight the utility and efficiency of the computerised BIODEX System 4 PRO dynamometry in the recovery of medial meniscus surgery, with a significant reduction (more than 20%) in recovery time (Tsiros et al., 2011).

Material and methods

Of the 5 patients who underwent medial meniscal surgery, we chose for our study a male subject aged 36 years, who was practicing handball and whose goal was to return to sport in less than 6 months. The recovery program was performed using the computerised BIODEX System 4 PRO dynamometer for a period of 5 months, with 3 weekly sessions of 90 minutes/session.
The research was performed in our rehabilitation clinic in Bucharest, over a period of 5 months. The chosen subject agreed to participate in the study and we received his consent to interpret and process the data and then disseminate the obtained results.

The BIODEX System 4 PRO (Figure 1) was used to initially identify the ROM compared to the healthy limb, the ROM ongoing progress and the force developed at the moment of active movements.

![Figure 1. BIODEX System 4 PRO (2019)](image)

The equipment can achieve accurate and standardised measurement of the ROM and display many interesting parameters for joint biomechanics such as: absolute force, relative force, reaction rate, time to peak torque, angle of peak torque, ratio between agonists/antagonists, work first/last third, average power, maximal repetition, total work, torque at 30.0 degrees (Figure 2).
The system offers the possibility of generating passive, isometric, isotonic and isokinetic movements using concentric/eccentric contraction. Moreover, the BIODEX System 4 PRO enables to accurately set the painless movement space and perform repetitive and standardised movements exactly to the point where pain occurs. With this, the intended ROM is quickly reached. No two meniscal patients with the same diagnosis present identically. Therefore, the most important principle guiding a rehabilitation program following meniscal repair surgery is individualisation. The method used relies on passive mobilisations between 25 and 45 degrees/sec for all patients in the first 3 weeks, with the objective of gaining mobility, and for strength, isometric contraction was used.

After the 3 weeks, we started isokinetic active movements providing a speed between 240-180 degrees/sec within the allowed range of motion, all of this for the next 5 weeks. After these 2 months, besides using the BIODEX System 4 PRO, we started to load the joint, as we understood that the recovery process would be much improved if the meniscus was loaded. In the next 3 months, we focused on gaining maximal ROM and strengthening the knee stabilisers, the first priority being the quadriceps to increase it to over 1500 J when performing an isokinetic movement at 120 degrees/sec.

Results

Using the BIODEX System 4 PRO in the recovery after meniscectomy allows for both its objective evaluation and the individualisation of treatment. Initially, we just tested the ROM in the passive mode, with speeds low enough to overcome the natural stretch reflex and fast enough to allow active assistive exercise (25 degrees/sec.) (Cvjetkovic et al., 2015) (Figure 3).
At the final evaluation, the subjects achieve a 2 to 1 force ratio in favour of extensors and an absolute force of at least 1500 J on an isokinetic movement at 120 degrees/sec for the knee extension, indicating the end of the recovery program. Impact-free acceleration eliminates joint trauma during the achievement of high speeds that correlate to function. The ability to choose concentric (500 degrees/sec) and eccentric (300 degrees/sec) contraction allows performing isolated plyometric exercises (Figure 4).

It also highlights a reduction in recovery time of at least 20% compared to existing studies. All of these figures are accompanied by the possibility for patients to perform any daily exercise and sport (such as football, handball) without pain and stabilise muscle.
Conclusion

Strength rehabilitation is undoubtedly a major goal of recovering from simple meniscus lesions or associated with ligament lesions, but not the only one (Cavanaugh & Killian, 2012). Stretch and speed are the physical attributes that ensure competitive success, and the fact that we can, on the basis of well-designed programs adapted to each patient, train these parameters to achieve values comparable to those before injury represents a benefit (Hume, Reid, & Edwards, 2006).

The computerised dynamometer is effectively used in both muscle strength testing and rehabilitation after surgery, reducing the recovery time and the risk of relapse to zero in the case of daily demands, with minimal risk for amateur sports. Our study is still ongoing by observing patients every 6 months either by consultation or phone anamnesis.

In conclusion, computerised dynamometry recovery provided by BIODEX System 4 PRO was of real help in gaining full mobility, increasing strength in a protective way for the joint and achieving a muscle balance that reduced to minimum the risk of relapse.
Authors’ contributions

All authors contributed equally to this article and should be considered as main authors.

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A SHOULDER INJURY PREVENTION PROGRAMME FOR NON-INJURED ATHLETES

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Abstract. The purpose of this study was to establish and implement a specific prevention programme adapted to individual particularities and needs, depending on the practiced sport, with a view to improving muscle strength and muscle tone, increasing joint mobility and stability, as well as preventing the occurrence of shoulder joint injury in non-injured athletes. The research included 30 male athletes aged between 18 and 30 years. The sports practiced by the subjects included in the prevention group were: handball (10), tennis (8), shot put (6), swimming (4) and volleyball (2). The research was carried out over 8 months, from April 2018 to November 2018, at the Physiotherapy Hospital, Orthopaedics Department, in Bagdad (Iraq). The obtained results demonstrate that kinesitherapy exercises are beneficial for athletes with no pathological condition of the shoulder joint and that the prevention programme applied to the subjects has reached the proposed objectives, thus confirming the research hypothesis.

Keywords: kinesitherapy, shoulder, prevention programme, athletes.

Introduction

The shoulder, this “complex” made up of 5 joints, over 30 muscles and 6 major ligaments, can assume about 1,600 positions, and therefore there is more movement at this joint than at any other joint of the body; consequently, it is easily prone to overuse and injury (Junk, 2019).

According to the literature, there are many intrinsic (anatomical, physiological) and extrinsic (environmental) factors that increase the risk of shoulder injury especially in young athletes; unfortunately, these factors appear to develop over time and, if not recognised and addressed as early as possible, they have undesirable outcomes (for instance, shoulder dislocation or subluxation) (Sciascia & Kibler, 2006).

In order to prevent shoulder injuries in contact, collision or overhead sports, a prevention programme needs to be implemented in the training schedule of the athlete (Cools et al., 2015). According to Clarsen et al. (2014), such prevention programmes should include interventions aimed to improve glenohumeral rotational range of motion, external rotation strength and scapular control.

A systematic literature review performed by Grygorowicz et al. (2014) has revealed that insufficient evidence is available on the efficiency of shoulder injury prevention programmes in non-injured overhead athletes. The authors claim that high-quality studies investigating this issue are needed to reduce the incidence of shoulder injuries in non-injured overhead athletes.

An interesting study conducted by Andersson et al. (2017) was based on the implementation of a shoulder injury prevention programme in the training of 45 elite handball teams totalling 660 players, who had to perform 5 selected warm-up exercises for about 10 minutes, 3 times per week. The proposed programme was designed to improve shoulder internal and external rotation, scapular muscle strength, kinetic chain and thoracic spine mobility. Upon programme completion (7 months later), the authors examined its effects, and the results demonstrated a 28% lower risk of shoulder problems and a 22% lower risk of significant shoulder problems in the intervention group compared to the control group who performed routine warm-up.

Junk (2019) believes that shoulder injuries can be prevented by the assessment and management of some key areas such as: sports-specific technique, flexibility, core stability, rotator-cuff strength control, general muscle strength. According to this author, the most effective prevention strategies are: balancing upper-body workouts, limiting range of motion and progressing slowly, performing plyometric exercises that mimic sports-specific movements.

Ward (2019) states that prevention is always better than rehabilitation for shoulder problems; due to the large range of mobility and lack of structural support, the risk of recurrent injury is constantly present. In turn, Rubino (2018) says that the best prevention is to make sure that an athlete is strong and appropriately conditioned before participating in sports.
The current study

Premise. Kinesitherapy exercises contribute to preventing shoulder injury in athletes.

Purpose. To establish and implement prevention programmes adapted to individual particularities and needs, depending on the practiced sport, with a view to improving muscle strength and muscle tone, increasing joint mobility and stability, as well as preventing the occurrence of shoulder joint injury in athletes.

Objectives. To establish and implement the most effective specific exercises for prophylactic purposes.

Tasks. To establish the objectives, select the group of subjects, perform the initial assessment of subjects, record and summarise the collected data, implement specific rehabilitation programmes, perform the final assessment of subjects, analyse and interpret the obtained data.

Hypothesis. Implementing prevention programmes adapted to individual particularities and needs in order to maintain and improve range of motion, muscle strength and muscle tone is very efficient, because it can prevent the occurrence of shoulder injury in athletes.

Material and methods

Participants

The research subjects were 30 male athletes aged 19 to 30 years. The sports practiced by the 30 participants were: handball (10), tennis (8), shot put (6), swimming (4) and volleyball (2). The investigated athletes had no pathological condition of the shoulder joint.

Period and location

The research was carried out over 8 months, from April 2018 to November 2018, at the Physiotherapy Hospital, Orthopaedics Department, in Bagdad (Iraq).

Assessment

After making up the prevention group, the research focused on performing the initial assessment of both range of motion and muscle strength.

Range of motion was tested in the initial phase and the final phase with the help of the classical goniometer, tracking the shoulder movements of flexion, extension, abduction, adduction, internal rotation and external rotation.

Muscle strength for all physiological movements involving the shoulder joint was tested by means of the F0-F5 scale, where F0 represents the minimum value, and F5, the maximum value.

The literature does not provide accurate values for shoulder internal rotation range of motion, which may vary between 18° (Wilk et al., 2011) and 25°, depending on the study design and population (Shanley et al., 2011). Therefore, for maximal protection of the athlete, side differences should be less than 18°, and the difference in total range of motion should not exceed 5° (Wilk et al. 2011).

It is worth mentioning that, in normal conditions, the flexion movement reaches 180°, the extension movement reaches 60°, the abduction movement reaches 180°, the adduction movement reaches 90°, the internal rotation movement reaches 90°, and the external rotation movement reaches 80°.

The prevention programme was aimed to maintain and improve range of motion, muscle strength and muscle tone in order to prevent the occurrence of shoulder injury in non-injured athletes.

The prevention plan was divided into two phases as follows: phase 1 – weeks 0-6; phase 2 – weeks 6-12.

Phase 1 aimed to maintain/improve range of motion, muscle strength, joint mobility and joint stability.

Phase 2 aimed to maintain/improve muscle tone.

Proposed programme – Shoulder injury prevention

The two phases of the prevention programme proposed by us for the investigated subjects are described below.

- Phase 1 – Description of the prevention programme (weeks 0-6)
  - Maintaining/Improving range of motion (weeks 0-6)
    1. Forearm flexion on the arm (free movement) – 30 repetitions x 2 series
    2. Arm flexion at full range of motion (free movement) – 30 repetitions x 3 series
    3. Arm extension (free movement) – 30 repetitions x 2 series
    4. Arm abduction at full range of motion (free movement) – 30 repetitions x 2 series
    5. Arm internal and external rotation (free movement) – 30 repetitions x 2 series
- Maintaining/Improving muscle strength
  1. Forearm flexion on the arm with dumbbell (5 kg) – 30 repetitions x 2 series
  2. Forearm extension on the arm with dumbbell (5 kg) – 20 repetitions x 3 series
  3. Arm flexion with dumbbell (5 kg) – 20 repetitions x 3 series
  4. Arm abduction with dumbbell (5 kg) – 15 repetitions x 2 series
  5. Arm extension with dumbbell (5 kg) – 25 repetitions x 3 series
  6. Forearm extension on the arm against the resistance of the elastic band – 20 repetitions x 2 series
  7. Forearm flexion on the arm against the resistance of the elastic band – 15 repetitions x 3 series
  8. Arm abstraction against the resistance of the elastic band – 15 repetitions x 3 series
  9. Arm extension against the resistance of the elastic band – 25 repetitions x 3 series
  10. Forearm flexion on the arm against the resistance of the elastic band – 20 repetitions x 2 series
  11. Arm abduction against the resistance of the elastic band – 15 repetitions x 3 series
  12. Arm flexion (90°) against the resistance of the elastic band – 25 repetitions x 3 series
  13. Arm internal and external rotation against the resistance of the elastic band – 20 repetitions x 3 series
  14. Pull-ups – 10 repetitions x 3 series
  15. Ramat with dumbbell (5 kg) – 12 repetitions x 4 series
  16. Compex 8.0 – muscular hypertrophy programme – 35 minute x 1 series

- Maintaining/Improving joint mobility
  1. Circular (circumduction) movements at the wall wheel – 25 repetitions x 2 series
  2. Arm flexion, extension, abduction, adduction – 20 repetitions x 4 series
  3. Arm internal and external rotation (free movement) – 30 repetitions x 3 series
  4. Kabat diagonals 1 and 2 – 10 repetitions x 2 series
  5. Codman’s pendulums with weight attached (2 kg) – 30 repetitions x 2 series

- Maintaining/Improving joint stability
  1. Circular (circumduction) movements with Bobath ball – 25 repetitions x 2 series
  2. Flexion and extension with Bobath ball – 15 repetitions x 3 series
  3. Keeping the arms in flexion 90° with elbows extended and dumbbells (4 kg) in both hands – 25 seconds, 10 repetitions x 2 series
  4. Keeping the arms in abduction 90° with elbows extended and dumbbells (4 kg) in both hands – 25 seconds, 6 repetitions x 3 series

- Phase 2 – Description of the prevention programme (weeks 6-12)
- Maintaining/Improving muscle tone
  1. Forearm flexion on the arm against the resistance of the elastic band – 30 repetitions x 3 series
  2. Arm internal and external rotation against the resistance of the elastic band – 25 repetitions x 3 series
  3. Forearm flexion on the arm with dumbbell (5 kg) – 20 repetitions x 2 series
  4. Forearm extension on the arm with dumbbell (5 kg) – 30 repetitions x 3 series
  5. Arm abduction 90° with dumbbell (5 kg) – 15 repetitions x 4 series
  6. Shoulder-blade retraction maintained for 12 seconds – 12 repetitions x 3 series
  7. Compex 8.0 – muscular hypertrophy programme

Results

Table 1. Shoulder flexion movement – Descriptive and inferential data

<table>
<thead>
<tr>
<th>Prevention group</th>
<th>Initial testing (I)</th>
<th>Final testing (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Arithmetic mean</td>
<td>176.8°</td>
<td>180°</td>
</tr>
<tr>
<td>Difference (F-I)</td>
<td>3.2°</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>180°</td>
<td>180°</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>4.3°</td>
<td>0.0°</td>
</tr>
<tr>
<td>Coefficient of variation</td>
<td>2.4%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Minimum</td>
<td>170°</td>
<td>180°</td>
</tr>
<tr>
<td>Maximum</td>
<td>180°</td>
<td>180°</td>
</tr>
<tr>
<td>Dependent t-test (I-F) calculated t-value</td>
<td>4.080</td>
<td>p = 0.000 (p &lt; 0.05)</td>
</tr>
</tbody>
</table>

Regarding the flexion movement (Table 1), a positive evolution was found between initial and final testing. On average, there was an increase of 3.2°, from 176.8° to 180°; calculated t-value = 4.080, p = 0.000 (p < 0.05).
Table 2. Shoulder extension movement – Descriptive and inferential data

<table>
<thead>
<tr>
<th>Prevention group</th>
<th>Initial testing (I)</th>
<th>Final testing (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Arithmetic mean</td>
<td>46.5°</td>
<td>50.0°</td>
</tr>
<tr>
<td>Difference (F-I)</td>
<td>3.5°</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>50°</td>
<td>50°</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>4.2°</td>
<td>0°</td>
</tr>
<tr>
<td>Coefficient of variation</td>
<td>9%</td>
<td>0%</td>
</tr>
<tr>
<td>Minimum</td>
<td>40°</td>
<td>50°</td>
</tr>
<tr>
<td>Maximum</td>
<td>50°</td>
<td>50°</td>
</tr>
<tr>
<td>Dependent t-test (I-F)</td>
<td>calculated t-value</td>
<td>4.583</td>
</tr>
<tr>
<td>p</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

For the extension movement (Table 2), a positive evolution was found between initial and final testing. On average, there was an increase of 3.5°, from 46.5° to 50°; calculated t-value = 4.583, p = 0.000 (p < 0.05).

Table 3. Shoulder abduction movement – Descriptive and inferential data

<table>
<thead>
<tr>
<th>Prevention group</th>
<th>Initial testing (I)</th>
<th>Final testing (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Arithmetic mean</td>
<td>177°</td>
<td>179.7°</td>
</tr>
<tr>
<td>Difference (F-I)</td>
<td>2.7°</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>180°</td>
<td>180°</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>4.7°</td>
<td>1.8°</td>
</tr>
<tr>
<td>Coefficient of variation</td>
<td>2.6%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Minimum</td>
<td>170°</td>
<td>170°</td>
</tr>
<tr>
<td>Maximum</td>
<td>180°</td>
<td>180°</td>
</tr>
<tr>
<td>Dependent t-test (I-F)</td>
<td>calculated t-value</td>
<td>2.804</td>
</tr>
<tr>
<td>p</td>
<td>0.009</td>
<td></td>
</tr>
</tbody>
</table>

Regarding the abduction movement (Table 3), a positive evolution was found between initial and final testing. On average, there was an increase of 2.7°, from 177° to 179.7°; calculated t-value = 2.804, p = 0.009 (p < 0.05).

Table 4. Shoulder adduction movement – Descriptive and inferential data

<table>
<thead>
<tr>
<th>Prevention group</th>
<th>Initial testing (I)</th>
<th>Final testing (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Arithmetic mean</td>
<td>35°</td>
<td>35°</td>
</tr>
<tr>
<td>Difference (F-I)</td>
<td>0.0°</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>35°</td>
<td>35°</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>Coefficient of variation</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Minimum</td>
<td>35°</td>
<td>35°</td>
</tr>
<tr>
<td>Maximum</td>
<td>35°</td>
<td>35°</td>
</tr>
<tr>
<td>Dependent t-test (I-F)</td>
<td>calculated t-value</td>
<td>-</td>
</tr>
<tr>
<td>p</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

As regards the adduction movement (Table 4), the value of 35° in the range of motion remained constant between initial and final testing.
Table 5. Shoulder internal rotation – Descriptive and inferential data

<table>
<thead>
<tr>
<th>Prevention group</th>
<th>Initial testing (I)</th>
<th>Final testing (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Arithmetic mean</td>
<td>93.7°</td>
<td>95°</td>
</tr>
<tr>
<td>Difference (F-I)</td>
<td>1.3°</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>95°</td>
<td>95°</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2.6°</td>
<td>0°</td>
</tr>
<tr>
<td>Coefficient of variation</td>
<td>2.8%</td>
<td>0%</td>
</tr>
<tr>
<td>Minimum</td>
<td>85°</td>
<td>95°</td>
</tr>
<tr>
<td>Maximum</td>
<td>95°</td>
<td>95°</td>
</tr>
<tr>
<td>Dependent t-test (I-F) calculated t-value</td>
<td>2.804</td>
<td>p 0.009</td>
</tr>
</tbody>
</table>

As to the internal rotation movement (Table 5), a positive evolution was found between initial and final testing. On average, there was an increase of 1.3°, from 93.7° to 95°; calculated t-value = 2.804, p = 0.009 (p < 0.05).

Table 6. Shoulder external rotation – Descriptive and inferential data

<table>
<thead>
<tr>
<th>Prevention group</th>
<th>Initial testing (I)</th>
<th>Final testing (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Arithmetic mean</td>
<td>78.7°</td>
<td>80°</td>
</tr>
<tr>
<td>Difference (F-I)</td>
<td>1.3°</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>80°</td>
<td>80°</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2.2°</td>
<td>0°</td>
</tr>
<tr>
<td>Coefficient of variation</td>
<td>2.9%</td>
<td>0%</td>
</tr>
<tr>
<td>Minimum</td>
<td>75°</td>
<td>80°</td>
</tr>
<tr>
<td>Maximum</td>
<td>80°</td>
<td>80°</td>
</tr>
<tr>
<td>Dependent t-test (I-F) calculated t-value</td>
<td>3.247</td>
<td>p 0.003</td>
</tr>
</tbody>
</table>

As regards the external rotation movement (Table 6), a positive evolution was found between initial and final testing. On average, there was an increase of 1.3°, from 78.7° to 80°; calculated t-value = 3.247, p = 0.003 (p < 0.05).

Conclusions

After applying the proposed prevention programme to the participating subjects, it has been found an increase of 3.2° in the range of motion for flexion, an increase of 3.5° in the range of motion for extension, an increase of 2.7° in the range of motion for abduction, a constant value of 35° in the range of motion for adduction, an increase of 1.3° in the range of motion for internal rotation and an increase of 1.3° in the range of motion for external rotation. Thus, the obtained results confirm the research hypothesis.

We can conclude that kinesitherapy exercises are beneficial for athletes with no pathological condition of the shoulder joint.

We believe that the obtained results have validated the statistical data, thus confirming the research hypothesis.

References


AUTISM AND LANGUAGE DEVELOPMENT

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Abstract. The history of autistic pathology research is opportunely suggested by a comparison used at the beginning of the book “Autism: An Introduction to Psychological Theory”, written by Francesca Happé: “The history of autism is much like waiting for a bus. Nothing happens for a long period, and eventually two buses appear at once” (Happé, 1994, p. 52). The severe communication problems specifically determined by the autistic pathology are thought to be the key elements of its diagnosis. Delay or absence of uttering the first words, accompanied by an apparent lack of reaction of autistic children when somebody talks to them, are usually the first signs that draw attention and alert those around them. An additional reason for which the language and communication problems of autistic children are so important is given by the consistency with which they are encountered as part of the symptomatic picture of autistic pathology, in the sense that they are present regardless of the severity or clinical form under which the autistic spectrum disorder is diagnosed. A characteristic feature of autistic pathology is the concomitant impairment not only of the production and understanding of messages as regards their strictly linguistic content, but also of the non-linguistic aspects of language and the nonverbal communication forms. The result is a rigid way of understanding and producing speech, as well as its stereotypical use.

Keywords: autism, language development, functional deficit.

Introduction

The term “communication”, which often appears in discussions about autistic symptomatology, is more general than the term “language” and therefore incorporates it. Communication defines any form of transmission and reception of information, including the one that is not dependent on a system of symbols (Ricks & Wing, 1976).

Typically, the act of communication between two people includes both the verbal linguistic system and the nonverbal forms of communication. The latter complements, stresses or nuances the message transmitted through the language, being the support of the emotions and attitudes expressed by participants in the communication act.

From this point of view, the role of nonverbal forms of expression in the communication and mediation of social relations is extremely important. This is because the act of communication involves, in both its receptive and expressive components, but especially in the process of relating the two components, the existence of previously acquired cognitive and socialisation skills, without which the decoding and encoding of information, regardless of its verbal or nonverbal support, is impossible.

If we stopped at the narrow meaning of the term “language”, namely the ability to speak, that is, to produce sounds and words, the role of language impairments in the context of autistic symptomatology would be less understood. It is true that half of autistic children will never be able to speak. However, 25% autistic people are capable to do this, namely to say words, and among them, there is a minority that can do this in a functional way, which allows them somehow to communicate and understand what they are told. But even in their case, identifiable impairments at the higher levels of communication, which go beyond the simple production and understanding of utterances, are an important obstacle to their social integration.

The attempt to clearly establish whether language abilities are definitely preceded by cognitive skills (Martin & McDonald, 2004) or, on the contrary, precede them, creates a vicious circle. On the one hand, language has an overwhelming importance in cognitive development, providing the material, the informational support for mental processes (Kamio & Toichi, 2000). On the other hand, the emergence and subsequently the development of language is inconceivable in the absence of cognitive processes such as attention, memory, analysis and synthesis, anticipation, by means of which the information provided by the surrounding environment is processed and integrated into our inner world. It is difficult to determine whether cognitive processes clearly precede the emergence of language through the production of non-linguistic concepts, as suggested by Piaget, or have a parallel development to that of language, as claimed by the correlational hypothesis.

Current level of knowledge reflected in the literature

The first contact of a newborn with the spoken language takes place a few hours after birth, when the baby tries to synchronise their actions with the adult’s voice, a sign of distinguishing it from other environmental noise. At the age of 1 month, the same newborn is able to make fine discrimination between the sounds of speech and the other ambient sounds, and at 3 months, the baby reacts differently, depending on the kind of language that adults...
use to address them. The newborn is mostly sensitive to the special form of speech used by adults to address babies, with exaggerated intonation and specific voice inflexions.

After the age of 3 months, the infant utters inarticulate sounds in an attempt to respond to those talking to them. It is only the beginning of a process that will reach its peak around the age of 6-7 months, when the baby manages to remember how adults utter certain words, depending on the context, and to reproduce them later. Locke (1996) believes that the motivation of this effort is given by the infant’s instinctive need to learn to differentiate between the caregiver’s unusual behaviours and the routine ones in order to find out when the environmental operating rules have changed.

Gradually, as a result of this process, the child learns and succeeds in imitating the emotional manifestations of the adult caregiver, expressing that “emotional contagion” which ultimately leads to the inner reconstruction of an emotional state similar to that of the adult. It is thus believed that communication language opens the way to learning another language, the emotional one (Locke, 1996). During the aforementioned period, the so-called “pre-linguistic conversation” takes place between the child and his/her mother. The infant responds when hearing his/her mother’s voice not only by vocalising, but also by gestures: he/she smiles at her, seeks her eyes and raises his/her arms to be lifted up, thus anticipating the reaction of his/her mother.

The occurrence of manifestations related to the recognition and preferential reaction of the infant when hearing his/her mother’s voice is doubly important. On the one hand, it stimulates the mother to get involved in her child’s play with more pleasure and confidence, and on the other hand, by recognising his/her mother, the child becomes more confident and willing to participate in the new games initiated by her. In this way, the interaction and formation of emotional ties between the two are fostered, the child also having the opportunity to practice the newly acquired preverbal skills. Between the age of 8 and 9 months, the infant is able to understand simple words such as “mom”, “dad”, “bye”, “no”, and before the age of 1 year, the baby is able to make associations between familiar words and objects. At the end of the first year of life, children are able to understand the words of a restricted common vocabulary. The ability to effectively use its words develops later; most often, the first words spoken by the child are not necessarily the first words they understand.

Around the age of 10-11 months, the infant begins to point their finger at objects of interest, managing to use the nonverbal form of communication to attract attention or ask for help, to protest or express their joy. The manifestation of this gesture is thought to be an extremely important step in the development of communication skills, indicating that the child has acquired the ability to coordinate their actions on a certain topic of interest with those of a communication partner. The coordination between “different points of view” opens, in terms of communication, the path towards developing a shared code (Lord, 1985). The gesture by which the child points at the object of interest is not the only one that appears in this period.

Through gesture and mimicry, the child can: request (reaching in the direction of a desired object while opening and closing the palm and looking alternately at the adult’s eyes and the object); give an object (usually with the intent to draw the adult’s attention to it); show or hold an object in the adult’s line of sight (with the same intent to draw the adult’s attention to it). Gestures are generally accompanied by a certain group of sounds, which gradually turn into a certain word that is initially used in a somewhat stereotypical way, but then this association becomes more diversified. It is believed that the emergence of the child’s ability to combine two gestures that encode either the same semantic element or distinct semantic elements, followed by the association between gestures and words, precedes the transition from using a single word to using two-word associations (Capirici et al., 1996).

In parallel with the above-mentioned evolution, starting with the same age of 10-11 months, the infant becomes able to respond specifically to the speech addressed to him/her, depending on the emotional content it involves and which is relatively independent of the strictly linguistically encoded information. The sensitivity to phonetic contrasts increases as the child’s experience of this kind becomes more diverse and richer (Locke, 1996).

As opposed to those described above, autistic children fail to follow the natural course of development. They are unable to use gesture to initiate social interactions and communicate, and the adults’ attempts to initiate communication remain ineffective (Jolliffe & Baron-Cohen, 1999), autistic children being indifferent not only to their mother’s voice, but also to her mimicry or gesture.

At the end of the first year of life, the first words also appear. For a normally developing child, this event represents the beginning of an intermediate stage, that of the echolalic speech, which imitates the adult’s utterance rather than having a communicative character.

According to the theory supporting the social bases of language, the child imitates both the specific way in which consonants and vowels are ordered in a certain word and the specific phonetic way in which they have been uttered. The explanation of the phenomenon known as “phonetic gravity” is supposed to rely on the child’s desire.
for social identification with the speaker and integration into the social group to which the speaker belongs (Franco & Butterworth, 1996). According to this hypothesis, language, before being a carrier of meaning, is the pathway to a certain identity, to belonging to a certain social group, to a certain culture. This also explains the fact that there is a moment of development when children raised in a certain culture develop additional skills necessary to speak in the language of that culture, while losing at the same time potential skills that are useless for the cultural and linguistic context in which they develop. In other words, the child initially becomes aware of the grouping of consonants and vowels in words, gets familiar with the way the sounds are uttered in his/her language and only then understands that they designate something and tries to learn what that something is. Thus, the echolalia phenomenon becomes accidental after the child utters the first functional words, persisting only sporadically until around the age of 2 years and a half - 3 years. However, for autistic children, this stage not only extends beyond the normally permitted age, but represents a particular way of speaking.

Consecutive to the events described above, the child utters the first functional words that are invariably and exclusively nouns commonly used by toddlers aged 1 year and 3 months - 2 years (Howlin, 1980). The reported event coincides with the cognitive acquisition of the ability to operate with mental representations and symbols. Typically, the first human beings or objects named by words belong to the familiar environment or are frequently encountered by the child. Often, the child does not want to express something specific when saying these words, but rather to demonstrate that he/she has learned correctly certain words and is able to utter them. At first, the association between the word and the object/person it designates is as strict as possible. The child probably thinks that each object he/she sees has its own name.

Around the age of 14-15 months, the use of terms becomes more lax, the child naming with the words already known objects similar to those familiar to him/her. Moreover, if the child initially names only the objects that are present at that moment in his/her visual range, towards the second half of the second year of life, he/she will start talking about objects that are not present. Many researchers believe that only with this progress the first true stage in language development has been completed, marking the transition from associative to symbolic naming (Tager-Flusberg, 1985).

However, in the case of autistic children, this strict association between the word and its designation when initially heard is preserved for a long time, which is difficult to delimit: not any mug will be called a “mug”, but only the one that the child has seen when he/she learned this word.

**Topic addressed**

For autistic children, the first signs of deviant language development can be identified since the period of vocal games played at the age of 6-9 months. Through these games, the normally developing child usually signals a certain need or expresses an inner state (joy, discomfort, pleasant surprise or fear). However, for the autistic child, vocal games are not only disjointed, but also less expressive by far, at least apparently. We used the term “apparently” because there are studies showing that parents of autistic children have learned, even in these conditions, to identify the message carried by their “inexpressive” sounds for anyone else (Ricks & Wing, 1976).

Although autistic infants also manage to use short combinations of sounds to “express themselves”, they do so in a personal, idiosyncratic way, which differs from what is accepted as normal (Schuler & Prizant, 1985).

In fact, for the autistic child, the entire pre-linguistic period is characterised by the absence of age-typical manifestations or their deviant production. From this point on, the most devastating consequences for language development and not only consist in the inability of the autistic infant to engage with his/her mother in “nonverbal dialogues”. The result is that no “bridge” is established between the adult world and the child’s world. Experts believe that this inability of autistic infants to “meet” with the adults around them for sharing a common ground is not only one of the first manifestations of autistic disease, but also one of the main causes of language and socialisation deficits that escalate later, during the course of the disease (Rollins & Snow, 1998).

Autistic babies “communicate” with adults only by crying and screaming, both of them being intense, monotonous and identical, no matter what they want to express. Once they have learned to walk, autistic children express their wishes by effectively pulling the hand of the adult caregiver and then placing it on the desired object or, when the situation allows, placing the content of the desired object in the adult’s hand. Throughout the entire operation, the baby does not look at the adult caregiver. In successful cases, the stage of concrete demonstrations is followed by the emergence of relatively symbolic gestures such as pointing at the desired object to be seen by the adult. Superior forms of this type of gesture, for instance, moving one’s head to say “yes” or “no”, are very rarely encountered in the motor behaviour of the autistic child (Bates, Thal, & Janowsky, 1992).
The production of the first relatively functional words may occur, in fortunate situations when one can talk about the existence of such an event, at any age, but usually long after the normal age. The few autistic children who will be able to speak mostly do this around the age of 5 years (Capirici et al., 1996). However, there are also situations where the autistic child uses rudiments of language at the age considered as normal for their appearance, but subsequently they lose them as a result of a general regression process (Ziatas, Durkin, & Pratt, 2003).

The first words of autistic children designate either food or other inanimate objects, generally static components of the environment instead of important familiar people or other expressions of social importance (“bye”), as expected in the case of normal development. In the further development of language, autistic children encounter difficulties in grouping familiar objects into broader categories, namely in the formation of concepts.

The difficulty is not so obvious in the case of simple concepts such as those related to size, form, colour and number. But when it comes to concepts whose formation requires much more than their simple linguistic storage, namely the mental processing of a certain piece of information, the impairments of autistic children are more severe by far. For this reason, autistic people have a tendency to learn new words by passively taking them from adults and mechanically storing them in memory. Unlike other children, for them, language learning is not an active process of analysis, of search for similarities followed by the classification of newly acquired semantic information into broader concepts that have been previously acquired. The words newly learned by the autistic child tend to rigidly preserve their initial meaning, without benefiting from the process of nuancing and broadening the initial meaning, which is encountered in children with normal development as they gain and diversify their experience.

In general, the vocabulary of autistic children is overwhelmingly made up of words for which there is immediate perceptual support (nouns, some adjectives). Words that do not meet this condition, namely verbs, prepositions, adverbs and commonly those parts of speech that express relationships between objects and events are very problematic for autistic children, both in terms of learning and usage.

With regard to verbs, autistic people have great difficulties with those referring to inner states (to think, to feel, to believe) or describing some change (to grow, to grow old), but also with verbs whose understanding requires a change of perspective (to come - to go, to take - to receive). An interesting feature of the way in which autistic people use verbs is given by a correct use of the present tense, accompanied by an invariably misuse of the past tense (Menyuk & Quill, 1985).

Pronouns are also misunderstood and misused. Autistic children frequently replace in their expressions the first-person singular with the third- or second-person singular. In general, the utterances made by autistic people are extremely short, because they tend to use as few words as possible. Even so, they often wrongly select the words with which they build sentences, replacing the appropriate words with others that have similar forms (Ricks & Wing, 1976).

But many autistic children are not able to acquire a sufficiently rich vocabulary from which to select words and put them together in intelligible statements. Some of these children use as an alternative a repetitive, echolalic language (Schuler & Prizant, 1985).

As previously shown, the echolalic utterance of words is an intermediate transient stage occurring around the age of 1-2 years in children with normal language development. But in their case, it is gradually replaced by the functional use of words. However, for autistic children, the automatic repetition of words or utterances heard from adults in different contexts, but which they do not understand, often remains the only form of language they will be able to use for communication purposes. Most autistic children mechanically repeat the words at the end of a sentence or fragments of a conversation heard in a context that has somewhat impressed them.

Everything is reproduced with the same intonation used by the person from whom the child has taken the words. Imitation of adult speech is a phenomenon also encountered in normally developing children, but they use it in order to adapt the statement to the social situation exiting at the time of imitation. This is not the case for autistic children: they mechanically repeat fragments of a statement sometimes heard even many days ago, without changing anything in the content. They often do so while being completely captivated by an activity that has nothing to do with the utterance. But there are also situations where echolalic statements are used for communication purposes. In this case, the sentences or phrases mechanically stored in a certain context are rigidly associated with that context, the autistic child subsequently trying to express something that has to do with the respective situation or to use them in similar situations to the one in which he/she has retained the text.

Although less commonly encountered than in specific language development disorders, pronunciation problems are also found in autistic symptomatology. But their intensity is variable, in the sense that some children are unable to utter intelligible words, others “miss” only the beginning or end of the word, and others have only minor problems with certain sounds.
The nonverbal aspects of communication are also obviously disturbed. In the best case, they are mechanically learned in their canonical form in order to be reproduced later. With bitter humour and referring to autistic people, Wing (2013, p. 83) stated that “life seems too short to teach the correct response in every imaginable situation”.

When they are not totally inexpressive, autistic children smile, laugh, cry, feel anger or fear, but they do so in a particular way, producing only the extreme forms of such manifestations. Moreover, the expression of inner states is totally inappropriate with the child’s age and almost always inadequate to the social context. Spontaneous forms of communicating emotional states are atypical. Autistic children often choose to express their feelings by singing short songs created by them or previously heard. Actually, there are studies showing that the different emotional states expressed through music are easily recognised by autistic children, whose performances in this area are similar to those of children with normal development (Heaton, Hermelin, & Pring, 1999). But autistic children can also express their joy by covering half their face with their palm, the significance of this gesture being completely inaccessible to a person who is not part of the child’s usual surroundings (Tager-Flusberg, 1985).

Wing (2013) described the conversation with autistic children as being similar to the one that somebody might have with a well-programmed computer or a stereo running a previously recorded cassette. This is mainly because the pragmatic aspects of language (so important in a conversation), such as idiomatic expressions, implicit humour or metaphorical expression, remain totally inaccessible to autistic people.

The way in which autistic children react to hearing these nuanced complex forms of expression has become somewhat anecdotal. Due to a literal manner of interpreting such statements, an autistic child, asked by his mother if he was so quiet because he “has lost his tongue”, got scared and started to search for it through the room and then in his oral cavity (Werth, Perkins, & Boucher, 2001).

But in some cases, with the passage of time and the accumulation of social and cognitive experience, such reactions may become improbable. In this case, autistic children who have become adults can understand and even produce simple forms of spontaneous humour (Ziatas et al., 2003), but never to the same extent as a normally developed person.

Conclusions

The inability of autistic children to understand the figurative aspects of language, metaphors, humour and irony, as well as to decipher the linguistic forms of encoding the emotional load of a message, is attributed to the deficit of these children in acquiring what is called a “theory of mind”. Broadly, this is the individual’s ability to understand and represent the inner state of another person, but also to use this ability to anticipate and assess the partner’s behaviour (Martin & McDonald, 2004).

There are numerous studies that establish a link between the deficit in attributing intentions to the communication partner and the inability of autistic people to use and understand the figurative language. Despite their ability to remember and accurately reproduce statements made by the discussion partners, autistic people are often unable to find an internal coherence of the discussion, because they are immune to the different types of connections that can be established between the statements they have heard. Their lacunar style of processing information, which compromises access to the global meaning of the statement, is also thought to be the result of a cognitive pattern of information processing characterised by weak central coherence (Jolliffe & Baron-Cohen, 1999).

Due to this specific cognitive function, autistic people tend to stop at particular, sometimes detailed aspects of the processed information, while remaining indifferent to its global meaning. This might be one of the reasons why language is perceived by autistic people independently of the social context in which it is produced (Muraru-Cernomazu, 2004).

We presented above the characteristics of language impairments in autistic children, mainly considering the role of language as a means of achieving interpersonal communication. However, there are also problems when talking about language as a support for one’s inner life. The lack of developing appropriate forms of symbolic play, imagination or pretence during childhood results in the absence of an adequate inner language. Subsequently, as adolescents and then adults, autistic people are described as having a poor inner life; they seem indifferent to what happens to them, incapable to worry or make plans for their future. This “angelic state”, as it is often called, is also the consequence of the deficit described above.

Authors’ contributions

All authors contributed equally to this study and should be considered as main authors.
References

HEART RATE VARIABILITY – A TOOL FOR ANALYSING THE AUTONOMIC REGULATION OF THE CARDIAC FUNCTION IN SPORTS

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Abstract. This study is focused on a topic integrated in advanced knowledge of cardiovascular physiology regarding the heart rate variability (HRV) as a tool for analysing the autonomic regulation system. These aspects will benefit either the sports performer, the person exercising for health or the patient receiving a therapeutic programme. HRV, namely the variability of intervals between consecutive heart beats, is related to the balance of autonomic nervous system (ANS), being a non-invasive measurement tool for analysing the ANS state in different categories of population, including all-level athletes. Besides the well-known short-term and long-term cardiovascular adaptations to exercise, HRV measurements (time domain, frequency domain and nonlinear methods) could be used in different directions linked to properly adjusting the training load, indicating the level of stress and recovery, detecting overtraining syndrome and fatigue or objectifying the training status. One of the innovative practical applications is the HRV-guided training, meaning adjusting the inter-play between exercise volume and intensity according to individual responsiveness to training loads. We can assert that HRV is a parameter that provides a picture of both the previous training load and the state of readiness of the athlete for the next training session, depending on the sympathetic-vagal balance during recovery. Increased HRV scores may reveal positive adaptations and the ability of adjusting to different training loads, while low HRV values prior to important competitions may represent readiness to compete and cope with stressful situations.

Keywords: heart rate variability, sports training, readiness, autonomic nervous system.

Introduction

One of the core aspects in sports science, which offers new insights into the maximisation of athletes’ potential, is represented by exercise physiology investigating the various effects of physical activity upon the adaptation mechanisms during training, competition and recovery sessions.

In sports training, the cardiovascular system, integrating the body as a whole, plays a crucial role in providing active muscles with nutrients and oxygen during exercise by means of a complex chain including a pump, an artery distribution circuit, exchange vessels and a venous return system. Complex mechanisms continually interact for maintaining an exquisite level of cardiovascular regulation in order to meet the physiological needs in different sport branches and environmental challenges.

This study is focused on a topic integrated in advanced knowledge of cardiovascular physiology regarding the heart rate variability (HRV) as a tool for analysing the autonomic nervous system (ANS). These aspects will benefit high-level athletes and coaches, people exercising for health or patients receiving a therapeutic programme.

Topic addressed

It is well known that cardiac performance is determined by the stroke volume and the heart rate, both acting in concert to optimise this physiological parameter.

Unlike other tissues, the cardiac muscle maintains its own rhythm due to the sinoatrial (SA) node, which provides the innate stimulus for the impulse transmission within the myocardium. This sinus rhythm is about 100 beats per minute (bpm), if just the inherent rhythmicity occurs (Kenney, Wilmore, & Costill, 2015, p. 156). The generated impulse in the SA node spreads across the atria up to the atrioventricular (AV) node and, through the bundle of His, penetrates the ventricles through the Purkinje system fibers. These mechanisms allow a unified and simultaneous subsequent contraction of both ventricles in a chain reaction (McArdle, Katch, & Katch, 2007, p. 335) due to the intrinsic regulation of heart rate.

The other type of heart rate regulation is the extrinsic one, which is responsible for accelerating the heart and rapidly adjusting to the exercise intensity. For example, in a highly-trained endurance athlete, the heart rate might be 30 bpm, while a sprinter may reach 200 bpm in a maximal intensity exercise (McArdle et al., 2007, p. 337). Also, at rest, a non-athlete typically has heart rate values between 60 and 80 bpm.

The extrinsic regulation mechanism overrides the intrinsic mechanism through the neural influences of the sympathetic and parasympathetic neural inputs originating in the cardiovascular centre (Kenney et al., 2015, p. 84).
The sympathetic nervous system, through the cardioaccelerator nerves, causes chronotropic and inotropic effects, which means activating the SA node (leading to tachycardia) and increasing myocardial contractility, respectively (Ehrman, Kerrigan, & Keteyian, 2018, p. 78), the neurohormones involved in this sympathetic regulation being the epinephrine and norepinephrine. Besides, massive sympathetic stimulation accompanying major competitions also leads to coronary vessel dilation, peripheral vasodilation, blood pressure augmentation or mental activation (Kenney et al., 2015, p. 86). Known as the fight or flight system, the sympathetic nervous pathway prepares the athlete to face the requirements of the sports event in conjunction with the parasympathetic system, often allowing competitors to challenge their human limits.

The parasympathetic nervous system reaches the heart via the vagus nerve, which delivers impulses to the SA and AV nodes, exerting opposite effects to those of the sympathetic system: decrease in heart rate, decrease in strength of the cardiac muscle contraction, constriction of coronary vessels and generally conservation of energy (Kenney et al., 2015, p. 86). The parasympathetic neurons release acetylcholine, its inhibition stimulating the heart rate during low to moderate intensity exercise. In maximal exercise intensity, heart rate increases due to additional parasympathetic inhibition along with the activation of cardioaccelerator sympathetic nerves.

Considering the above, one of the most important markers of autonomic nervous activity is represented by the heart rate variability. HRV is a conventionally acknowledged term expressing “the oscillation in the interval between consecutive heart beats” (RR intervals), “as well as the oscillations between consecutive instantaneous heart rates” (Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996, p. 354).

It is widely accepted that the amount of heart rate variability reflects the sympathetic and vagal balance within the autonomic nervous system, with consequences in clinical medicine, but also in the sports science area.

- **HRV – A theoretical approach**

Historically speaking, HRV was studied for the first time in the 1960s, within clinical research of the foetal distress, while in the 1970s, Wolf et al. (1978) investigated the correlation between decreased HRV and increased risk of mortality after myocardial infarction. Nowadays, besides the clinical use, HRV is gaining momentum also in sports science, in terms of monitoring the training status, fatigue and recovery, competition readiness and stress coping. This is possible through the use of modern computerised devices and various on-line applications that are permanently improved and continuously upgraded in order to provide more detailed information on the athletes’ physiological responses to training stimuli. Given that the heart is not a metronome, and its beats do not have the regularity of a clock (Vanderlei et al., 2009), fluctuations in heart rate are normal, indicating the heart’s ability to respond to various stimuli, including breathing, mental stress, haemodynamic changes, pathological conditions and physical exercise (Aubert, Seps, & Beckers, 2003; Rajendra Acharya et al., 2006; Catai et al., 2002). Thus, the intervals between consecutive heart beats are related to the autonomic nervous system influences on the sinus node, being a non-invasive measurement tool for analysing the ANS state in different categories of population, including all-level athletes. Figure 1 shows an example of time difference between four successive heart beats, illustrating the very essence of heart rate variability.

![Figure 1. Example of RR intervals (Elite HRV, 2019)](image)

As shown in Figure 1, changes in HRV patterns signify two types of physiological responses: high values of HRV indicate good adaptation and effective autonomic mechanisms, while low HRV might reveal maladaptation of the ANS to different circumstances (Pumprla et al., 2002).
Analysing RR intervals leads to different HRV indexes calculated by means of various measurement devices, such as electro-cardiographer or cardio-frequency meter, using top-notch technology including external sensors attached to the body (Gamelin, Berthoin, & Bosquet, 2006; Brunetto et al., 2005).

According to the relevant literature for sports science, analysis models for HRV indexes comprise the time domain, frequency domain and nonlinear methods (Vanderlei et al., 2009).

Time domain methods are probably the simplest way to analyse fluctuations during the cardiac cycles by using statistical and geometric indexes.

Statistical methods for the time domain include the following indexes (Aubert et al., 2003) (Table 1):

<table>
<thead>
<tr>
<th>Index</th>
<th>Unit</th>
<th>Description</th>
<th>ANS cues</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDNN</td>
<td>Ms</td>
<td>Standard deviation of all normal RR intervals recorded in a time interval</td>
<td>Global HRV</td>
</tr>
<tr>
<td>SDANN</td>
<td>Ms</td>
<td>Standard deviation of the normal RR interval means every 5 minutes in a time interval</td>
<td>Global HRV</td>
</tr>
<tr>
<td>PNN50</td>
<td>%</td>
<td>Percentage of RR intervals with a difference of duration greater than 50 ms</td>
<td>Parasympathetic activity</td>
</tr>
<tr>
<td>RMSSD</td>
<td>Ms</td>
<td>Root-mean square of differences between RR intervals in a time interval</td>
<td>Parasympathetic activity</td>
</tr>
</tbody>
</table>

According to Niskanen et al. (2004), SDNN and SDANN indexes are used in long-term records giving cues about sympathetic and parasympathetic activities, with no distinction between their ratios within the HRV changes, while PNN50 and RMSSD indexes emphasise the parasympathetic activity (Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996).

One of the most common geometric methods is represented by the triangular index (Vanderlei et al., 2009). The triangular index is the total number of heart beats recorded in a certain period divided by the number of beats in the modal frequency, namely the group of beats with the highest peak in the histogram (Stein, 2002), which corresponds to the median of RR intervals (Figure 2).

The shape of the histogram is an indicator for normal, low or very low HRV values; narrow histograms are associated with decreased HRV, which is typical for cardiac patients.

**Frequency domain**

This analysis is based on decomposing the HRV into fundamental oscillatory components (Table 2).

<table>
<thead>
<tr>
<th>Index</th>
<th>Unit</th>
<th>Description</th>
<th>ANS cues</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF</td>
<td>ms²</td>
<td>Low frequency (0.04 – 0.15 Hz)</td>
<td>Sympathetic activity predominance</td>
</tr>
<tr>
<td>HF</td>
<td>ms²</td>
<td>High frequency (0.15 – 0.4 Hz)</td>
<td>Parasympathetic activity</td>
</tr>
<tr>
<td>LF/HF</td>
<td></td>
<td>Ratio between low and high frequency components</td>
<td>Balance between sympathetic and parasympathetic activity</td>
</tr>
</tbody>
</table>
An example of histogram for the frequency domain is presented in Figure 3.

![FFT spectrum](image)

Figure 3. Example of histogram for the frequency domain analysis

**Nonlinear methods**

Biological systems exhibit nonlinear behaviour due to their dynamic natural complexity. HRV is a good example in this regard, as it emerges from multiple regulation mechanisms. This idea might be in opposition with the homeostasis concept as a state of steady internal parameters maintained within the living systems. Even in resting conditions, complex fluctuations occur, their dynamics being often irregular. In this context, nonlinear analysis allows assessing the complexity of heart regulation through the autonomic nervous system. RR variations throughout time emphasise the ability of the nervous system to integrate numerous stimuli and provide different optimal responses. We can assume that RR interval signals seem to be in apparent disorder, the concept of entropy being relevant for this state and also possible to quantify. For this reason, most software programs for analysing HRV indexes include nonlinear cues: approximate entropy (ApEn) and sample entropy (SampEn), both depicting the capability of the nervous system to adapt to internal and environmental factors. Specifically, low entropy values testify a predictable regular non-messy phenomenon, while high values emphasise a more complex irregular signal. Another nonlinear method that complements the HRV complex analysis is the Poincaré plot.

The Poincaré plot represents the dispersion of RR intervals in a certain time period, being possible to analyse it qualitatively (by assessing the figure resulting from the values) and quantitatively (by adjusting the ellipse of the resulting figure), from which three indexes can be obtained: SD1, SD2 and SD1/SD2 ratio (Brunetto et al., 2005) (Figure 4).

![Poincaré plot](image)

Figure 4. Example of Poincaré plot for a junior athlete

SD1 represents the dispersion of RR intervals related to short-term values, while SD2 represents the dispersion in long-term records. These two parameters are related, a ratio between them (SD1/SD2) expressing the short- and long-term variations in RR intervals (Gamelin et al., 2006). The most common Poincaré plot, as described by Tulppo et al. (1998), has the shape of a comet (normal pattern) – the longer the RR intervals are, the higher their
dispersion. The Poincaré analysis offers information about the parasympathetic activity (SD1) and global autonomic regulation (SD2).

The above-mentioned HRV indexes (time domain, frequency domain and nonlinear methods) are statistically processed by specific software, the data being interpreted in a correlative approach.

- **HRV – practical applications in sports**

In sports practice, cardiovascular adjustments represent an important resource for maximising the athlete’s capabilities, as a result of integrating neural, chemical and motor components. Reaching high performance requires continuous search for identifying mechanisms and parameters to be optimised in relation to a proper prediction of sports results. Besides the well-known short-term and long-term cardiovascular adaptations in exercise, HRV measurements could be used in different directions linked to properly adjusting the training load, indicating the level of stress and recovery, detecting overtraining syndrome or objectifying the training status. Also, there is a large body of evidence related to the application of HRV in sports according to gender and age characteristics.

One of the fundamental cues in sports periodisation is the training load distribution, meaning the inter-play between the training volume and intensity. Authors like Kaikkonen et al. (2010) examined if post-exercise HRV indices could be used to assess training loads in different types of effort. The results of this study emphasised a significantly delayed HRV recovery after intense or prolonged exercise and also a significant relationship between post-exercise HRV and the rate of perceived exertion. Generally speaking, an intensive endurance exercise can lower the HRV values, but proper recovery will end in increasing the HRV up to the baseline values. If HRV does not recover post-exercise in a certain amount of time, the training might have been too hard or too frequent (Oura, 2018). In the long-run, regular endurance exercise tends to enhance HRV as an adaptation effect.

As heavy training shifts the cardiac autonomic balance towards the sympathetic drive over the parasympathetic one, this might induce decreased HRV; hence, the HRV monitoring could optimise training by diminishing the overtraining risk and personalising the training load and recovery as cues for guiding training plans. The HRV monitoring one day after rest or easy training sessions leads to higher HRV values, while the HRV assessment one day after average or intense training sessions leads to lower HRV indexes (Altini & Amft, 2017).

One of the innovative practical applications is the HRV-guided training, an idea developed by authors like Plews et al. (2013), Javaloyes et al., (2018), Nuuttila et al. (2017), who consider HRV as an effective alternative to adjust the training load versus the predefined traditional training programmes. Experimental patterns were performed on standardised training and HRV-guided groups, with significant positive effects in terms of VO2max, peak power output, ventilatory thresholds etc.

Other studies (Buchheit & Gindre, 2006) investigated the relative association between the fitness level, the training loads and the cardiovascular parasympathetic modulation. It seemed that vagal-related indexes were higher in fit subjects for all training loads, and post-exercise HRV recovery was faster when moderate training loads were used, whatever the fitness level of the subjects.

Flatt and Howells (2019) referred to how elite rugby players responded to incremental training loads by using HRV measurements. Results showed that the players exhibited, during a 3-week period of monitored training sessions with incremental training loads, a small increase and then a moderate decrease in RMSSD index, which proved moderate training stress and good tolerance and adaptation to specific stimuli.

Although there is the assumption that high training loads will result in athletes’ negative responses and fatigue accumulation, an optimal training status will lead to reductions in subjective negative perceptions of general mood, exhaustion, stress level, self-confidence, etc.

Most modern devices specialised in assessing the physiological responses of athletes use the recovery time as a measure of the training load in the previous exercise. Concerning the relationship between HRV and recovery time, studies (Gifford et al., 2018) examined the HRV temporal change in linear and nonlinear measures emphasising a significant increase in relative parasympathetic dominance and RR interval irregularity at 15 days after extreme endurance exercise in fit adult women versus pre-exercise baseline.

In this context, we can assert that HRV is a parameter that provides a picture of both the previous training load and the state of readiness of the athlete for the next training session, depending on the sympathetic-vagal balance during recovery. Furthermore, studies on HRV and overtraining have revealed that this state is often associated with the activation of the sympathetic branch and cardiorespiratory system, along with a lower HRV value. Thus, the coach will have feedback on the internal status of their athletes, which requires a continuous adjustment of the training load and recovery means and duration.

HRV measurements can link emotional intelligence in sports to some frequency domain parameters, the purpose being to analyse the influence of the above-mentioned psychological trait on the LF/HF ratio, as an
indicator of mental stress “when the athlete is exposed to a competition-like stressor” (Laborde et al., 2011, p. 34). This research found a significant increase in the LF/HF ratio for all athletes, irrespective of their different emotional intelligence profile, as a sign of the sympathetic activation; this increase was higher for low-trait emotional intelligence subjects, who displayed a higher level of stress compared to high-trait emotional intelligence subjects, who were able to better cope with stress. Equally, nonlinear methods, including the Poincaré plot, generate the possibility to detect the stress level by calculating the stress score based on SD1 and SD2 parameters (Naranjo Orellana et al., 2015).

Dong et al. (2018) studied how resting HRV parameters were used as a stress resilience indicator, in a quantitative approach. In the long term, this might contribute to stress management in athletes by predicting their internal responses to upcoming stressful events.

In brief, we present below the significance of the HRV score related to sports performance (Figure 5).

**Figure 5. HRV score related to sports performance**

It is widely acknowledged that comparing HRV individual values for different subjects can be misleading, as many factors impact this parameter.

Although there are no normative HRV values for different categories of population, studies analysing sedentary versus active subjects have emphasised a higher RMSSD index and RR intervals, as well as lower heart rates for those regularly practicing physical activities (Melo et al., 2005; Paschoal, Polessi, & Simioni, 2008). The authors reveal that increased vagal tone and parasympathetic activity, coupled with a reduced sympathetic reaction and higher HRV, have been found in trained men and women at rest. Significant differences between athletes and active subjects were found for the time domain, frequency domain and Poincaré parameters.

Koenig and Thayer (2016), as well as Gifford et al. (2018), focus on the differences between men and women, women having a lower sympathetic reaction than men, with positive cardio-protective effects and some recovery advantages post heavy exercise.

According to the Elite HRV users’ data, some normative HRV values were possible to identify, the average HRV score being 59.3 on a 1-100 scale. In relation to aerobic fitness levels, studies emphasised increased HRV indices meaning better recovery, energy levels, muscle regeneration, etc. (Moore, 2017).

**Conclusions**

HRV represents one of the most important markers of autonomic nervous activity, giving insights into the maximisation of athletes’ potential. HRV might be a valuable tool for monitoring the training status, fatigue and recovery, competition readiness and stress coping.

Analysis models for HRV indexes comprise the time domain, frequency domain and nonlinear methods. Longitudinal monitoring of elite athletes is an essential requirement for analysing the unique personal HRV fingerprint. Based on these data, the coach will incorporate specific training contents according to their physiological responses.

Increased HRV scores may reveal positive adaptations and the ability of adjusting to different training loads, while low HRV values prior to important competitions may represent readiness to compete and cope with stressful situations.
Authors’ contributions

All authors contributed equally to this article and should be considered as main authors.

References


ADAPTED TRAINING SESSIONS – A PLUS FOR BEGINNER ATHLETES

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Abstract. The written and unwritten law of sport states that the beginning of a new year of training must rely on a large amount of running (to develop the aerobic mechanism) and muscle strengthening exercises. This paper, which is intended to be a mini-guide for youth coaches, describes a more and more common situation encountered in athletics clubs, as well as the possible ways of managing it. Thus, as a result of the pressure to have a certain number of athletes in a group, but also of the continuous selection process, the coach has to work with heterogeneous-level athletes. In order to make progress, even if the chosen path remains the improvement of physical condition and the optimisation of motor skills, the initial concept needs to be adapted. Using exercises that also involve the anaerobic pathway and practicing the technique in a playful environment (which is called varied training) are important sources of progress.

Keywords: adapted training, beginner athletes, coaching.

Introduction

Children and adolescents require a specific approach to physical preparation for sports participation, because they are still growing, developing and maturing, which means that any appropriate training programme must rely on the individual’s level of physical development, movement mechanics, posture control and psychosocial maturity. Therefore, youth coaches should consider that their trainees are not miniature adults, so philosophies such as “no pain, no gain” should not be imposed on them even if they are well-built, strong and have good coordination skills. Improper physical preparation or training errors such as “too much too soon” is another problematic issue that may lead aspiring young athletes to be unable to cope with the demands of sports training and competition (Faigenbaum & Meadors, 2010).

Trotter (2017) reinforces the idea that advancing too quickly reduces movement quality, which creates inefficient and unsafe movement patterns that lower the intended adaptation. Early sport specialisation should also be avoided, several studies indicating that a variety of sport and exercise activities decreases the risk of musculoskeletal disorders, which are usually associated with the participation in a single sport or physical activity (Auvinen, 2008). Moreover, it produces young athletes with a limited skillset, because their bodies have only been asked to perform a very limited number of tasks (Trotter, 2017).

Another “endeavour” of the youth coach is to provide children and adolescents with a positive and enjoyable approach while improving their motor skills. Basic locomotor skills (running, skipping, hopping) and object control skills (throwing, catching, striking), which require agility, balance, coordination and speed, are the foundation for more advanced sports-specific movements that will be experienced later in life. To be successful with their trainees, youth coaches should understand the importance of developing quality movement patterns and improving exercise technique with less intense training sessions, obviously interspersed with hard workouts, knowing that both of them are required for adaptation. A balanced schedule for training and competition will optimise the development of young athletes throughout their careers. Youth coaches should praise good athletes for their performance in order to enhance their self-confidence; they should also teach young athletes to see mistakes as part of the learning process and use failure to improve their motivation. Developing and demonstrating physical competence, gaining social acceptance and support, as well as having fun, are among the most important motives of children and adolescents involved in practicing sports activities (Faigenbaum, & Meadors, 2010).

Recent studies have identified “lack of fun” as the main reason for young athletes to quit their sport (Schwellnus et al., 2016). Because sometimes youth coaches focus on the technical, tactical and physiological aspects of training and physical preparation, they forget that enjoyment is a crucial determinant of intrinsic motivation, which in turn is a direct predictor of effort and persistence (Soligard et al., 2016). Warm-up games, team relays, a challenge or athlete-directed cool-downs at the end of the session are fun, while hard workouts and circuits are rarely fun for young athletes (Gazzani, 2019).

The training involves a permanent consumption of energy that different muscles, tissues and organs must use uninterruptedly (Geambașu, 2018). But each training session should be stimulating and challenging while providing fun and enjoyment in a friendly environment able to generate positive behaviour and to foster the achievement of personal goals. In order to optimise sports performance, reduce the risk of injury, prevent early
dropout and produce elite athletes, a long-term athletic development plan should be designed. Youth coaches (but also parents) who want immediate results and search for quick solutions should remember the famous saying that “there are no shortcuts to success”. Therefore, only a systematic and sensible progression of the targeted variables can lead to successful sport programmes. The good intentions and willingness of a coach to work with children and adolescents are praiseworthy but not enough. Since the long-term development of an athlete depends on coach education, youth coaches should change old habits (if appropriate) and learn new skills to better help athletes improve their performance; for this purpose, they should adapt workouts to each individual’s chronological, developmental and training age (Faigenbaum & Meadors, 2010).

In addition, Trotter (2017) believes that emphasising more control and smart progression of the fundamentals is the most effective workout for the first years of training.

**Topic addressed**

A good coach possesses knowledge (gained through reading, research), experience (practical work on the track and field) and the desire to impart (dynamism and creativity during practice).

Starting from the famous saying of Socrates, “I know that I know nothing”, a coach needs to learn all the time, because the human motricity is complex and so are the athletes. Coaches must help them (especially the younger ones) acquire maximum competences so that they can later choose the suitable athletic event. To produce successful athletes, the coach must build their self-confidence and give meaning to their learning (Thompson, 2009).

However, a question arises: what to do with low-level athletes?

Most of all, specialisation is excluded. In spite of their apparent helplessness, young athletes must be kept in group, because the trigger factor may appear later. More precisely, they will be allowed to clear the hurdles with 5 or 6 strides, to perform the shot put from the standing position or with cross steps, to perform the long jump with a run-up of no more 10-12 strides. All this requires some kind of organization, but especially the coach’s adaptation.

Even if the selection is made on a scientific basis, it can raise various problems for the youth coaches. Thus, a common situation is highlighted in the following example: at the end of September, the training group mostly includes juniors interested in the jumping event and hurdle races, as well as two girls and two boys with completely atypical profiles: the girls are poorly endowed with motor qualities and have no physical condition – one is very thin, and the other is overweight. They are beginners within a group made up of athletes with at least 3 to 4 years of experience. How can a coach manage this situation?

The club has competitive objectives for each age category, from beginners to veterans. Therefore, the activity will be playful for the youngest children, endurance-based (running) for veterans and traditional athletics will be used for the rest; physical activity will be organized according to the competition calendar. These people join the club having their personal motivations, which are not very clearly explained: to do a little exercise, to lose weight, to do what they have seen in the morning gymnastics TV shows or the YouTube, but not to train for competing.

In this situation, what should we offer them? Obviously, if the club had been structured differently and had included a sector only for physical training, they would have been guided towards this group. However, in the current context, when fewer and fewer children and adolescents are interested in athletics, there is no question of exclusion from the group, especially due to the fact that, at their age, the practice “pushed” towards performance more effectively leads to the development of long-term physical condition.

Consequently, how to proceed?

So, we start the year with four new athletes included in a group that is preparing to compete according to the FRA (Romanian Athletics Federation) calendar. A solution for them would be to follow the same training sessions by eluding technical aspects to the benefit of long runs and muscle strengthening. The same sessions, it is true, but adapted in terms of intensity, amount of effort and possibly the type of pre-technical exercises.

In a first stage, the explosive power, technical skill, distances to be travelled, duration and number of repetitions, briefly, the amount of effort, is reduced. The emphasis is put more on the aerobic pathway, at least because this practice does not present the risk of injury.

The training of the group is not focused on competitions, but is always guided by the same idea: to move, to stay in shape, to discover the athletic disciplines.

The chosen path should be that of physical condition and the development of motor skills, two indispensable elements for both beginner and advanced athletes in the group; these elements will facilitate the transition to exercises that also involve the anaerobic pathway and will put them into progressively more difficult technical situations that have been proven to be important sources of progress (Lohmann, 1990).
The varied training will give another meaning to the duration, except for the sole purpose of “running a lot”, and if practicing the technique will be (the most) entertaining and motivating, it will make the aspiring athlete want to continue. At the beginning, it is not about seeking performance, but only experiencing sensations, positions, efficiency and various learning-related issues.

For the progress of such a heterogeneous group, the initial concept, which necessarily involved aerobic effort and muscle strengthening, proved to be not quite correct. Not because the targeted issues would not have been useful, but because that concept did not make much sense to athletes.

The trigger factor “awakened” when they tried to do technical exercises and explosive efforts; thus, they were shown that they could perform them too and could dare efforts previously considered to be difficult. Far from being restrictive, they all experiencing all areas of development, as effects of practicing athletics.

Another opinion regarding the training methodology for low-level athletes is expressed by Guadango (2013), who uses a general scheme of bodyweight GPP (General Physical Preparedness) and a block formatting of energy system training. The author states that such athletes should perform aerobic capacity first, alactic capacity second, alactic power third and then alactic capacity again.

**Acceleration and exercises in the school of running**

It is imperative for young people who come to the stadium only for movement to be taught how to run, because, beyond physiological or muscular development, they must be efficient, and this can only be achieved by acquiring and consolidating elements specific to the school of athletics (a period of initiation, during which beginner athletes gain knowledge and learn specific skills – running, jumping and throwing, as a basis for the correct learning of the exercise technique).

The classic warm-up exercises are generally known. The high-knee marching is the most common means if we focus on the accuracy (form) of achievement, but if we are concerned with the association between biomechanical principles and fine sensations, it becomes the most severe one.

In the high-knee marching, attention should be focused on the leg, the segment that initiates the movement. Its lifting first involves the hopping (leaping) of the supports so that the descending knee is fully relaxed.

However, in order to jump, the movement must be slow, with sufficient time allocated to the ground support, instead of a fast execution. At the level of representations, a small revolution is needed. The knees should not be lifted as a champion does, because this one lifts and lowers the knees voluntarily to obtain the range of motion and relaxation, but by leaping on the supports (soles) and slowing down to achieve an easier vertical jump so that the knee lifting becomes more a consequence and less a goal (Radcliffe, 2007).

The following two directions are fundamental:

- the use of acceleration, which is preferable to aerobic efforts or maximal intensity sprints;
- the repeated work of elements specific to the school of running, which will allow the athlete to build an efficient, dynamic and active support on the foreleg.

Progressive acceleration should not be pushed at the end of the warm-up, because it has an exceptional influence on both the development of motor qualities and (especially) the sense of acceleration. The most commonly used session for speed development consists of gradual acceleration over 4 x 40 m (break: 2-3 minutes between repetitions), 2 x 60 m (break: 3 minutes) and 2 x 80 m (break: 4 minutes), with 6-8 minutes of rest between series. The main indications for this type of lesson are: dynamic start, increasingly larger strides, full impetus, relaxation and gradual acceleration to the finish line that must be crossed at maximum speed.

This way of working is beneficial on multiple levels:

1. it allows athletes who are less explosive, slower, overweight or weak (lacking strength) to experience the sensation of speed by contrast;
2. the objective (acceleration) is maintained throughout the race – the athlete will not be satisfied with (only) maintaining speed;
3. the slow start leaves enough time to feel the supports before the initiation of acceleration. Acceleration is triggered in better position than that of the start in a sprint race, being based on the push-off and forward unbalancing. In this case, we first talk about recovery, leaping supports and range of motion before introducing frequency, a difficult scheme for a beginner, which usually starts with the frequency, but (almost) never manages to add the range of motion.

Acceleration is therefore a very promising exercise in technical terms, because it offers the possibility of building an efficient step, as a result of all energetic aspects related to the anaerobic mechanism. The sensations, as well as the desire to respond to the coach’s instructions, play an important role.
The school of running and jumping is the source of rapid progress and the place where very fine technical elements are acquired. Exercises in these groups allow consolidating each key moment of the running step: engaging the knee forwards (through high-knee marching), leg extension prior to the support (through foreleg extension marching), impetus and full extension (through skipping steps) and/or returning the heel under the pelvis/buttock (through butt-kick running).

They should not be considered as the warm-up sequence that athletes do by themselves while discussing trivialities, but a favourable moment for learning, experiencing and consolidating. Special exercises in the school of athletics allow initiating new problems. Thus, the athlete who is efficient in running with high knees (quickly passing the pelvis above the support) will no longer be equally productive if he or she performs simultaneously the alternate rotation of the arms. The required disturbance of balance and segmental dissociation turn a perfectly controlled situation into a new problem.

Running with high knees can also be performed over lower obstacles (fence pickets) or higher obstacles (small hurdles) and requires much wider movements, namely new potential imbalances. Lifting the knees over the small hurdles associates the forefoot strength development with its correct placement; for beginner athletes, it represents an intermediate moment between learning and development, where the actions make more sense due to the confrontation with a more demanding and destabilising means.

**Example of progression**

Marching over 5 or 6 hurdles placed less than 1 meter apart, at a height correlated with that of the athletes, but never lower than the mid-thigh. The beginner or advanced athlete must keep facing the finish, not open (twist) the pelvis and take support on the forefoot to stay high (Carr, 1999).

The exercise then evolves to a leap on the attacking foot (and landing in the same time) after each hurdle, thus emphasising the dynamic work of the foot, which leaps and does not remain stuck to the ground.

While the former exercise insists on using the forefoot, the latter fosters the dynamic action upwards. Without reaching the end of the evolution of beginner athletes (over a period of one year), the next step would be to increase the distance between hurdles up to 3-4 m so that it can be covered with four leaps: two on the attacking foot, two on the other. Thus, an athlete who clears the hurdle with the right foot, lands on it and will move using a slight leap (right-right – left-left) so that the supports produce a movement forward. Obviously, these exercises can be transformed and therefore substantially multiplied.

This is how, starting from a problem caused by the diversity of the group, we have come to describe technical exercises, as well as exercises for speed development, which seem to be suitable for anybody and give pleasure to everyone.

**Conclusions**

Working with the four new athletes has shown that the usual path, namely focusing on aerobic efforts and possibly muscle strengthening exercises, is not always the best choice.

First of all, because it “excludes”, while beginner athletes only want to practice with other peers, and secondly, it does not give them the confidence needed to approach the technique, an essential sequence in athletics, and does not develop motor skills as a whole, but just one or may be two areas.

Last but not least, it is too little motivating. Supressing the aerobic base necessary for the development of physical condition is out of question; on the contrary, it must be included from the very beginning of the above-mentioned efforts, as part of the development of young athletes. Thus, a global (not only physiological) health status will be achieved, and beginner athletes will experience various technical skills while being aware that they belong to the same single group.

**References**


VERBAL AND NONVERBAL SKILLS OF PROFESSIONALS IN THE CULTURAL AND ARTISTIC ENVIRONMENT

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Abstract: The issue of communication has been extensively studied by specialists. Culture and art professionals rely on a thorough preparation as regards communication in all its forms of manifestation. Professional success is ensured when the “body language” manages to complement the expression by words. Public communicators undoubtedly possess innate qualities in this respect, which are cultivated during long hours of rehearsal in the elocution, body expression and stage movement classes. This paper aims to investigate verbal and nonverbal skills and is part of a study focused on assessing some personality traits of artists, with a view to developing them by implementing motor programmes with artistic specificity. The research used the test method applied to 62 subjects working in the cultural and artistic environment. Testing was conducted in two stages, before and at the end of the practical experiment, namely in June-July 2018 and March 2019. The BIG test was used to assess verbal and nonverbal intelligence. The results, validated by statistical calculations, have shown that the tested individuals have different levels of verbal and nonverbal intelligence, which can be influenced through psychomotor stimulation programmes. In conclusion, diagnosing the level of verbal and nonverbal intelligence can lead to complementing our study on the personality profile of respondents. It can also provide important information about the effectiveness and benefits of the original and profile-specific motor programmes applied in our experimental study. ARTFITMENT programmes are motor programmes that can successfully complement and enhance the routine artistic training of professionals in performing arts.

Keywords: artists, verbal and nonverbal skills, ARTFITMENT original motor programmes.

Introduction

The issue of communication has been extensively studied by many scientists. The topic of “body language” has aroused the interest of more and more specialists, who have highlighted its importance in human relationships. Pease, known for his books and public seminars, brings to light his studies about body language, initiated in 1971. The author says that nonverbal communication is a complex process, in which people reveal by messages a range of feelings and emotions (Pease, 1993, p. 8). He offers the general public interpretations of body language and advice for adopting the most appropriate postures, gestures and behaviours in order to achieve success or the desired effect in human relationships. Fiske, another emblematic specialist, wrote, in his famous Introduction to Communication Studies, that “communication is a central dimension of our cultural life” (Fiske, 2003, p. 16).

The current “Theory of communication” should be regarded from the perspective of communication processes that rely on the semiotic processes, the philosophy of language and the theory of epistemological knowledge. In communication campaigns, such as public communications, the semiotic approach becomes a prerequisite for success (Borțun, 2004, p. 22; Anderson, 2007, pp. 262-265). The ability to master communication in all its forms of manifestation becomes an essential requirement of the 20th century, being often associated with intelligence. Knowing the psychological particularities of individuals is a very important issue in contemporary research (Cosmovici, 2005, p. 13). Within the individual’s personality, several structural components are revealed, the model proposed by Guilford specifying seven: temperament, skills, attitudes, interest, needs, morphological background and physiological background, while the Romanian specialists mention temperament, skills and character (Epuran & Horghidan, 1994, p. 348). Sociocultural factors shape temperamental traits to a certain extent, and, on the other hand, skills condition the performance and success of an individual in his or her activity. General skills ensure success in a range of activities and fields of science, art, sport, while special skills allow reaching mastery in areas that require accuracy and creativity. These are upgraded complex forms of special skills, such as the musical, literary, mathematical, sporting or artistic ones, and represent exceptional manifestations in the cultural and artistic fields, actually being expression forms of the so-called “multiple intelligence” (Epuran & Horghidan, 1994, pp. 358-360).

Piaget’s research reveals how intelligence evolves before and after the acquisition of language. Starting from genetic psychology, the intelligence development stages play an essential role in cognitive learning. Intelligence is defined by Piaget (Predoiu, 2019, pp. 101-102) as the perfect adaptation, the balance between assimilation (the process by which the individual accumulates new information) and accommodation (which involves modifying the
existing knowledge and schemes according to the new information added, restructuring the patterns of knowledge and transcending the previous state of the system). Adapted behaviour implies a balance between the two processes: assimilation and accommodation. But the human being’s cognitive development (in the transition from one developmental stage to another) is characterised by disruptions in this balance and the establishment of a new balance at a higher level, the mental structures becoming able to coordinate more complex activities. New assimilations will lead to new accommodations (assimilations of the assimilations and accommodations of the accommodations are possible). The French philosopher Descartes defined intelligence as a “perfect science”, a means of infinite acquisition of the human brain (Zlate, 2000, p. 268). Intelligence is investigated by verbal and nonverbal or spatial, topographic intelligence tests. Specialists say that the stimulation of topographic memory through motor activity both during the developmental period of the individual and throughout life can lead to increased intelligence in close relationship with the development and retention of psychomotor qualities (Predoi et al., 2017; Macovei, 2013, p. 8). Enhancing the self-assertion component and the individual’s satisfaction as a result of assimilating new information at the motor, functional and mental levels should be achieved through motor and psychological interventions able to allow the exploitation of skill-related resources (Tudös & Mitrache, 2017, pp. 169-171).

Specialists in the field of physical education and sport are in agreement with specialists in the cultural and artistic fields. They think that man is a biological entity, whose somatic and functional components are dependent on the systematic practice of physical exercise (Bota, 2007, pp. 42-45). An individual whose biological potential is increased has an optimal state of health permanently maintained through physical exercise. In the last decades of the 20th century, exercise to improve fitness was promoted as a form of “exercise for health”. Thus, motor activities are a direct and almost exclusive stimulus of morphofunctional development, as a prerequisite for optimal health status and the fulfilment of goals regarding bodily appearance and the wellbeing felt by participants (Bota, 2007, p. 44; Wadsworth, 2009, pp. 10-15; Gavriluță & Gavriluță, 2010, pp. 83-84). The fitness culture has developed as a form of bodywork since the 1980s, and nowadays it encompasses movement offers like aerobics, Pilates, yoga, cycling or dance. Therefore, each individual can choose the form of movement suitable for his or her physical and psychological profile (Wadsworth, 2009, pp. 16-21).

We mention that several cultural and artistic professions (for example, actors, singers, presenters etc.) are based on the development of performers’ verbal and nonverbal skills through artistic, physical and psychological training (Macovei, 2013, p. 14). Activities provided in the job description can be complemented by motor activities aimed to improve physical status and enhance the repertoire of cultural and artistic competences useful for a socio-professional life matching the individual’s aspirations.

The purpose of our research is to identify the manifestation of some forms of intelligence in professionals working in the cultural and artistic environment. The recorded data were collected before and after applying customised ARTFITMENT programmes of motor activities. The experiment aimed to improve the investigated subjects’ physical, functional and psychological levels, specifically as regards the manifestation of verbal and nonverbal skills.

Material and methods

Participants

The research subjects were 62 people working in the cultural and artistic environment, with ages between 16 and 53 years (34 female and 28 male), distributed as follows: 31 in the experiment group (17 women and 14 men) and 31 in the control group (17 women and 14 men). 13 subjects have secondary education, and the remaining 49, higher education. Among those with higher education, there are also subjects with advanced and doctoral studies. The experiment group includes 7 subjects with secondary education, the remaining 24 having higher education, and the control group includes 6 subjects with secondary education, the other 25 having higher education.

Instruments

The BIG test is a paper-and-pencil test consisting of eight subtests with 15 items/tasks each to be solved within 4 minutes/per subtest. The total time to complete the entire test is 32 minutes.

The assessment of verbal and nonverbal intelligence using the BIG test is part of the Psiselteva psychological testing system developed by RQPlus (an accredited Romanian company).

In our research, we applied the eight subtests to all 62 subjects participating in the study. To assess verbal skills, we used subtests 1-4, namely: “Verbal differences” (e.g., cane-corn-barley-oat-wheat), “Verbal similarities” (e.g., rain-sun-day-warm-water), “Opposite words” (e.g., life: joy, hope, black, death, shadow) and “Word
relationships” (e.g., lightning-light, thunder: ...). To assess nonverbal skills, we used subtests 5-8, namely: “Opposite shapes”, “Geometric differences”, “Unfolded shapes” and “Sections”. All these subtests are based on geometric shapes, the subjects being trained to identify certain aspects as indicated in the preamble of each subtest.

The final result is given by the total number of points obtained in the eight subtests. Scores are interpreted, according to the standard, in classes from 1 to 10, where class 10 denotes the best performance (for verbal and nonverbal intelligence). From the perspective of interpreting the obtained values, in the case of adults, good values fit into classes 7 and 8, very good values place subjects in classes 9 and 10, classes 5 and 6 indicate mean values, the results placing subjects in classes 4 and 3 are poor, and those placing them in classes 1 and 2 are very poor.

Procedure

The tests were administered in two stages: 1st stage, between June and July 2018, and 2nd stage, between March and April 2019, at the National Institute for Sport Research and the National Institute for Research and Cultural Training. The first testing was applied prior to the experimental intervention, while the second testing took place on completion of ARTFITMENT workouts by the experimental group. Throughout this period, the control group performed cultural and artistic professional activities. The experimental group participated in ARTFITMENT training sessions from 1 September 2018 to 16 March 2019, in addition to and beyond their own commitments within the cultural and artistic projects of the contracting organizations.

ARTFITMENT is an original concept subscribing to the cult and culture of the body to which modern people are more and more mentally affiliated. ARTFITMENT brings together a number of Pilates-type bodywork techniques from basic gymnastics, as well as technical elements inspired by gymnastic jazz, contemporary dance and rhythmic gymnastics (for Pilates exercises, see Campbell, 2012, pp. 16-20, Eisen, 2014, pp. 8-15, and for communication through dance and rhythmic gymnastics exercises, see Macovei, 2013, pp. 12-17). ARTFITMENT is an acronym for “artistic-fitness-mental”, which is inspired by the artists’ motor repertoire and is designed to improve physical condition in an accessible, agreeable, motivating, energising and yet relaxing manner. The motor programme is harmoniously combined with yoga breathing, stretching, relaxation and visualisation techniques specific to mental training (for yoga and Pilates exercises, see Birch, 1995, pp. 37-46, Freedman et al., 2010, pp. 12-13 and pp. 480-491, and for the relaxation and visualisation exercises used, see Predoiu, 2016, pp. 65-67).

ARTFITMENT is an algorithmic motor programme designed to be performed as a form of warm-up, physical training or relaxation, before, during and after the scenic activities of the subjects at their contractual locations.

The equipment is mostly the one used in aerobic gymnastics programmes, namely a T-shirt and loose trousers, a neoprene mattress and a personal towel; the subjects work barefoot, an aspect specific to yoga programmes. Exercises are performed in the standing position or on the mattress, with short travels, without leaps or jumps, which allows the subject to practice in non-conventional areas (hallway, backstage, locker room, hotel room etc.).

Musical accompaniment plays a very important role in the execution of the proposed programme; musical selections correspond to the dynamics and intensity of each component part of the work session, which complies with the physical education and sports methodology, for example, from simple to complex, from easy to difficult. Musical accompaniment is generally lyrical, from the melodic Buddha bar menu, which allows participants to focus on aspects related to the bodily elements proposed by the instructor.

ARTFITMENT programmes last 60 minutes and consist of three classical parts: preparation of the body for effort, fundamental part and final relaxation.

The introductory part includes breathing and stretching exercises focusing on abdominal breathing and elongation, the controlled stretching of body segments. Bodily elements are inspired by gymnastics, power yoga (mountain pose, tree pose, triangle, warrior, sun salutation intermediate and advanced), classical ballet and jazz dance (port de bras, relevé, demi-plié, grand plié, passé-développé, attitude, arabesque, rond de jambe, temps lié, soutenu etc.). They are harmoniously connected, the position of one element being the initial position of the next one, like a choreographic sequence, which highlights the artistic side of the motor programme.

The fundamental part is mainly performed on the mattress and includes exercises inspired by the Pilates method (hundred, spine stretch forward, corkscrew, saw, scissors, shoulder bridge, teaser, rolling like a ball, swimming, low and high planks, push-up, pointing dog etc.), gymnastics (shoulder stand, knee stand, headstand, rolls) and power yoga (cat, dog, cobra, sphinx, tortoise, crow, camel, side triangle, twisted postures etc.). Dynamic exercises and postures target each muscle group, with an emphasis on neuromuscular control and joint mobility, the transition from one exercise to the next respecting the connections specific to gymnastics and dance choreography.

The final part is signalled by the musical background in slow time, with sounds of nature and running water, which induces the message that relaxation is being initiated. The subjects perform, under the instructor’s guidance,
a few breathing and passive stretching exercises, after which they enter the meditation position (lying on the back), when a state of tranquility and peace, then weight (as a form relaxation, from the Schultz autogenous training) starts being induced. The relaxation session ends with activating and energising subjects through the musical background and activation and breathing exercises.

Introducing objectives for the development of intelligence and concentration ability into the ARTFITMENT motor programme leads to inducing a state of relaxation and psychological comfort, with effects on the performance of professional activities, but also on the artists’ active and healthy lifestyles (Macovei, 2013; for the breathing exercises used, see Predoiu, 2016, pp. 81-86).

ARTFITMENT is the result of the research conducted during the preliminary studies (Vlăduțu, Macovei, & Zahiu, 2018), prior to the experimental study. The motor programme proposed by us aimed to exploit previous research on the needs and preferences of cultural and artistic professionals for the exercises performed.

The data processing was carried out at the Psychology and Psychomotricity Laboratory within the National University of Physical Education and Sports in Bucharest. Analysis of the results was done using the mathematical and statistical method in order to calculate: arithmetic mean, standard deviation, coefficient of variation, minimum value, maximum value and range. We also used a significance test, namely Student’s dependent t-test, in which case we were interested in the differences between the two tests by applying the independent variable.

Results

The results of the 62 subjects participating in the study were statistically analysed with regard to the verbal and nonverbal skills recorded in initial and final testing.

After interpreting the statistical data of the results obtained by both groups (the experiment and control ones) for verbal skills, an average value of 7.68 in initial testing and 8.4 in final testing has been highlighted (the classes into which participants fell, depending on the standard, were averaged). The value 2.02 of Student’s t-test reveals that the differences between the two tests are marginally significant, the p-value being 0.05. For nonverbal skills, average values of 7.16 and 8.15, respectively, were recorded in final testing. It is noted the value 2.60 of Student’s t-test, p = 0.0011.

These results are thought to be good at group level and emphasise significant improvements in the manifestation of both verbal skills and nonverbal skills (Table 1).

<table>
<thead>
<tr>
<th>Table 1. Manifestation of verbal and nonverbal intelligence in culture and art professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Verbal skills</strong></td>
</tr>
<tr>
<td><strong>No. of subjects:</strong></td>
</tr>
<tr>
<td><strong>Minimum:</strong></td>
</tr>
<tr>
<td><strong>Maximum:</strong></td>
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<tr>
<td><strong>Range:</strong></td>
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<tr>
<td><strong>Mean:</strong></td>
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<tr>
<td><strong>Standard deviation:</strong></td>
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<tr>
<td><strong>Coefficient of variation:</strong></td>
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<tr>
<td><strong>Student’s dependent t-test:</strong></td>
</tr>
<tr>
<td><strong>p</strong></td>
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</table>

*Results in initial and final testing by applying the Student’s dependent t-test to each of the two groups. A significant difference between the two tests if p < 0.05

The statistical test results for subjects in the experiment and control groups are shown in Table 2.

In verbal skill tests, the experiment group subjects recorded average values of 7.87 in initial testing and 9.10 in final testing. The difference between the two tests is significant, the Student’s t-test being 3.13 and p = 0.002. In the same tests, the control group recorded average values of 7.48 initially and 7.68 finally. The difference between the two tests is not relevant, the Student’s t-test being 0.336 and p = 0.74 (p > 0.05).

In nonverbal skill tests, the experiment group subjects achieved average values of 7.58 in initial testing and 9.23 in final testing. The Student’s t-test is 3.69, p = 0.00, highlighting a significant improvement. In the same
tests, the control group subjects achieved values of 6.74 initially and 7.07 finally. It is noted that the two values are very close, so there are no significant changes in this group from the perspective of nonverbal skills (p > 0.05).

Consequently, the relevant statistical results of the entire group in the final test are due to the improved scores achieved by the experimental group subjects who have performed ARTFITMENT motor activities.

Table 2. Initial and final test results for subjects in the experimental and control groups

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th>Nonverbal skills</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>EXPERIMENT</td>
<td>CONTROL</td>
<td>EXPERIMENT</td>
<td>CONTROL</td>
</tr>
<tr>
<td></td>
<td>GROUP</td>
<td>GROUP</td>
<td>GROUP</td>
<td>GROUP</td>
</tr>
<tr>
<td>No. of subjects:</td>
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<td>31</td>
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<td>31</td>
</tr>
<tr>
<td>Minimum:</td>
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<td>7</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Maximum:</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Mean:</td>
<td>7.87</td>
<td>9.10</td>
<td>7.68</td>
<td>9.23</td>
</tr>
<tr>
<td>Standard deviation:</td>
<td>2.01</td>
<td>2.461</td>
<td>2.262</td>
<td>2.449</td>
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<td>0.2984</td>
<td>0.1109</td>
</tr>
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<td>variation:</td>
<td></td>
<td></td>
<td></td>
<td>0.3633</td>
</tr>
<tr>
<td>Student’s</td>
<td>3.13</td>
<td>0.336</td>
<td>3.69</td>
<td>0.595</td>
</tr>
<tr>
<td>dependent t-test*</td>
<td>0.0027</td>
<td>0.74</td>
<td>0.0005</td>
<td>0.55</td>
</tr>
</tbody>
</table>

*Results in initial and final testing by applying the Student’s dependent t-test to each of the two groups. A significant difference between the two tests if p < 0.05

Figure 1 shows the values obtained by the subjects participating in ARTFITMENT motor activities, which are converted into classes for verbal skill testing. It has been noted that, in the initial test, 1 subject recorded a poor result, namely class 4, other 8 participants obtained mean results (classes 5 and 6), 7 subjects obtained good results (classes 7 and 8), and 15 subjects recorded very good results (classes 9 and 10). In the second verbal skill test, the experiment group achieved the following results: 7 subjects had good results (classes 7 and 8), and the remaining 24 subjects recorded very good results (classes 9 and 10).

![Figure 1. Evolution of values recorded by the experimental group in verbal skill testing](image)

For the control group, the evolution of values recorded between the two verbal skill tests is shown in Figure 2. In the initial test, 3 subjects had poor and very poor values (classes 2, 3 and 4), 10 subjects obtained mean values (classes 5 and 6), 4 subjects obtained good values, and the remaining 14 subjects had very good values. In the second test, there were no significant changes in the results achieved by the control group. Thus, 1 subject had a
very poor result, 8 subjects recorded mean results, 9 subjects recorded good results, and the remaining 13 subjects had very good results.

It has been found that the initial values of the experiment group are relatively close to those of the control group in verbal skill tests, the average values achieved by the experiment group being 7.87 and 7.48, respectively. At the end of ARTFITMENT training sessions, the experiment group recorded much higher values than the control group in final testing, the average scores being 9.13 for the experiment group and 7.68 for the control group.

For the experiment group, the evolution of values recorded between the two nonverbal skill tests is shown in Figure 3. In the initial test, the experiment group subjects recorded the following results: 3 subjects obtained poor and very poor values, 5 subjects had mean values, 11 subjects had good values, and 12 subjects achieved very good values. In the final test, the values obtained by the experimental group subjects were significantly better. Thus, 1 subject had a mean value, 5 subjects recorded good values, and the remaining 25 subjects had very good values.

It is noted that, in terms of nonverbal skills, the average values of the experimental group subjects have increased from 7.58 (initial testing) to 9.23 (final testing).
For the control group, the nonverbal skill testing showed the following initial values: 8 subjects had poor values, 6 subjects obtained mean values, 8 subjects obtained good values (classes 7 and 8), and the remaining 9 subjects recorded very good values (classes 9 and 10) (Figure 4). In the final nonverbal skill test, the control group subjects achieved the following values: 14 subjects recorded poor and mean values, 7 subjects had good values, and the remaining 10 subjects obtained very good values.

The average values recorded by the control group subjects in the initial and final tests are close and reveal that no changes have occurred. However, very poor values were not recorded any longer, which was probably due to paying more attention to solving the test items.

![Control group - Nonverbal skills](image)

**Figure 4. Evolution of values recorded by the control group in nonverbal skill testing**

**Conclusions**

The results obtained from the application of motor programmes lead us to state that the hypothesis according to which “the use of ARTFITMENT specific programmes significantly improves aspects of verbal and nonverbal intelligence in professionals working in the cultural and artistic environment” has been confirmed.

After applying the independent variable to the experimental group, we believe that the obtained results confirm the effectiveness of ARTFITMENT motor programmes used in our practical study.

This research certifies that, due to multiple beneficial effects at the physical, motor and psychological levels, the practice of motor activities is an efficient way to improve and develop verbal and nonverbal skills. We can say that ARTFITMENT programmes have had a beneficial effect and have led to psychomotor and skill-related developments for the experimental group. Thus, the improvements recorded by cultural and artistic professionals will also reflect favourably on their professional level through higher-quality adaptive responses to contractual obligations and possibly stressing events in everyday life.

We believe that ARTFITMENT motor programmes should complement and harmonise with the specific artistic training means used by cultural organizations and performing arts in order to improve professional, personal and social performance.

**Authors’ contributions**

All authors contributed equally to this article and should be considered as main authors.

**References**


EUROPEAN AND ROMANIAN SPORT LAW

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Abstract. Sport law in general should have a global dimension, since sport in itself has one. Sport laws have a large impact on athletes, coaches, sport organizations and even national or international sport federations. The set of norms that apply to sport at a global level include only the autonomous global legal order implemented by the Court of Arbitration for Sport, the World Anti-Doping Agency and the UNESCO Convention against Doping in Sport. However, the legislative framework is different in each country, being based on the country’s Constitution and on whether or not it has a specific law on sport at a national level. In the European Union’s Treaty, sport is not specifically regulated, but there are extensions beyond the specific sport regulation, involving commercialisation of sport, social, cultural and educational policy objectives (represented in treaties, declarations, reports and white papers), that have a major impact on the sport field. In this context, it is important for each country to have a legislative framework that benefits sport and its organizations in all EU member states. The purpose of this article is to review the sport laws characteristic to European countries and Romania.

Keywords: sport law, sports law and policy, sport regulation.

Introduction

According to Beloff, Kerr and Demetriou (1999), sports law is not just international; it is nongovernmental as well, and this differentiates it from all other forms of law. It is true that the Sport Law is multidisciplinary, as it uses concepts from labour law, civil law, administrative law and European Union Law. However, the European Union does not include in the Treaty a special law dedicated to sport, although it does contain, in Article 3, policies that regulate it through commercialisation of sport, social, cultural and educational policy objectives. According to Lyon-Caen (2004, p. 18), “each branch of law is integral with the legal system as a whole”, so policies must coordinate with the entire legal system. It is also important for the legislative framework in each country to coordinate with EU competences and policies in order to benefit the sport field at an international level. There are many interactions between sport law, international law and national laws at a normative, organizational and legal level, especially in the countries that host world sport events (Casini, 2010, p. 3). National laws must be coordinated with the system of norms produced by international sport institutions.

Topic addressed

European Sport Law

Globalisation has produced major legal effects on the Sport Law, since many sport institutions have emerged in order to issue a set of norms that apply internationally. This set of norms, or corpus, is usually referred to as the International Sports Law, Global Sports Law or even Lex Sportiva (Nafziger, 2006, p. 862). Because of the multicultural aspects of the Olympics, starting with the 19th century, an organizational corpus has also been shaped by international federations and national Olympic committees (Chappelet, 2008, p. 36). After the Second World War, the Council of Europe was established as the first international organization with the purpose of protecting democracy, human rights and the rule of law. The Council of Europe is also the first international organization that offers an institutional framework for the regulation and development of Sport at European level (Siekmann & Soek, 2007, p. 92). Despite the fact that there is no specific regulation that can qualify as European Sports Law in the EU’s Treaty, the EU’s policy involvement in sport does show how much the law of European Union can impact the sport field and why the concept of European sports law is widely circulated.

Each EU member state creates a legal framework for sport, specific legislation, policies and private regulations according to the European Law and the countries’ constitutions (Chappelet, 2008). The European Community Treaty has established a free movement regulation referring to the fact that all discrimination on the basis of nationality is prohibited and professional and semi/professional athletes are workers within the meaning of this Article, and consequently Community Law applies to them. This principle has also been adopted in the White Paper on Sport, in 2007. National Sport Authorities that are members of the international sports authorities must also apply the rules adopted at international level. In case of implementation of rules that are contrary to European Laws, the member states are subjected to infringement proceedings before the European Court of Justice, if government authorities of that member state are at the origin of the infringement (Siekmann & Soek, 2007).
There were many cases brought before the European or National Court in recent years. One of the issues was “the specificity of sport”, its structures and educational functions, an issue which was solved by including in the Lisbon Treaty article (149). Another issue consisted in the relationship between Community Law and sport regulation. The most famous ruling is known as the Bosman ruling, which represents the decision made by the European Court of Justice in 1995 for the free labour movement. The case was introduced by Jean Marc Bosman, who played for the Belgian first division in Belgium and had his contract expired in 1990. But he wanted to move to another team. His transfer was refused, but his wages were reduced and he sued for restraint of Trade, citing Article 17 of the FIFA rules regarding football. The ruling resulted in Article 45 of the Treaty on the Functioning of the European Union and had a large effect on the transfers of footballers within the EU (Parrish, 2003, p. 223).

The rulings in Deliège and Lehtonen placed limits on the application of EU Law to sport and represented the contribution of the European Court of Justice to the construction of separate territories. Miss Deliège was a judoka who claimed that her career had been impeded by the refusal of the relevant national federation. Because of the refusal, she was not able to meet the necessary criteria in order to participate in the 1992 Olympic Games, citing that she had economic rights guaranteed by Articles 49, 82 and 82 of the EC Treaty. The second case, introduced by Lehtonen, a basketball player, regarded the refusal of registering him at the basketball team he had moved to, due to the fact that “the transfer had not taken place during the transfer window” (Parrish, 2003, p. 111).

With regard to the approaches to sport legislation, two distinctive models are known in the EU, the interventionist model and the non-interventionist sports legislation model (Table 1). The difference between them consists in the fact that, in the case of the former, the interventions contain specific legislation for the national sport movement, while the latter does not contain such regulations.

Over time, laws are amended, replaced or repealed, and the new government may have different ideas based on different social conditions, which also happens in the field of sport. National regulation of sports activities has become an important topic of discussion globally and this mostly occurs due to the Olympic Games. Ideally, countries that want to reform a national Sports Act or reform an existing one or even introduce a new Act must review all options and base them on a model that would rely on an inventory of all existing national Sports Acts in the world (Siekmann & Soek, 2007, p. 48).

Table 1. Sports legislation framework in EU countries

<table>
<thead>
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<th>Sports Act</th>
<th>Type of sport legislation</th>
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<tr>
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</tbody>
</table>

Note: Adapted from Nafziger (2011, p. 131)
According to Chaker (2004, p. 10), the interventionist model can provide accountability of the government and the sports movement and can maintain order in the national movement. On the other hand, the non-interventionist model can provide higher flexibility, which can allow policy makers to react more quickly to funding or new sports.

Romanian sport legislation

Romania has an interventionist legislation model in sport. The Romanian sports normative framework consists of laws, decrees, governmental decisions, ministerial orders and provisions of other public institutions with attributions in the field of sport and related activities and constitutive acts, statutes and regulations for the organization of associations, clubs, national sports federations and other representative structures. Sports norms are developed and set up by national federations, whose main objective is the organization of the training and the process of participation in competitions, as well as the organization of sports competitions.

The Romanian Constitution contains regulations with regard to sport starting from 1967. After 1989, the Council of Europe, through its specialised Steering Committee for the Development of Sport (CDDS), launched the SPRINT programme, a support programme for the new member states of Central and Eastern Europe countries that wanted to modernise their sports policies, structures and management in order to initiate athletes into a European approach to sport and provide them with better opportunities. The programme included workshops, hearings on legislative matters, proposals and reforms, which were attended by Parliamentary Assemblies, and also professional training sessions for athletes and seminars abroad.

At national level, however, there have been concerns about setting up organizations to support sports activities. The initiative to adopt new sports laws has been developed since 1991, and on the background of political and social influences at national and international levels, the Law on Physical Education and Sport was adopted in 2000. This law included some of the European modern concepts (Popa, 2018).

In 2000, the Law on Physical Education and Sport, also known as the Sports Law (69/2000), was enacted. The Republican Constitution, however, contained sport regulations since 1967. The interventionist legislation model is illustrated in Article 2, which depicts sport as a public service and major sport organizations as public utility institutions, stating that “practicing physical education and sports is a person’s right, free of any discrimination, guaranteed by the state” (Chaker, 2004, 84). The Law no. 69 of April 28, 2000, on Physical Education and Sport was published in the Official Gazette, Part I, no. 200 of 9 May 2000. The version was strengthened by various modifications throughout the years.

The National Agency for Sport in Romania is the Ministry of Youth and Sport since 2003, and its role is regulated by Article 18 of the Sport Law, whose functions are to define and support the general strategy of initiating, organizing and developing sporting activities. According to Article 25 of the Sports Law (69/2000), sports associations are sporting structures without legal personality. Sports associations without legal personality can be constituted as private civil societies, according to the legislation in force. The establishment of a sports association without legal personality entitles it to obtain a sports identity certificate, as well as to affiliate to the county association on the appropriate sporting branch in order to participate in local official sports competitions.

As far as sports funding is concerned, compared to other EU countries, Romania has one of the lowest financial allocations for sport. Funding for sport is deducted and allocated in relation to Gross Domestic Product (GDP). Between 2000 and 2015, Romania’s GDP had an upward trend (with some fluctuations during the economic crisis). This steady growth is not reflected in the funds allocated to sport. In 2015, the budget of the Ministry of Youth and Sport was 82,250.2 million euros representing 0.052% of GDP (Order 607/3026/2017/2018). The budgets of the Ministry of Youth and Sport were developed irrespective of the concrete financial needs of sport. With 0.052% of GDP allocated to sport in 2015, Romania has an average allocation of €0.87 per capita. In other European countries, budget allocations for the same activity range from 27 to 67 per capita (Andreff & Szymanski, 2006).

Another issue that concerns the Romanian legislation is the sponsorship regulation. The law governing sponsorship in sport is not very encouraging and does not allow the development of marketing sponsorship policies. Micro-enterprises only sponsor entities accredited on the list of the Ministry of Labour and Social Justice providing social services, which is not a satisfactory solution, as stated in the explanatory memorandum supporting the change of the Sponsorship Law in Romania. The Law on Sponsorship in Romania (Law 32/1994 with further additions) did not receive much attention and there were not enough changes to support sponsors and their beneficiaries. Various proposals for the modification of the law were presented in this respect, but the results did not have a major impact on sponsorship. Further research is needed on this topic.
Conclusions

According to Chaker (2004, p. 23, p. 85), the Romanian Sport Legislation complies with all governance principles measured by the Council of Europe. The Sport Law recognizes various types of sports organizations, it defines the national sports federations in similar terms, and the sports organizations follow the relevant legislation in the performance of their activities. The issues concern mostly the funding of sport organizations and the law regulating sponsorship. A better sponsorship law would be a beneficial element for both the sports promotion and marketing and attracting external funding for sports organizations.

References

PERCEPTION OF CHILDREN WITH BEHAVIOURAL DISORDERS ON SPORT ACTIVITIES FOR SOCIAL INCLUSION

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Abstract. Nowadays, we all know that the evolution of human society has changed people’s lifestyle, which has increasingly highlighted the fact that humans are essentially social beings and need interaction with the others. In this context, education plays an important role in the process of integration into the society they belong to. We consider that sports activities are particularly suitable for students in terms of their content, whereas the specific methodology of organisation and deployment brings to the fore certain attributes necessary for the process of socialisation and integration or even social inclusion. Taking into account the characteristics of the activities carried out during physical education and sports classes, they “offer socialisation opportunities, while facilitating social integration” (Bichescu, 2009, p. 349). The learning environment, together with the designed learning and practice situations, through their content and form of organisation, will allow the appearance and manifestation of all types of interaction, from cooperation to adversity/competitiveness. The purpose of this research was to determine the perception of students with behavioural disorders on the role of sports activities in social inclusion. The main method of research was the questionnaire survey carried out within a group of 20 students with behavioural disorders, aged between 10 and 14, enrolled at the “Traian Lalescu” National College in Reşiţa. The results obtained support our view that sports activities are perceived as suitable by students with behavioural disorders for their social inclusion.

Keywords: students, sports activities, inclusion.

Introduction

Lately, the concept of inclusive education has been more and more frequently encountered; it is based on the principle of equal education for all children, regardless of their social or cultural background, religion, ethnicity or the environmental conditions in which they live.

Education “is one of the principal means available to foster a deeper and more harmonious form of human development and thereby to reduce poverty, exclusion, ignorance, oppression and war” (Delors, 1996, p. 13) and the idea has started from the belief that the right to education is one of the fundamental human rights and the foundation of a just society. To achieve this right, the “Education for All” Movement promotes the access of all children to basic education.

Loreman, Deppeler and Harvey (2010) or Barton and Slee (1999) assert that, essentially, inclusive education results from the development of ideas based on the exclusive value of human personality, its uniqueness, the right to decent life whatever the individual’s physical or intellectual state is, the right to enjoy all cultural values of modern civilisation.

Inclusion is different from integration, as the integration of children into mainstream education refers to welcoming new members who need support for adaptation, integration and socialisation within a group, classroom or school. The acceptance of these children with special needs by the group, classroom and school is only a step called “physical integration of the child” rather than the inclusion in itself. For the emergence and success of inclusion, structural and functional changes should occur in both the person who is to be integrated and those who receive/incorporate new elements among them.

Nowadays, it is no longer a secret for anyone that sports activities make an important contribution to social cohesion, as well as the formation of more integrated societies. Taking into account the requirement that “All residents should have access to sport”, as set out in the White Paper on Sport presented in Brussels (2007) by the Commission of the European Communities (2007, p. 7), it is imperative to ensure that children with disabilities have as many opportunities as possible to practice physical activities. In this respect, it is necessary to address “the specific needs and situation of underrepresented groups”, and to consider “the special role that sport can play for young people, people with disabilities and people from less privileged backgrounds”.

On the other hand, children learn through interaction taking place between the motor, cognitive, social and emotional domains. Therefore, physical education contributes, through movement experiences that focus on basic movement skills, to the total growth and development of all young children social skills (Zachopoulou et al. (2009).

Furthermore, Epuran and Horn (1985) point out that sport fully responds to the need for affiliation, whether it is an individual or a social group. The simplest way to show the need for affiliation is to look for human contact,
which, in sport, is achieved not only in the form of coexistence (common training) or cooperation within a team, but also in meetings with opponents in competitions. Another form of affiliation is the search for the group, the desire to get integrated into a group of individuals organised and united by common interests and actions, the desire to participate in the life of the group and to play a certain role in the team, a trend largely satisfied by the sporting activity. A third form of manifesting social trends refers to the need to get integrated into the institutionalised sporting activity – institutions that require compliance with certain regulations, norms, etc. (Figure 1)

![Figure 1. Forms of manifestation of the need for affiliation (Epuran & Horn, 1985)](image)

Socialisation, another concept related to integration and inclusion, “is a set of processes by which an individual incorporates the norms and values of the society in which he or she lives. Consisting in the incorporation of rules, laws, customs and norms of a society, it aims to enable the individual to possess a set of common knowledge, contribute to the learning of external social rules by the individual and strengthen solidarity between social groups” (Boudon, 1997, p. 21).

Physical education and sport constitute an important factor in fostering the socialisation of children, and the physical education and sport class too targets both the individual and the group. Individual socialisation is achieved when the human being assimilates attitudes, values, conceptions or behavioural models specific to the group. Socialisation through sport signifies the extent to which the attitudes, values, skills and rules learnt in sport are transferred to and manifested in other social spheres.

Given that children are the main beneficiaries of physical education and sport, because childhood is the crucial period in which motor activity is of vital importance for socialisation, we understand that, by involving children in physical education and sport classes, they acquire and develop positive values such as fair-play, responsibility, spirit of competition and self-esteem, an aspect also highlighted by Findlay and Coplan (2008), who, besides the positive adjustment indications determined by the participation in sport activities, have also noted that shy children who participated in sport over time reported a significant decrease in anxiety.

Some researchers have even shown that children’s involvement in the physical education and sport class had positive results in terms of behavioural change and major attitudes, unless otherwise agreed; thus, when young people discontinue playing sport, they lose the protective social networks, as well as connections to caring adults and pro-social peers, that help to promote healthy youth development (Eime et al., 2013).

**Material and methods**

**Participants**

A total of 20 students from the “Traian Lalescu” National College in Reșița, aged between 10 and 14, with behavioural disorders, took part in this research.

**Instruments**

The main method of investigation was the questionnaire survey. This questionnaire consisted of 10 items and gave us the opportunity to confirm that sports activities are perceived as suitable by students with behavioural disorders in terms of their social inclusion.

**Procedure**

The questionnaire was applied between February and April 2019.
Results

To item no. 1, “I like to be part of the classroom team”, most of the responses have been recorded for the “agreement and total agreement” options, which highlights that students with behavioural disorders are willing to be part of the classroom community (Figure 2).

![Figure 2. I like to be part of the classroom team](image)

The responses given to item no. 2 by 65% of secondary school students have shown that, at some point, they prefer to be part of noisy groups, demonstrating that participation in sports activities, where students can express themselves loudly, satisfies this need (Figure 3).

![Figure 3. I like to be part of noisy groups](image)

The responses to item 3 highlight a picture of the student willing to move, always in motion, and this is confirmed by the 35% total agreement and 35% agreement options recorded (Figure 4).
Middle-school students with behavioural disorders do not prefer loneliness, but like to be surrounded by others, which is highlighted by the percentage recorded for the “total disagreement” response, with a significant weight of 35% (Figure 5).

The fact that they like to be part of noisy groups and do not always enjoy the moments of silence can be noticed from the correlation of responses to the item “I like silence” and item no. 2, where 65% of the surveyed students say they prefer to be part of noisy groups.
The responses to item 6 reveal that students with behavioural disorders are pleased to be under the spotlight at certain organised events, both school and extra-curricular ones, preferring to be together with their colleagues, only a small percentage of students showing their disagreement with this kind of action (Figure 7).

![Figure 7. I do not like busy events (such as parties, anniversaries, presentations)](image)

The main way to interact with other colleagues is the game, and this form is highlighted by middle-school students through the responses to item no. 7, where only 10% said they did not prefer such activities (Figure 8).

![Figure 8. I do not like to play with my schoolmates](image)

Socialisation through sport or movement is felt beyond the desire of involving students in sports activities, which is revealed by an 85% percentage for the “agreement and total agreement” response to item no. 8 (Figure 9).

![Figure 9. I like to be involved in sports activities](image)
As a result of the sports activities attended, 70% of middle-school students report that they have made many new friends by engaging in such activities, while 15% disagree with this fact (Figure 10).

![Figure 10. Involvement in sports does not help making new friends](image)

As asked if they liked to be team captains when participating in sports activities, 75% of students expressed their agreement with this statement, and only 15% disagreed with it (Figure 11).

![Figure 11. I like to be a team captain in sports activities](image)

**Conclusions**

After the analysis and interpretation of the results, the following conclusions could be drawn:

- Students with behavioural disorders prefer to engage in sports activities, be part of noisy groups and spend time with their colleagues;
- The lack of attention of children with behavioural disorders is felt by them and manifested in their desire to be “team captains” in sports activities (i.e., to be “under the spotlight”);
- The fact that students with behavioural disorders prefer to spend time together with other students shows that they are aware of the benefits that sports activities provide by involving them in their organization and development, so the process of social inclusion of these students can be easy because of their need for a sense of belonging to the social group that they discover during physical training, as well as in extracurricular sports activities, making them interested in this type of activity.

**Authors’ contributions**

All authors contributed equally to this article and should be considered as main authors.
References


SPORT AND SOCIETY

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Abstract. The ideology of sport is different in each society, reflecting their cultural, political and economic levels. The concept of sport that decision-makers promote among citizens is reflected in the extent of their participation in various physical activities (performance, leisure or adapted ones). The priority given to sport in the ideology of a society becomes visible in the quality of life of its members. As evidence of social influences, sport is present or absent in the lives of individuals, guiding them towards performance, sedentary behaviour or ignorance. The role of sport in society is related, on the one hand, to the personal benefits for participants and, on the other hand, to the benefits of specific human interactions, which are reflected in the development and evolution of a society. Socialisation in sport provides a unique learning environment based on cooperation, mutual support, group emulation and communication. Thus, sport can be a development factor for a society and can improve people’s quality of life insofar as it is part, as an educational act, of their early training. Sport is not only a mirror of society, but plays an important role in its structuring and function due to the influences that the practice of sport has on the members of a society. It can be mentioned that the members of a society, direct or indirect consumers, are the conductors of these functions, being the only ones that can reduce the negative effects of sport and promote the multidisciplinary benefits of physical activities.

Keywords: physical activities, human being, social benefits.

Introduction

The complexity of phenomena and ways of manifesting life and civilisations had led to the analysis and interpretation of the social as a whole. From a systemic perspective, society can be understood as a unitary set of components, which includes specific structures and levels of organization, or an integrated complex of subsystems (economic, social, administrative, political, educational, cultural ones and more), which are hierarchically separated but in causal and functional relationships, according to their specific way of organizing and structuring (Jude, 2003). In this context, sport appears as a social subsystem through which the individual develops and evolves multifactorially, thus becoming more competitive, more adaptable, more efficient and longest-living.

Topic addressed

The ideology of sport is different in each society, reflecting their cultural, political and economic levels. The concept of sport that decision-makers promote among citizens is reflected in the extent of their participation in various motor activities (performance, leisure or adapted ones). There are institutions that prioritise performance sports, others where the sport for all is directly related to the health status and is included in the weekly programme of daily activities, but also organizations that implement adapted sports.

As evidence of social influences, sport is present or absent in the lives of individuals, guiding them towards performance, sedentary behaviour or ignorance.

The priority given to sport in the ideology of a society becomes visible in the quality of life of its members. Sport can be a development factor for a society and can improve people’s quality of life insofar as it is part, as an educational act, of their early training. Thus, sport promotes educational, social and health goals (Kay, 2009).

The role of sport in society is related, on the one hand, to the personal benefits for participants and, on the other hand, to the benefits of specific human interactions, which are reflected in the development and evolution of a society. Authors like Bailey et al. (2012, p. 1054), analysed a human capital model speaking about different benefits of sports: improvements of social relationships, increasing of motor skills and fitness level, improvements of emotional and intelligence processes, financial and individual advantages. Thus, there are underlined concepts like social capital, physical capital, intellectual capital, emotional capital, financial capital, and individual capital, as parts of the human capital model that can be achieved through sports.

Another particular dimension of expert analysis is represented by the socialisation process, which transforms individuals practicing different sports activities, but also spectators. Socialisation in and through sport is a process by which participants and indirect consumers acquire new behavioural skills and new values, receive feedback for their actions, discover certain milestones of social behaviour and self-educate. Socialisation is “the process by which a human being, beginning at infancy, acquires the habits, beliefs and accumulated knowledge of society through education and training for adult status” (Tenorio, 2018).
Some objectives and functions of socialisation are:

- socialisation is a learning process;
- transforms the individual from a bio-logical being into a social being;
- develops the personality of the individual;
- educates the sense of duty and responsibility;
- develops knowledge and skills;
- establishes social order;
- conveys cultural values;
- develops social qualities (Bohat ALA, 2019).

Particularising the above issues, we believe that socialisation in sport provides a unique learning environment based on cooperation, mutual support, group emulation and communication. Dragnea and Teodorescu (2002, p. 28) talk about the different roles played in sports games, through which the child also learns to belong to a group, and individuals learn to react and adapt to various group situations (training camps, competitions, training sessions), make friends and develop communication skills; gradually, the increase in individual autonomy diversifies their moral experience, too. If children initially accept the rules without fear of punishment, subsequently they are influenced by the expectations of those around and learn to be loyal and responsible to the people and institutions that impose rules on them. Through team games, the child accepts multiple tasks and develops the ability to establish and maintain simultaneous relationships, understanding not only his/her own role, but also the roles of others; the child also becomes able to discern the attitudes, opinions and expectations of others, understanding that the same person can play many roles that differ in value, depending on the situation. Under these conditions, we can state that sport transforms individuals into sociable, open people, who control their instinctual impulses and become disciplined, organized and responsible; for example, the performance athlete has a balanced diet, respects the hours of rest and has a well-planned and scheduled professional workload (training sessions and competitions).

Sport, as a socialisation process, develops the personality of the individual and contributes to educating their willpower, perseverance, resistance to frustration, courage, personal determination, ambition, self-confidence, etc. Sport responds to the need for belonging to a group, joining a community and enjoying the social recognition of personal merits, which provides mental balance and self-satisfaction. Thus, transposed into daily activity, these aspects positively influence the individual’s social behaviour.

Sport involves an increased sense of duty and responsibility. Great performers have rigorous training schedules, are fully committed to sports activity and bear the responsibility of achieving the established performance objectives, together with their coach.

Sport means competition, but also performance, record, victory, success, fair-play, team spirit. All these elements are the ultimate goals of a systematic activity, which induce the individual the desire to surpass oneself and the desire to surpass others – alone or together with others, through others that ensure their training and participation in competitions, in front of others that stimulate, encourage and appreciate them (Epuran, Holdevici, & Tonita, 2001, p. 119).

The need to compete, to compare with others, to demonstrate their value in the eyes of others determines the individuals participating in sports activities to also get involved in competitive activities. The 2000 statistics (Duret, 2008, p. 19) show that, out of 36 million athletes worldwide (regardless of subsystem), 8 million take part in competitions, and of them, 4.7 million attend official competitions, women being less competitive than men.

Although performance and success define sports activity, the need to win and to be the best can be found in any human activity. In other words, modern society is characterised by competition and competitiveness, which lead to increasingly better results, provided that the economic, political and social rules are respected.

In sport, competition obviously has the power to influence performance (Martens, 1975, p. 69). Competition does not take into account laws or ethical rules. It can be regarded as an opposition relationship when the subjects struggle to get possession of an object, especially victory or success. Under these conditions, social relations also contain elements of conflict, disagreement and opposing interests; consequently, within the cooperating groups, rivalry relations between some of their members are manifested as an expression of individual aspirations, but also as a particular way of expressing negative preferential relationships (for example, the “competition” between full players and reserve players, the rivalry during the selection actions) (Epuran, 2013, p. 242).

Regarding the competition itself, there are situations where athletes evade the regulations and try (and sometimes even succeed) to win a competition by using doping, bribing referees or, worse, their opponents. The ability to do this includes several competences, but annihilates a large part of the bio-psycho-motor and social
improvements gained through training and that actually should be optimised or maximised under fair competition conditions.

As a result, we encounter statements like this: “Serious sport has nothing to do with fair play. It is bound up with hatred, jealousy, boastfulness, disregard of all rules and sadistic pleasure in witnessing violence; in other words, it is war minus the shooting” (Orwell, 1945). Such actions take place for various reasons and can become dangerous for both those who directly participate in the sporting act and spectators.

The fiercer the competition, the more we expect athletes to display and exploit their performance potential in a framework that legitimises the competitive system. In these circumstances, the competition is no longer the struggle between competitors to prove their superiority, but a show for an increasingly numerous and demanding audience. Therefore, a series of technical, tactical and organisational regulatory changes have been made in recent decades in order to increase the spectacularity of sports competitions.

In this context, competition appears as a mechanism aimed to improve the effectiveness of the results, which involves the connection of an increasingly higher number of domains to the current trends of performance marketing and management (Teodorescu & Ganera, 2013).

In establishing the cooperative and/or competitive relationship, the starting premise is that each individual sets out a number of objectives whose solution gathers positive and/or negative situations that, at a given moment, may generate a form of intra- and intergroup conflict, from the perspective of different intra- and interpersonal aspects.

Cooperation involves the presence of motivation for belongingness, acceptance and security, group members having a common goal and organising their actions so as to surpass the opposing group (Epuran, 2013, p. 245).

Team sports are thought to have a greater contribution to the social development of athletes compared to individual sports, because the sports team, regarded as a miniature society, is defined as the encounter of two or more individuals who have a common identity, have common goals and objectives, share a common destiny, have interaction and communication relationships, have common perceptions of the group structure, are personally and instrumentally interdependent and show mutual interpersonal attraction, considering themselves as a group (Carron & Hausenblas, 1998). Sopa and Pomohaci (2014) list the following benefits of sports games: acquisition of social skills and behaviours, resolution of conflicts and prevention of their occurrence, development of communication and cooperation skills, team spirit and mutual support. These gains are positively transferred into the social plane and will manifest regardless of context, making the individual more adaptable.

Thus, another dimension of deliberative practice is called into question, namely the contribution of interpersonal relationships to achieving success. Considering the performance not only as a state (the result of the peak sports shape), but also as a process (the preparation behind the result), the relationships with teammates, the coach and other staff/club members significantly contribute to a more intense and more efficient activity, increasing the athlete’s interest and determination.

The team performance is much more than the sum of individual performances; to build a team, it is not enough to bring together a number of people in the same place, because collaboration is based on mutual conditional relationships, which involves a specific structure and specific functions. In a group, responsibilities are assumed individually, the members mainly interacting to exchange information, knowledge and make decisions, but do not engage in collective actions. Thus, there is no positive synergy that creates a higher performance than the sum of individual work. In a team, shared responsibilities are individual and reciprocal, and the obtained result is better than the one that participants would have achieved individually, due to the synergies between its members.

When the competition takes place in front of many people or when the stands are full, the ambition to surpass one’s opponent increases, because the athlete relates to both the other competitors and the audience. Moreover, sport, by its sociocultural dimension, creates unique opportunities to know others and oneself, adopt certain roles, accept some behaviours and typologies of people and trigger moments of introspection and behavioural change according to the context. Interactions between participants in the sports phenomenon also contribute to the exchange of cultural values and social attitudes, which transforms them as members of the society to which they belong.

Although physical exercise and competition between individuals have a multitude of positive aspects, there is a risk of deteriorating their integrity either biologically or morally. On the one hand, specialists in the field report a tendency towards excessive physical exercise, which is addictive and affects individuals both physically and mentally. Here are some terms used in the literature for the issue addressed: exercise dependence, obligatory running, morbid exercising, running addiction, excessive exercising, fitness fanaticism, compulsive athleticism (Krumm, 2016, p. 199). Considered as an obsessive passion, such a sports practice (be it performance or leisure) is not recommended and does not bring a plus on the social plane. On the other hand, the pursuit of success may lead
athletes to use doping substances and violate the ethical and sporting values. At the same time, the socially exacerbated competition may cause the disregard of moral and human values in different professional interactions.

Although sport has a predominantly beneficial role at the social level, there are also negative aspects of practicing sports activities, which may provoke controversy and criticism. Duret (2008, p. 5) makes a parallel analysis between the positive and negative functions of sport in society, which we present in Table 1.

Table 1. Positive and negative functions of sport

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hygienic function of maintaining the health status (benefits on the sanogenetic plane)</td>
<td>Disciplinary function of learning bodily constraints (obsession for a beautiful body and obsessive compulsive behaviour regarding life hygiene)</td>
</tr>
<tr>
<td>Political function of producing national symbols (champions are the heroes of a country)</td>
<td>Political function of producing exacerbated nationalism (the traditional rivalry between different countries)</td>
</tr>
<tr>
<td>Show function, sport as a promoter of moral and aesthetic values (a generator of beauty and moral instance)</td>
<td>Entertainment function, as a drug for the audience (media broadcasts of sports shows)</td>
</tr>
<tr>
<td>Socialisation and social integration function (strong interactions between people and the overcoming of social constraints)</td>
<td>Function of exclusion and maintenance of some racism and discrimination forms (women’s/men’s sports)</td>
</tr>
<tr>
<td>Function of educating respect and solidarity (ethical education)</td>
<td>Function of transmitting/promoting violence and the tendency to do anything to win (violence in stadiums, consumption of doping substances)</td>
</tr>
<tr>
<td>Cultural function</td>
<td>Consumption function, hiding mercantile interests (promotion of different brands, marketing of customised products, etc.)</td>
</tr>
<tr>
<td>Service producer function (educational services, physical conditioning services)</td>
<td>Function of increased commitment to the consumer society (fitness industry)</td>
</tr>
</tbody>
</table>

Apart from the aforementioned aspects, the role of sport in society is to prevent delinquency acts and harmful leisure, especially in adolescents, by filing their free time with physical activities able to consume their energy and refine their behaviour.

Social relationships are known to influence the individuals’ option for practicing one sports activity or another. Duret (2008, p. 118) presents the results of a survey that reveals the main social actors influencing the choice of a sport among adolescents (Table 2).

Table 2. Main social actors influencing the choice of a sport (a study of French adolescents)

<table>
<thead>
<tr>
<th>Sports activity</th>
<th>Family member</th>
<th>Sports friend</th>
<th>School friend</th>
<th>Neighbourhood friend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volleyball</td>
<td>38%</td>
<td>36%</td>
<td>12%</td>
<td>14%</td>
</tr>
<tr>
<td>Handball</td>
<td>36%</td>
<td>34%</td>
<td>8%</td>
<td>22%</td>
</tr>
<tr>
<td>Surfing</td>
<td>33%</td>
<td>49%</td>
<td>6%</td>
<td>12%</td>
</tr>
<tr>
<td>Dance</td>
<td>31%</td>
<td>23%</td>
<td>14%</td>
<td>32%</td>
</tr>
<tr>
<td>Rugby</td>
<td>25%</td>
<td>54%</td>
<td>10%</td>
<td>11%</td>
</tr>
<tr>
<td>Skating</td>
<td>21%</td>
<td>58%</td>
<td>8%</td>
<td>13%</td>
</tr>
</tbody>
</table>

We notice that the family plays an important role in involving adolescents in sports activities. In the case of sports with a higher degree of risk (surfing and rugby), the influence is stronger from a friend who shares the same hobby, being activated here mechanisms of social mimicry.

For another category of individuals living in special conditions (penitentiaries, immigrants), sport helps to focus energy on a constructive activity, relieve frustration, avoid conflicts, counterbalance social limitations, educate discipline and change behaviour.

Social stereotypes related to gender differences are also reflected in sport, children being directed from an early age towards certain activities that parents consider predominant for male or female athletes. The family should take into account the child’s talent and preferences and act beyond the social trends of practicing some specific sports. Stroot (2002, p. 130) emphasises the parent’s responsibility to provide their children with opportunities for the formal and informal practice of sports activities, as well as to support their participation both financially and emotionally. According to MacPhail and Kirk (2006), younger children engage in sports activities for fun,
entertainment and the pleasure of playing. In all sports subsystems, the coach/educator/teacher/trainer/instructor will play an important role in attracting children to systematic activity.

Therefore, the commitment of individuals to a sports activity is also marked by the gender differences existing at the social level. For example, in 2000, the French Ministry of Youth and Sport conducted a survey that has revealed that men are twice as many in 15 sports as compared to women, who are more numerous in sports such as gymnastics, dance and skating. The same research shows that sports games are predominantly male, except for volleyball, where there is a balance between female and male athletes. On the other hand, specialists (Penney, 2002, p. 114) talk about equal opportunities and equity in the practice of sports activities. In their opinion, team sports involving mixed groups are disadvantageous for girls, because boys are the ones who dominate the lesson and record a higher motor density.

Cayla and Lacrampe (2007, p. 187) highlight that, from a cultural point of view, there are sports considered to be more suitable for men (basketball, boxing, football, rugby), sports thought to be more suitable for women (dance, horse riding, rhythmic gymnastics, artistic gymnastics, synchronised swimming) and there are also neutral sports (badminton, swimming, tennis, volleyball). The above authors state that, particularly during adolescence, the social and cultural pressure influences the choice of a sports activity according to gender. This explains the dropout of girls or boys from certain sports activities. For instance, female adolescents more often withdraw from handball, while boys give up dancing. These decisions are related to age-specific growth and development processes, the self-image occupying a major place in adolescents’ concerns.

Cultural differences regarding the role of sport in society can also be identified in the case of extreme sports. A study conducted by Corneloup (2002, p. 84) shows cultural differences between skiers and surfers (Table 3).

Table 3. Cultural differences between skiers and surfers

<table>
<thead>
<tr>
<th>Concept of the sports activity practiced</th>
<th>Skier responses</th>
<th>Surfer responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>The mountain, an area of freedom...</td>
<td>Agree 90%</td>
<td>Agree 90%</td>
</tr>
<tr>
<td>The desire to go away from the modern world</td>
<td>Agree 38%</td>
<td>Agree 68%</td>
</tr>
<tr>
<td>Sliding, a great thrill (emotion)!</td>
<td>Agree 57%</td>
<td>Agree 81%</td>
</tr>
<tr>
<td>Sliding, a surge of adrenaline!</td>
<td>Agree 24.5%</td>
<td>Agree 62%</td>
</tr>
<tr>
<td>Sliding, health, solidarity, security!</td>
<td>Agree 62%</td>
<td>Agree 36%</td>
</tr>
<tr>
<td>Practicing in raw land is real sliding!</td>
<td>Agree 16.5%</td>
<td>Agree 57%</td>
</tr>
</tbody>
</table>

There are societies that encourage the practice of high-risk sports, which are considered a way of expression and a right to freedom of participants. A variety of sports activities are encountered, such as cross-country skiing trail, free ride skiing, capoeira or street dance battles, which are organized outside institutions and serve social missions subordinated to the message: “Become yourself by yourself!” (Duret, 2008, p. 120).

Most people practicing extreme or risk sports act individually, isolated from the members of the society to which they belong. But the desire to separate from other competitors often leads to social alienation, which may have fatal consequences.

The desire to succeed on one’s own and stand out by one’s own strengths, the continuous pursuit of self-improvement and the permanent tendency to break one’s own records make the athlete an individualist.

As long as things have an upward trend and athletes gain the appreciation of those around due to exceptional results, their life runs normally, being full of satisfactions. Problems arise when their sports performance inevitably begins to decline or when they no longer have supremacy in the performed sports act due to the presence of other competitors who are better trained or offer the audience a more interesting show. It is not rare that athletes (as in the case of famous actors or artists) can no longer lead a normal life after disappearing from the public eye (Cristea, 2015).

Another aspect related to the participation of people in sports activities and their socialisation is the socioeconomic level of individuals. Within the higher social class, the nuclear family controls and regulates the children’s exercise behaviour; thus, they learn specific skills at specific places. By contrast, within the lower social class, the children’s habits depend on the extended family, the physical education teacher or peers, which results in less strictly ordered activities performed at different places (Stuji, 2015).

It is not uncommon for individuals in some communities to think that doing performance sports in Romania is an activity with no future for their professional and material fulfilment and consequently they have a discouraging attitude towards this practice. This is another type of social stereotype, according to which sport develops only the somatic appearance and motor qualities, while other educational activities such as mathematics or computer science develop a person’s cognitive processes. Thus, some parents choose for their children to take private
lessons in the school subjects considered important and restrict their engagement in a performance sports activity, without taking into account their abilities.

Staying in the area of social stereotypes, we add that the involvement of individuals in sports activities also depends on their ethnicity. Although they may demonstrate superior motor ability or performance capacity, ethnic minorities may have difficulty integrating into a sports activity. There are situations where they prove their superiority in the sports arena. We can give the example of Roma athletes who have recorded superior results in sports such as boxing, wrestling or football.

Performance sport can be regarded as a chance of success for individuals from disadvantaged environments, who overcome their social status by practicing a sports discipline, but also as a road to social failure, in the case of performers who have difficulty adapting to the non-sporting life after a successful career.

Specialists pay particular attention to social integration through sport (Duret, 2008, p. 3), at the level of all subsystems:

- in performance sports, there are champions for whom sport is a framework of social compensation and integration into a socio-educational environment where the individual is valued;
- in the sport for all, individuals feel the need to join a group with common goals, but also to communicate with others;
- in adapted sports, people with disabilities find effective means to overcome social barriers and integrate into sports groups/teams.

Engaging people with disabilities in sports activities responds to their need for social integration, belongingness and acceptance, which involves respecting the rules of behaviour without discrimination (Teodorescu, Bota, & Stănescu, 2007, p. 6). Social strategies for integrating people with disabilities mostly include sports activities, which is why we believe that sport is a bridge between the individual’s motor potential and social behaviour.

Another context in which sport facilitates social development is therapy. Sports therapy solves both social integration problems, especially in the case of inclusive programmes based on motor activities, and mental regulation problems (arising at the emotional and locomotor levels), in the case of diseases or different forms of addiction.

There are numerous situations where people on the edge of survival because of the use of narcotics tried to find stronger stimuli in sports activities, sometimes extreme ones, and eventually have become world-class athletes (Cristea, 2015). The best example is Andreas Niedrig, one of the top triathlon racers in Germany; he abandoned his sports career of competitive swimmer due to drug use. After a specialised recovery period, being aware of his situation, the athlete decided to start preparing for the marathon race, succeeding to rank 7th at the 2007 Ironman Hawaii, the toughest triathlon competition in the world. In 2010, he was ranked 8th with his team at the 5000 km Race across America (a cycling competition).

Last but not least, it should be emphasised that sport plays an important role in the lives of spectators. Their tendency to identify as much as possible with the athletes in the sports arena provides them the opportunity to live the social phenomenon of sport at higher intensity, to join a specific group of supporters, to interact with people who share similar hobbies, and thus they can communicate and create social relationships. Moreover, sport generates opportunities to manage emotional states, representing one of the social life spheres where an increased level of spontaneous emotional manifestation and a relatively low level of tolerance are noted (Houlian & Malcom, 2016, p. 23).

Conclusions

Sport is not only a mirror of society, but plays an important role in its structuring and function due to the influences that the practice of sport has on the members of a society. We mention that the members of a society, direct or indirect consumers, are the conductors of these functions, being the only ones that can reduce the negative effects of sport and promote the multidisciplinary benefits of physical activities.

Finally, we summarise the main interactions between sport and the social side of human existence (Figure 1).
Figure 1. Interactions between sport and society

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References


VEGETARIAN DIET IN AEROBIC SPORTS. PARTICULARITIES, NECESSITIES AND RECOMMENDATIONS

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Abstract. It is challenging to sustain a balanced diet for an active vegetarian in order to ensure the proper nutrients – quantity and quality wise. In the medium and long terms, poorly constructed vegetarian and vegan diets might prompt individuals to macronutrient (protein and also fatty acids such as omega 3) and micronutrient (vitamin B12 and vitamin D; iron, zinc, calcium) deficiencies. Hence, more attention needs to be paid towards planning a vegetarian diet to ensure all the nutrients excluded as a result of eliminating animal products, and if necessary, to supplement the missing elements with proper medication. In aerobic sports, as opposed to strength-building exercises, there is also an increased need for complex slow-absorption carbohydrates to sustain the effort and for recovery. Therefore, the meal plans should be tailored to reflect the sport-specific requirements. The current narrative focuses on a vegetarian active female, 38 years old, amateur athlete, engaged in after-work fitness classes, whose lifestyle includes at least 3 aerobic (cardio) sessions per week, while performing a 40 hour-job and 11 hour-study weekly. The project employs the following instruments: a one-week food diary; a quality assessment of food intake and the necessity for supplementation throughout one day; a one-day meal plan ensuring the necessary macronutrients; nutritional recommendations to manage meatless diets for athletic purposes. Although prone to deficiencies, if appropriately planned, a vegetarian diet can be healthful, nutritionally adequate and can meet all nutrient needs at any stage of life and for any type of activity.

Keywords: vegetarian diet, aerobic sports, macro- and micronutrients, nutritional balance.

Introduction

Vegetarian diets in general and veganism in particular have become increasingly popular throughout the world in the last century as people choose to eliminate animal products from their lives due to numerous reasons such as ecological and environmental sustainability, ethical, compassion for animals, better health, or religion. A vegetarian diet is defined as one that excludes meat, fish, or fowl, but keeps dairy and eggs, whereas a vegan diet includes only grains, vegetables, fruit, legumes, seeds and nuts and the products resulted from these. Veganism has become more visible in sports, in the health and fitness industry due to some high-profile athletes that have opted for meatless food or/and for no animal-origin clothing and footwear, and this has not affected their performances, on the contrary, some have recorded better athletic results. In this respect, popular publications feature some famous stories of athletes who have chosen veganism as their lifestyle. Most of the literature on this topic has covered the vegan nutrition in general, sporadically in different types of sports and with particular attention to children.

The aim of this paper is to demonstrate that a properly planned and followed vegetarian diet does not limit the fitness level, performance and energy of a very active person throughout the day or/and at the gym, but, on the contrary, it brings numerous benefits that increase the quality of life, physical wellbeing and health status in the long term.

The research and case study featured in this paper show that plant-based diets benefit athletes’ heart health, endurance and recovery, as Loomis (2019) also draws attention to. According to the British Dietetic Association (BDA) (2017) and Canadian Dietitians Association (CDA) (2014), “appropriately planned vegetarian diets are healthful, nutritionally adequate and provide health benefits in the prevention and treatment of certain diseases”, and “can meet all nutrient needs at any stage of life including for pregnant, breastfeeding or for older adults”. Athlete nutrition focuses on covering energy needs throughout the effort during daily activities and recovering after. Therefore, food intake is meant to provide energy, structural and catalytic requirements of the body in the long term.

Advantages of vegetarian diets for athletes

For aerobic sports, in particular, where the effort exceeds 60 minutes, energy deposits (the muscle and liver glycogen) get almost fully depleted and the body needs more carbohydrates to continue effort and for recovery.
The rational plant-based diets are built on complex whole carbohydrates – grains, legumes and root vegetables that take more to be absorbed and release energy progressively for a longer time.

Intense effort generates production of lactic acid, acidosis and, consequently, leads to sour muscles, vasodilation and impacts the tissue reactivity. To prevent or rapidly deal with these effects, alkaline foods ing plant foods have prandial energy expenditure; thus, tryptophan, double fibre like oats, barley, beans, soy protein and almonds in a diet, the LDL cholesterol levels have been reduced by nearly 30% in four weeks. This entails better blood circulation and a healthier heart to sustain the physical effort. Moreover, plant-based diets also influence postprandial energy expenditure; thus, the use of a low-fat vegan diet for 14 weeks increased postprandial energy expenditure by 16%.

Compared with omnivores, people following vegan and vegetarian diets have increased antioxidant activity due to higher intakes of vitamin C, vitamin E, beta-carotene and other antioxidants, as well as to higher antioxidant enzyme production (Kahleova et al., 2011). For athletes, who undergo a lot of oxidative stress and inflammation, the antioxidant activity is meant to improve their ability to recover.

“By reducing blood viscosity and improving arterial flexibility and endothelial function, they (vegetarians) may be expected to improve vascular flow and tissue oxygenation. Because many vegetables, fruits and other plant-based foods are rich in antioxidants, they help reduce oxidative stress. Diets emphasising plant foods have also been shown to reduce indicators of inflammation. These features of plant-based diets may present safety and performance advantages for endurance athletes” (Barnard et al., 2019).

**Challenges of vegetarian and vegan diets. How to tackle them?**

Plant-based foods are less bioavailable and less digestible due to anti-nutrient factors such as phytic acid, oxalates, trypsin inhibitors, which limit the absorption of nutrients. Additionally, rich fibre meals with low caloric density easily bring satiety without the adequate nutrient intake, and for athletes, this can be very detrimental (Clarys et al., 2014). Moreover, there are nutrients very limited or completely missing from plant-based food, such as:

- **Proteins. Lipids. Carbohydrates.**

Rogerson (2017) draws attention to the fact that plant-based protein sources are often incomplete, missing important essential amino acids (EAAs), and contain less branched-chain amino acids (BCAA) than their animal-based equivalents. The most common limiting amino acids in plant-based proteins include lysine, methionine, isoleucine, threonine and tryptophan. Of these, lysine appears to be usually absent, particularly from cereal grains. Foods such as grains, legumes, peas, beans, nuts and seeds should be included in the vegan diet to ensure that all EAAs are present and that adequate BCAA are consumed to support training recovery and adaptation. For lacto-ovo-vegetarians, quality proteins should not be of concern, as the egg and dairy proteins provide complete and high quantities of amino acids. Eating two large eggs provides almost 12 grams of dietary protein and all EAAs, as calculated on Cronometer (2019).

According to Crețu and Popescu (2014, p. 99), the optimal ratio of protein-lipid-carbohydrate intake for omnivore athletes is 1:1:4, which translates to approximately 120-180 g of proteins/day, 100-140 g of fat/day and 600-700 g of carbohydrates/day for a robust male athlete. Based on Rogerson’s recommendations, these quantities require supplementation in the case of vegetarian athletes to compensate for the reduced digestibility and low biological value of plant-based sources (Table 1).

<table>
<thead>
<tr>
<th>Macronutrient needs</th>
<th>Omnivore</th>
<th>Vegetarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proteins</td>
<td>1.5-2.5 g · kg⁻¹ · day⁻¹</td>
<td>1.8 g · kg⁻¹ to 2.7 g · kg⁻¹ · day⁻¹</td>
</tr>
<tr>
<td>Lipids</td>
<td>1.2-1.7 g · kg⁻¹ · day⁻¹</td>
<td>0.5–1.5 g · kg⁻¹ (30% fat)</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>6-7 g · kg⁻¹ · day⁻¹</td>
<td>3–10 g · kg⁻¹</td>
</tr>
</tbody>
</table>

- **Vitamin B12**

This vitamin deficiency leads to a lot of serious health challenges (Rizzo et al., 2016). Eggs and dairy foods contain Vitamin B12. Hence, vegetarians might be at bay, provided they get enough of it. The recommended daily allowance is 2.4 μg - 2.8 μg. However, B12 is found in meat, fish and organs, consequently vegans should include fortified foods containing Vitamin B12 or supplement accordingly.
- Omega-3 fatty acids

The benefits of these fats on human health are numerous, as described by Burke and Cox (2010, pp. 7-9), and any deficiency thereof affects heart and brain health. The omega-3 fatty acids group comprises the long chains of DHA and EPA acids found in oily fish and the short version of alpha linolenic acid (ALA) from vegetable oils, particularly flaxseed, walnut, rapeseed and soy. Although our bodies can convert some ALA into EPA and DHA, the conversion is not very efficient. Vegetarians need to consider supplements from algae and include sea vegetables into the diet. Although the omega-6 fatty acids have a positive effect on blood fat levels, they are structural competitors to the omega-3 series and may counteract their effects. According to more nutritionists, the optimal ω6:ω3 ratio is 3:1 and should be limited to maximum 5:1.

- Vitamin D

The vitamin D complex is essential for calcium absorption, the bone and generally the body’s health, being of vital importance for athletes. The D family contains D2 from plants and D3 from animals, especially fish, the latter being produced by the human body as a result to sun exposure. During low sun seasons, D3 needs to be procured from food and supplements. The Dietary Recommended Allowance (DRA) for non-deficient is 1.5 mg (150-800 UI); particularly vegetarian and vegan females with deficiency can opt for higher dosages.

- Iron

Vegetarian athletes whose diets are heavily or solely based on plant iron foods may find that the iron they consume is inadequate and metabolically unavailable as inhibited by tannins and phytates, according to Saunders et al. (2013). They also claim that vegetarians need about twice as much dietary iron as non-vegetarians because the non-heme iron from plant foods is not as well absorbed as the heme iron from animal foods. To meet these needs, vegans should choose iron-rich foods daily. Good sources include soy products (tofu, tempeh and fortified soy beverages), beans, peas and lentils, chickpeas, fortified grain products (breads, cereals and pasta), some nuts and seeds like cashews, almonds, pumpkin and sesame seeds, dried apricots, cooked spinach, kale.

- Calcium

It is highly recommended that the adequate calcium dose for athletes is no less than 1000 mg/day. The importance of Ca for athletes reflects its role in the maintenance of skeletal health during exercise. Best sources of calcium include dairy products, and for vegans, soy, beans, almonds, vegetables such as broccoli, bok choy, fruits – figs.

- Zinc, Selenium

Zinc is important to cell growth, repair and protein metabolism. Meat, oysters, dairy and eggs are rich in zinc and selenium, and although there are plant-based sources that contain them, their bioavailability and absorption are limited by anti-nutrients. In order to prevent this, foods should be processed – soaked, boiled, sprouted, fermented. Vegetarians might need to consume up to 50% more zinc than non-vegetarians. Soy products, beans and whole grains, nuts and seeds are rich in zinc and nuts, especially Brazil nuts, which boast good deposits of selenium. Selenium is an important trace element for the immune system, thyroid function and reproduction, being found in meat, fish and eggs in higher proportions. For vegans, it is available in nuts and seeds.

Material and methods

The current paper brings to the fore a case study focusing on a subject’s meal behaviour, food planning, daily energy intake and physical activity in order to assess if a vegetarian diet is appropriate to the lifestyle she leads and ensures the necessary nutrients to preserve, in the short and long term, the body’s health and energetic balance. The case study focuses on a vegetarian active female, 38 years old, amateur athlete, engaged in after-work finesses classes, whose lifestyle includes at least 3 aerobic (cardio) sessions per week, while performing a 40 hour-job and 11 hour-study weekly.

For this, we made anthropometric measurements using a professional scale based on the bio-electrical impedance analysis (BIA) technology – Tanita BC 730 Corrective Scale for the Monitoring of Body Composition (1). Additionally, we followed the subject’s physical activity and estimated her energy consumption while calculating the theoretical requirements (2). In parallel, we monitored all her meals throughout a week, calculated the energy intake and the quality of nutrients (3), and eventually came up with recommendations and a meal plan providing the necessary nutrients for a healthy state of the body (4).
1. **Anthropometric measurements:** Female, 38 years; Height: 162 cm; Lacto-Ovo-Vegetarian Weight 48 kg; Body Fat Mass 18.1%; Body Water 56.7%; Muscle Mass in kg 38.2; Bone Mass 2.1, Basal Metabolic Rate 1191 kcal, Visceral Fat 1.5 kg (level 1 out of 18), Physical Rating 8 (out of 9), Metabolic Age 23 years old. All measurements show the subject fits in the correct health parameters and physically scores a very good rating.

2. **Daily food diary for one week**

   **Day 1**  
   **Breakfast**  
   Shake: banana (120 g), avocado (100 g), sesame milk (150 ml), one apple (100 g), 50 g granola Energy: 900 kcal  
   **Lunch**  
   Veggie Wrap: pita bread, lentil balls, salad, pickled cucumbers, tahini sauce Energy: 1900 kcal  
   **Snack**  
   - Energy: 400 kcal  
   **Dinner**  
   Indoor Cycling – 60 min Energy: 210 kcal

   **Day 2**  
   **Breakfast**  
   Shake: banana (120 g), 1/2 avocado (50 g), sesame milk (150 ml), 1/2 apple (50 g), 30 g granola Energy: 700 kcal  
   **Lunch**  
   Vegan falafel, potato wedges, sauce Energy: 1500 kcal  
   **Snack**  
   Cashew yoghurt, milk chocolate 40 g, 30 g granola Energy: 620 kcal  
   **Physical activity**  
   Zumba dancing – 60 min Energy: 111 kcal  
   **Dinner**  
   Seaweed salad (200 g) Energy: 250 kcal

   **Day 3**  
   **Breakfast**  
   Shake: banana (100 g), 1/2 avocado (50 g), coconut milk (120 ml), 1/2 apple (50 g), 30 g granola, 2 boiled eggs Energy: 800 kcal  
   **Lunch**  
   Baked oyster mushrooms (Pleurotus) 200 g, Green salad (50 g) and red pepper (50 g), Figs in chocolate – 100 g, 1 apple Energy: 500 kcal  
   **Snack**  
   - Energy: 400 kcal  
   **Physical activity**  
   Indoor cycling – 60 min Energy: 210 kcal  
   **Dinner**  
   1 loaf of rye bread, 30 g zacusca (a vegetable spread), 100 g pickled cucumbers Energy: 141 kcal

   **Day 4**  
   **Physical activity**  
   Yoga class – 60 min Energy: 216 kcal  
   **Dinner**  
   1 cup of fresh orange juice, walnuts 30 g, arugula salad: 100 g arugula, 30 g baked beets, 1/2 apple, 20 g tofu, 10 ml olive oil Energy: 587 kcal  
   **Desert**  
   Pudding: 50 g cashew, 70 ml orange juice, 10 ml coconut oil, 15 ml maple syrup Energy: 775 kcal

   **Day 5**  
   **Breakfast**  
   Granola shake (see above) Energy: 700 kcal  
   **Physical activity**  
   Pilates – 60 min, Indoor cycling – 60 min Energy: 224 kcal  
   **Lunch**  
   Arugula salad and baked oyster mushrooms, 2 boiled eggs Energy: 837 kcal  
   **Dinner**  
   50 g seaweed salad, 50 g bulgur Energy: 325 kcal  
   **Snack**  
   250 g Greek yoghurt, sour cherry gem 80 g Energy: 382 kcal

   **Day 6**  
   **Breakfast**  
   Granola shake Energy: 700 kcal  
   **Lunch**  
   Cashew and sunflower seed, vegetal cheese 150 g with crackers Energy: 900 kcal  
   **Dinner**  
   2 Belvita biscuits (chocolate, hazelnut) – 100 g Energy: 414 kcal

   **Day 7**  
   **Breakfast**  
   Shake Energy: 900 kcal  
   **Physical activity**  
   Cycling – 60 min Energy: 211 kcal  
   **Lunch**  
   Legume salad – peas, green beans, lentils (200 g), 6 Marlenka cookies Energy: 850 kcal  
   **Dinner**  
   40 g rye bread, cottage cheese 50 g, 2 red peppers, 200 ml fresh orange juice, apple Energy: 360 kcal

The average daily intake is 2130 kcal (to calculate the energy intake, we used the Oneden website (2019)).
3. **Types of effort and the energy expenditure**

- 1 hour Zumba dancing 194 kcal
- 1 hour indoor cycling 450-500 kcal (3x/week)
- 1 hour yoga 100 kcal
- 1 hour Pilates 100 kcal

**Results**

Following the monitoring of one-week meals, the findings show that:

- The energy intake recommended by the professional scale used for anthropometric measurements is 1962 kcal and, according to our calculation that takes into consideration the basal metabolism and the activity coefficient that we considered to be 1.7 due to a very dynamic lifestyle, the energy intake should exceed 2000 kcal.  
  \[ \text{BM*Activity coefficient} = \text{Daily energy needed: 1191*1.7} = 2025 \text{ kcal}; \]
- During the monitored week, the subject’s weight did not change at all; the energy level was constant and she could perform all her duties tirelessly, meaning that there was a match between energy supply and energy demand;
- Physical activities add up to 6 hours/week (360 minutes), out of which 4 very intense aerobic effort sessions; this should add extra 200-500 calories to the daily energy intake based on the type of effort performed;
- Besides physical activity, the subject works 40 hours/week and attends a Master’s programme – 8 hours/week and a foreign language course – 3h/week. The mental effort adds up to the physical effort, and the non-exercise activity thermogenesis (NEAT) is high as well;
- The meal timing is disorganised, meals should be programmed according to the activities throughout the day and especially in regard to the sports classes in order to provide the energetic and recovery nutrients;
- Reduce saturated fats. Excessive amounts of avocado, cashew, sunflower seeds, coconut and olive oil have also a significant level of saturated fats and an unbalanced ratio of omega-6 – omega-3 fats;
- Continue supplementation with vitamin D3;
- Increase calcium sources and quantity; a lacto-vegetarian can take the needed Ca dose from milk, cheese, yoghurt;
- Pay attention to the iron and electrolytes lost during sweating due to effort;
- Hydrate properly with at least 1.7 l/day (0.35 l/kg x 48 kg);
- Include 2 main meals a day – breakfast and lunch, and two snacks before and after sports classes in order to ensure energy and recovery material.

To scrutinise the quality and quantity of macro- and micronutrients provided throughout one day, we took day 3 as an example due to being closer to the average energy intake (Cronometer, 2019). The following graphs were calculated with the Chronometer App (Figure 1).

![Figure 1. Nutrient targets throughout day 3, based on customised targets by the App for the subject’s anthropometrics](image)

A thorough analysis of the eating habits shows that more attention should be paid to ensuring the necessary protein intake while lowering and balancing the lipids, even if of plant origin. The following table shows that the protein intake is lower than it should be quantity wise, but quality wise, all EAAs are fully covered. The fats however highly exceed the amount needed, and the saturated fat level is concerning. The lipid profile of the polyunsaturated fats looks promising, with a good ratio between omega-3 and omega-6 fatty acids (Table 2).

<table>
<thead>
<tr>
<th>Micronutrients</th>
<th>Percentage</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>10%</td>
<td>100%</td>
</tr>
<tr>
<td>Lipids</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>30%</td>
<td>30%</td>
</tr>
</tbody>
</table>

In terms of micronutrients, vitamin D and calcium seem to record serious deficits, and this needs to be taken
into consideration for further supplementation from foods or medicine. The subject has been vitamin D3 deficient for a long time and currently takes an extra 2000 UI supplement every day (Table 3).

Table 2. Protein and lipid intake profile for day 3

<table>
<thead>
<tr>
<th>Proteins</th>
<th>48.6 g</th>
<th>53 %</th>
<th>Fats</th>
<th>84.0 g</th>
<th>145 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amino acids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cysteine</td>
<td>0.7 g</td>
<td>147 %</td>
<td>Monounsaturated</td>
<td>37.2 g</td>
<td></td>
</tr>
<tr>
<td>Histidine</td>
<td>0.9 g</td>
<td>133 %</td>
<td>Polyunsaturated</td>
<td>14.6 g</td>
<td></td>
</tr>
<tr>
<td>Isoleucine</td>
<td>1.6 g</td>
<td>166 %</td>
<td>Omega-3</td>
<td>2.8 g</td>
<td>254 %</td>
</tr>
<tr>
<td>Leucine</td>
<td>2.6 g</td>
<td>125 %</td>
<td>Omega-6</td>
<td>11.7 g</td>
<td>98 %</td>
</tr>
<tr>
<td>Lysine</td>
<td>1.9 g</td>
<td>100 %</td>
<td>Saturated</td>
<td>21.2 g</td>
<td>21.158 g</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.7 g</td>
<td>155 %</td>
<td>Trans-unsaturated fatty acids</td>
<td>0.3 g</td>
<td>0.256 g</td>
</tr>
<tr>
<td>Phenylalanine</td>
<td>1.8 g</td>
<td>219 %</td>
<td>Cholesterol</td>
<td>328.2 mg</td>
<td></td>
</tr>
<tr>
<td>Threonine</td>
<td>1.5 g</td>
<td>149 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tryptophan</td>
<td>0.5 g</td>
<td>193 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyrosine</td>
<td>1.1 g</td>
<td>134 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valine</td>
<td>2.1 g</td>
<td>172 %</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Vitamin and mineral intake profile for day 3

<table>
<thead>
<tr>
<th>Vitamins</th>
<th>Minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 (Thiamine)</td>
<td>1.5 mg</td>
</tr>
<tr>
<td>B2 (Riboflavin)</td>
<td>2.4 mg</td>
</tr>
<tr>
<td>B3 (Niacin)</td>
<td>26.3 mg</td>
</tr>
<tr>
<td>B5 (Pantothenic Acid)</td>
<td>7.4 mg</td>
</tr>
<tr>
<td>B6 (Pyridoxine)</td>
<td>3.7 mg</td>
</tr>
<tr>
<td>B12 (Cobalamin)</td>
<td>6.9 μg</td>
</tr>
<tr>
<td>Folate</td>
<td>1285.8 μg</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>22154.9 IU</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>281.2 mg</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>260.3 IU</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>15.8 mg</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>465.4 μg</td>
</tr>
</tbody>
</table>

Hereby, we provide a vegetarian meal plan that would put into practice the following distribution (Table 4):

Table 4. Distribution of the vegetarian meal plan

<table>
<thead>
<tr>
<th>Macronutrient distribution (approx. energy: 2000 kcal)</th>
<th>Approximate distribution of meals</th>
</tr>
</thead>
<tbody>
<tr>
<td>55% carbohydrates = 257 g</td>
<td>Breakfast 40% (800 kcal)</td>
</tr>
<tr>
<td>30% fats = 66 g</td>
<td>Lunch: 30% (600 kcal)</td>
</tr>
<tr>
<td>15% proteins = 100 g</td>
<td>Snack before gym: 15% (300 kcal) focus on carbohydrates</td>
</tr>
<tr>
<td></td>
<td>Snack after gym: 15% (300 kcal) focus on carbohydrates and proteins to replenish glycogen deposits and ensure recovery</td>
</tr>
</tbody>
</table>

Table 5. A vegetarian menu

<table>
<thead>
<tr>
<th>Breakfast Smoothie with granola and 2 eggs</th>
<th>Quantity (g)</th>
<th>Energy (Kcal)</th>
<th>Proteins (g)</th>
<th>Fats (g)</th>
<th>Carbohydrates (g)</th>
<th>Fibers (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avocado</td>
<td>70</td>
<td>116.9</td>
<td>1.4</td>
<td>10.8</td>
<td>6</td>
<td>4.8</td>
</tr>
<tr>
<td>Banana</td>
<td>120</td>
<td>106.8</td>
<td>1.3</td>
<td>0.4</td>
<td>27.4</td>
<td>3.1</td>
</tr>
<tr>
<td>Frozen berry mix</td>
<td>50</td>
<td>37</td>
<td>0.9</td>
<td>0.4</td>
<td>4.6</td>
<td>0</td>
</tr>
<tr>
<td>Coconut milk</td>
<td>150</td>
<td>36</td>
<td>0.5</td>
<td>2</td>
<td>3.8</td>
<td>0</td>
</tr>
<tr>
<td>Granola</td>
<td>50</td>
<td>207</td>
<td>4.9</td>
<td>4.8</td>
<td>34.1</td>
<td>4.2</td>
</tr>
<tr>
<td>Boiled egg</td>
<td>80</td>
<td>124</td>
<td>10.1</td>
<td>8.5</td>
<td>0.9</td>
<td>0</td>
</tr>
</tbody>
</table>
Cafe late 250 56.3 1 5 1.5 0
Oat biscuit 8 38.7 0.6 1.8 4.8 0.6
TOTAL 722.7 20.7 33.7 83.1 12.7

Lunch
Greek quinoa salad
Desert: yoghurt with sour cherry jam

<table>
<thead>
<tr>
<th>Quantity (g)</th>
<th>Energy (Kcal)</th>
<th>Proteins (g)</th>
<th>Fats (g)</th>
<th>Carbohydrates (g)</th>
<th>Fibers (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feta cheese</td>
<td>50</td>
<td>132</td>
<td>7.1</td>
<td>10.7</td>
<td>2.1</td>
</tr>
<tr>
<td>Cherry tomatoes</td>
<td>100</td>
<td>20</td>
<td>1.3</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Green peas</td>
<td>50</td>
<td>146</td>
<td>12.3</td>
<td>0.6</td>
<td>22.8</td>
</tr>
<tr>
<td>Quinoa</td>
<td>50</td>
<td>184</td>
<td>7.1</td>
<td>3.1</td>
<td>32.1</td>
</tr>
<tr>
<td>Yoghurt</td>
<td>75</td>
<td>69</td>
<td>9</td>
<td>2.3</td>
<td>3</td>
</tr>
<tr>
<td>Sour cherry jam</td>
<td>15</td>
<td>43.8</td>
<td>0.1</td>
<td>0</td>
<td>10.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>594.8</td>
<td>36.9</td>
<td>16.7</td>
<td>74.5</td>
<td>5.4</td>
</tr>
</tbody>
</table>

Snack 1
Arugula and roasted beet salad
Glucose

<table>
<thead>
<tr>
<th>Quantity (g)</th>
<th>Energy (Kcal)</th>
<th>Proteins (g)</th>
<th>Fats (g)</th>
<th>Carbohydrates (g)</th>
<th>Fibers (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roasted red beet</td>
<td>100</td>
<td>47</td>
<td>1.7</td>
<td>0.1</td>
<td>10</td>
</tr>
<tr>
<td>Arugula</td>
<td>50</td>
<td>12.5</td>
<td>1.3</td>
<td>0.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Apple</td>
<td>100</td>
<td>49</td>
<td>0</td>
<td>0</td>
<td>11.2</td>
</tr>
<tr>
<td>Sun flower seeds</td>
<td>20</td>
<td>105.1</td>
<td>4</td>
<td>9.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Tofu</td>
<td>50</td>
<td>72.5</td>
<td>6.6</td>
<td>4.2</td>
<td>2.1</td>
</tr>
<tr>
<td>Glucose (as chocolate bars)</td>
<td>15</td>
<td>51</td>
<td>0</td>
<td>0</td>
<td>12.7</td>
</tr>
<tr>
<td>TOTAL</td>
<td>337.1</td>
<td>13.6</td>
<td>14.3</td>
<td>38.6</td>
<td>5</td>
</tr>
</tbody>
</table>

Snack 2
Banana milkshake

<table>
<thead>
<tr>
<th>Quantity (g)</th>
<th>Energy (Kcal)</th>
<th>Proteins (g)</th>
<th>Fats (g)</th>
<th>Carbohydrates (g)</th>
<th>Fibers (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana</td>
<td>120</td>
<td>106.8</td>
<td>1.3</td>
<td>0.4</td>
<td>27.4</td>
</tr>
<tr>
<td>Milk</td>
<td>100</td>
<td>45</td>
<td>3.3</td>
<td>1.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Raisins</td>
<td>30</td>
<td>89.7</td>
<td>0.9</td>
<td>0.2</td>
<td>23.8</td>
</tr>
<tr>
<td>Protein hemp powder</td>
<td>20</td>
<td>75.4</td>
<td>10.4</td>
<td>2.4</td>
<td>2.1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>316.9</td>
<td>15.9</td>
<td>4.5</td>
<td>57.8</td>
<td>9.2</td>
</tr>
</tbody>
</table>

Food

<table>
<thead>
<tr>
<th>Energy (Kcal)</th>
<th>Proteins (g)</th>
<th>Fats (g)</th>
<th>Carbohydrates (g)</th>
<th>Fibers (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1971.5</td>
<td>87.1</td>
<td>69.2</td>
<td>254</td>
</tr>
</tbody>
</table>

Conclusions

Vegetarianism does not prevent athletes from having good performances and preserving a good and sustainable health status. However, it is easier for ovo-lacto-vegetarians than for vegans to ensure a good quality and quantity of proteins and other micro-nutrients.

For an amateur or professional athlete that has decided to go vegetarian or vegan, the resolution should be taken after thorough documentation and consulting with a nutritionist about the implications of animal-based food elimination and the necessity of supplementing with the required nutrients for proper and flourishing health. It is essential that the diet covers the energetic and nutritional needs for preserving the body’s homeostasis and proper functionality.

In a vegetarian, but particularly in vegan diets, there must be taken into consideration that the plant-based food presents a lower degree of digestibility due to richer fibre content, anti-nutrients such as phytates, oxalates, and no or very little sources of some nutrients to be found only in animal-origin meals – cobalamin (vitamin B12) vitamin D3, omega-3 fatty acids from fish. If the diet does not provide enough quantities of these nutrients, they need to be supplemented from other sources.
A personalised meal plan tailored to the necessary nutrients and the activity level, which takes into account a vegetarian’s habits, food consuming behaviour, expected results and, above all, maintaining a balanced, healthy lifestyle is compulsory to increase fitness performance and preserve health from a sustainable point of view.

Authors’ contributions

All authors contributed equally to this study and should be considered as main authors.

References


STATISTICAL INDICATORS AND SPECIFIC LEGISLATION FOR PHYSICAL EDUCATION AND SPORTS: THE CASE OF ROMANIA

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Abstract. Due to the increasing role that sport plays in social and economic life, it was and still is subject of public opinion surveys, recommendations regarding policies and activities that mainstream and support it into other EU’s policies, as well as working plans for developing a framework of European cooperation in the field and Sport Statistics. In Romania, the last two decades have been under both the influence of a new legislation and working plans, actions and programmes derived from the White Paper on Sport. This paper, using desk research of relevant legislation and the TEMPO database, aims to provide an insight view of the first post-revolution law on physical education and sport in Romania (compared with the previous one established in the communist period) and to determine its impact on sport performance through the lens of nine annual statistical indicators used by the National Institute for Statistics in the field of sport.

Keywords: sport performance, sport statistics, statistical indicators.

Introduction

Sport, defined as “all forms of physical activity which, through casual or organised participation, aim at expressing or improving physical fitness and mental well-being, forming social relationships or obtaining results in competition at all levels” (Council of Europe, 2001), has a recognized social and economic impact that has grown considerably over the last two decades. That is why, at European level, sport was subject of: (1) a series of public opinion surveys, i.e., the Special Eurobarometer on Sport and Physical Activity (European Commission, 2003, 2004, 2010, 2014, 2017); (2) recommendations regarding policies and activities that mainstream and support it into other EU’s policies such as health, youth, citizenship, education and training, employment, social inclusion and social integration, research, regional development (i.e., the White Paper on Sport in 2007); (3) working plans for developing a framework of European cooperation in the field of sport between policy makers, sport organisers and competent international bodies and developing activities dedicated to the societal role of sport, its economic dimension and its organization or integrity (i.e., the “Pierre de Coubertin” action plan in 2007, EU Work Plan for Sport 2011-2014, 2014-2017 and 2017-2020).

But in 2006, the European Commission set up the EU Working Group “Sport and Economics”, which developed “the Vilnius definition for sport” to identify economic activities in goods and services associated with sport. This is why the Vilnius definition for sport (set in the context of an economic analysis) uses a three-stage approach (Eurostat, 2008): (1) a statistical definition (that corresponds to NACE code 93.1 “Sport activities”), (2) a narrow definition (that includes the statistical definition and all activities that provide inputs to sport, meaning all industries which produce goods that are necessary to perform sport) and (3) a broad definition (that includes the narrow definition and activities for which sport is an input, such as television broadcasting, hotels accommodating guests doing sport, etc.).

At European level, one of the priorities pursued over the years was the Sport Statistics in order to strengthen the evidence base for sport and secure evidence-based policies in this field, especially regarding its economic dimension, but also physical activity to promote health, the European Week of Sport initiative and Erasmus+ Sport programme. Therefore, under the EU Work Plan for Sport 2014-2017, Eurostat, with the European Commission’s Directorate General for Education and Culture (DG EAC), has initiated in 2016 (and continued in 2018) the regular dissemination of harmonised statistics on sport, based on the Vilnius definition of sport and covering: (1) “employment in sport”, (2) “international trade in sporting goods”, (3) “attendance at live sports events” and (4) “private expenditure on sporting goods and services”, this last issue being replaced in 2018 by “active engagement in sport and physical activity” (Eurostat, 2016; Eurostat, 2018). As can be seen, the Sport Statistics have a strong economic anchor, but the initial 2016 perspective dominated by economic issues was replaced by a more nuanced one in 2018, health and social aspects being more intensely pursued.

According to these statistics, Romania presents itself as follows:

(1) for “employment in sport”, no data provided (both in 2011 for Sport Statistics, 2016 edition, and in 2015, for Sport Statistics, 2018 edition);
(2) for “international trade in sporting goods”, the value of exports in 2017 was 377,419 (thousand euro), and the value of imports in the same year was 187,670 (thousand euro); for both categories, Romania’s values for 2017 increased compared to the values of previous years;

(3) for “attendance at live sports events”, 27.4% of the population aged between 16 and 64 years attended, at least once in the last 12 months, live sports events; the value should be viewed considering that the average at European level was estimated at 63.7% and only North Macedonia (with 23.9%) has a value below Romania (in 2015, for Sport Statistics, 2018 edition);

(4) for “active engagement in sport and physical activity”, less than 10.0% of the population aged 15 and more is practicing sport, fitness or recreational (leisure) physical activities at least once a week - 12.8% of them are cycling to get to and from a place, 4.9% are doing aerobics and 1.9% are doing muscle strengthening; these values should be viewed considering that the average at European level was estimated at 19.7% for those who are cycling to get to and from a place, 44.4% for those who are doing aerobics and 24.2% for those who are doing muscle strengthening; in addition, only Turkey has values below Romania - 5.3% for the first category, 7.5% for the second one and 3.3% for the third one (in 2014, for Sport Statistics, 2018 edition).

Leaving aside these statistical approaches that emphasise the economic perspective of sport, at national level, the last two decades have been under both the influence of a new law of physical education and sport established in April 2000 and working plans, actions and programmes derived from the White Paper on Sport.

Given that “sport is considered to be a way of developing well-being, increasing the quality of life of individuals” (Predoiu, 2016, p. 10), this paper aims to provide an insight view of the first post-revolution law on physical education and sport in Romania, compared with the previous one established in the communist period, and to determine its impact on sport performance through the lens of nine annual statistical indicators used by the National Institute for Statistics (INS) in the field of sport. Although important, the economic outlook is not followed mainly because the data are either not collected/not available or not updated. In other words, this research tries to answer the following question: “Has the 2000 legislative change led to an increase in sport performance at the national level?”

Research methodology

Methodologically, in order to answer the research question, it was developed: first, a desk research analysis of successive legislation in the field of physical education and sport (covering the last 50 years); second, a desk research analysis of the evolution of nine indicators for the sport area: I1 Sports sections (by federation), I2 Athletes holding sports cards (by federation), I3 Sports coaches (by federation), I4 Sports instructors (by federation), I5 Referees (by federation), I6 Medals at the Olympic Games, I7 Places obtained at the Olympic Games, I8 Medals at the Olympic and Paralympic Games, World and European Championships by sports federation/international sports competitions, I9 Places obtained at international competitions by sports federations; for I1, I2, I3, I4, I5, I8 and I9 indicators, a series of data are used for the period 1992-2017, and for I6 and I7 indicators, a series of data are used for the period 1932-2016, all available in the TEMPO database of the National Institute for Statistics (INS, 2018).

Results

The analysis of successive legislation in the field of physical education and sport has led to a diachronic comparative study with similarities and differences between Law no. 29 of December 29, 1967 (Marea Adunare Naţională, 1967) on the development of physical education and sports and Law no. 69 of April 28, 2000, on physical education and sport (with subsequent modifications and completions) (Parlamentul României, 2000). Although the two normative acts belong to different political eras, they regulate the same field, “physical education and sport”, and proclaim physical education and sport as activities of national interest supported by the state. The differences are considerable (Table 1) especially since the fall of the post-communist sports system, in the sense that there is a strong need for institutional definition, while the communist law regulated an already functional system.
Table 1. Differences between the two normative acts

<table>
<thead>
<tr>
<th>Law no. 29 of December 29, 1967, on the development of physical education and sport</th>
<th>Law no. 69 of April 28, 2000, on physical education and sport</th>
</tr>
</thead>
<tbody>
<tr>
<td>- does not define physical education and sport, but places them in the perspective of achieving some objectives assumed by the state, namely: strengthening health, increasing physical and intellectual capabilities, good use of free time, harmonious physical and moral development of the population;</td>
<td>- defines physical education and sport (“All forms of physical activity meant, through organized or independent participation, to express or improve physical condition and spiritual comfort, establish civilised social relations and lead to results in competitions of any level”), but only stipulates the obligation of the public administration authorities, schools and sport NGOs to support the sport for all and performance sport and ensure conditions for practicing physical education and sport in local communities, without specifying the responsibilities and the resources required;</td>
</tr>
<tr>
<td>- emphasises the idea of developing sports activities;</td>
<td>- reshapes the sport field, without considering the positive aspects (tradition) that led to the achievement of notable results in the previous period;</td>
</tr>
<tr>
<td>- established a supra-ministerial body, namely the National Council for Physical Education and Sport, as a specialised central body to coordinate and guide the activity of physical education and sport; this body was also responsible for the performance sports activity.</td>
<td>- distinguishes between the sports administration structures and the sports structures themselves; the newly established Ministry of Youth and Sport plays the coordinating role, but the law provides exceptions, some of them contradicting even the philosophy that underlies the foundation of the sport performance pyramid, namely the activity of physical education and sport in schools is assigned to another ministry – the Ministry of National Education;</td>
</tr>
<tr>
<td></td>
<td>- the sports federations also ensure the representation of Romania in sports competitions within the international bodies to which they are affiliated, but the responsibility regarding the performance sports activity is not specified; the same is the case with the Romanian Olympic and Sports Committee (COSR) that has exclusive competence for representing Romania at the Olympic Games – the COSR allocates financial resources, the federations lead, organize and coordinate, and the ministries and other types of authorities collaborate and support the performance sports activity.</td>
</tr>
</tbody>
</table>

Source: The authors’ own development based on Law no. 29 of December 29, 1967, on the development of physical education and sport, and Law no. 69 of April 28, 2000, on physical education and sport

The analysis of the evolution of these nine indicators for the sport area led to splitting them into two categories: input (resource) indicators – I1, I2, I3, I4 and I5 – and output (result) indicators – I6, I7, I8 and I9. As can be seen in Table 2, after a sharp overall decline of all five input (resource) indicators, starting with 2008, there has been an upward trend for all, but the values of 2017 are below the level of 1992 for at least 4 indicators: I1 Sports sections (by federation), I2 Athletes holding sports cards (by federation), I3 Sports coaches (by federation) and I5 Referees (by federation).
Table 2. Evolution of resource indicators

<table>
<thead>
<tr>
<th>Year</th>
<th>Sports sections (number)</th>
<th>Athletes holding sports cards (number)</th>
<th>Sports coaches (number)</th>
<th>Sports instructors (number)</th>
<th>Referees (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>11,928</td>
<td>379,842</td>
<td>8,953</td>
<td>No data</td>
<td>14,309</td>
</tr>
<tr>
<td>1993</td>
<td>9,029</td>
<td>310,901</td>
<td>9,840</td>
<td>No data</td>
<td>13,907</td>
</tr>
<tr>
<td>1994</td>
<td>9,064</td>
<td>336,159</td>
<td>8,797</td>
<td>4,058</td>
<td>13,083</td>
</tr>
<tr>
<td>1995</td>
<td>8,436</td>
<td>336,947</td>
<td>8,987</td>
<td>3,365</td>
<td>14,757</td>
</tr>
<tr>
<td>1996</td>
<td>7,191</td>
<td>251,715</td>
<td>9,158</td>
<td>3,283</td>
<td>14,688</td>
</tr>
<tr>
<td>1997</td>
<td>7,235</td>
<td>253,097</td>
<td>9,158</td>
<td>3,181</td>
<td>14,638</td>
</tr>
<tr>
<td>1998</td>
<td>6,397</td>
<td>233,161</td>
<td>9,500</td>
<td>3,621</td>
<td>14,534</td>
</tr>
<tr>
<td>1999</td>
<td>6,390</td>
<td>226,295</td>
<td>9,765</td>
<td>1,303</td>
<td>13,984</td>
</tr>
<tr>
<td>2000</td>
<td>8,272</td>
<td>222,737</td>
<td>5,700</td>
<td>3,523</td>
<td>12,836</td>
</tr>
<tr>
<td>2001</td>
<td>5,365</td>
<td>208,524</td>
<td>5,965</td>
<td>4,295</td>
<td>11,563</td>
</tr>
<tr>
<td>2002</td>
<td>4,762</td>
<td>181,539</td>
<td>4,806</td>
<td>3,738</td>
<td>11,442</td>
</tr>
<tr>
<td>2003</td>
<td>4,708</td>
<td>183,100</td>
<td>4,385</td>
<td>3,721</td>
<td>8,780</td>
</tr>
<tr>
<td>2004</td>
<td>5,862</td>
<td>213,934</td>
<td>4,754</td>
<td>4,076</td>
<td>8,979</td>
</tr>
<tr>
<td>2005</td>
<td>3,379</td>
<td>106,632</td>
<td>4,890</td>
<td>1,707</td>
<td>4,830</td>
</tr>
<tr>
<td>2006</td>
<td>3,725</td>
<td>120,267</td>
<td>5,357</td>
<td>4,143</td>
<td>5,151</td>
</tr>
<tr>
<td>2007</td>
<td>3,914</td>
<td>125,882</td>
<td>6,012</td>
<td>4,106</td>
<td>5,176</td>
</tr>
<tr>
<td>2008</td>
<td>6,739</td>
<td>239,434</td>
<td>6,769</td>
<td>6,391</td>
<td>7,928</td>
</tr>
<tr>
<td>2009</td>
<td>7,275</td>
<td>245,590</td>
<td>6,982</td>
<td>7,870</td>
<td>8,013</td>
</tr>
<tr>
<td>2010</td>
<td>7,296</td>
<td>234,569</td>
<td>6,150</td>
<td>6,192</td>
<td>9,038</td>
</tr>
<tr>
<td>2011</td>
<td>7,622</td>
<td>249,808</td>
<td>8,750</td>
<td>5,720</td>
<td>9,985</td>
</tr>
<tr>
<td>2012</td>
<td>7,919</td>
<td>246,033</td>
<td>6,822</td>
<td>6,398</td>
<td>10,878</td>
</tr>
<tr>
<td>2013</td>
<td>7,803</td>
<td>248,703</td>
<td>7,168</td>
<td>5,299</td>
<td>10,232</td>
</tr>
<tr>
<td>2014</td>
<td>7,314</td>
<td>243,375</td>
<td>6,861</td>
<td>5,055</td>
<td>8,852</td>
</tr>
<tr>
<td>2015</td>
<td>8,348</td>
<td>273,926</td>
<td>7,580</td>
<td>4,520</td>
<td>9,972</td>
</tr>
<tr>
<td>2016</td>
<td>7,837</td>
<td>245,644</td>
<td>6,142</td>
<td>6,278</td>
<td>9,324</td>
</tr>
<tr>
<td>2017</td>
<td>7,628</td>
<td>268,525</td>
<td>7,646</td>
<td>5,997</td>
<td>9,156</td>
</tr>
</tbody>
</table>

Source: The authors’ own development based on the TEMPO database of INS (2018)

As regards the output (result) indicators, the year 2000 did not bring any changes, the number of medals and places at the Olympic Games still having a downward trend established since 1988. Figure 1 (the authors’ own development based on the TEMPO database of INS, 2018) shows the evolution of indicators I6 and I7.

Figure 1. Results at the Olympic Games

However, in terms of the last two output (result) indicators I8 and I9, the year 2000 certainly brought changes, the number of medals and places in international competitions other than the Olympic Games being increased. As
can be seen in Table 3, a clear trend in the evolution of indicators I8 and I9 cannot be identified at this point, the values increasing or decreasing differentially.

Table 3. Results at international competitions other than the Olympic Games

<table>
<thead>
<tr>
<th>Year</th>
<th>Medals at the Senior World Championships (number)</th>
<th>Medals at the Senior European Championships (number)</th>
<th>Medals at the Junior World Championships (number)</th>
<th>Medals at the Junior European Championships (number)</th>
<th>Places at international competitions (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>8</td>
<td>50</td>
<td>22</td>
<td>56</td>
<td>No data</td>
</tr>
<tr>
<td>1993</td>
<td>34</td>
<td>21</td>
<td>23</td>
<td>37</td>
<td>No data</td>
</tr>
<tr>
<td>1994</td>
<td>51</td>
<td>60</td>
<td>37</td>
<td>70</td>
<td>No data</td>
</tr>
<tr>
<td>1995</td>
<td>46</td>
<td>68</td>
<td>32</td>
<td>61</td>
<td>No data</td>
</tr>
<tr>
<td>1996</td>
<td>37</td>
<td>65</td>
<td>33</td>
<td>80</td>
<td>No data</td>
</tr>
<tr>
<td>1997</td>
<td>76</td>
<td>43</td>
<td>22</td>
<td>42</td>
<td>No data</td>
</tr>
<tr>
<td>1998</td>
<td>77</td>
<td>69</td>
<td>36</td>
<td>83</td>
<td>793</td>
</tr>
<tr>
<td>1999</td>
<td>49</td>
<td>91</td>
<td>38</td>
<td>84</td>
<td>738</td>
</tr>
<tr>
<td>2000</td>
<td>37</td>
<td>98</td>
<td>19</td>
<td>88</td>
<td>769</td>
</tr>
<tr>
<td>2001</td>
<td>47</td>
<td>92</td>
<td>23</td>
<td>81</td>
<td>873</td>
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<tr>
<td>2002</td>
<td>82</td>
<td>106</td>
<td>41</td>
<td>74</td>
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<tr>
<td>2003</td>
<td>150</td>
<td>127</td>
<td>77</td>
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<td>1,307</td>
</tr>
<tr>
<td>2004</td>
<td>86</td>
<td>215</td>
<td>79</td>
<td>221</td>
<td>1,360</td>
</tr>
<tr>
<td>2005</td>
<td>205</td>
<td>207</td>
<td>122</td>
<td>200</td>
<td>1,509</td>
</tr>
<tr>
<td>2006</td>
<td>93</td>
<td>246</td>
<td>85</td>
<td>184</td>
<td>1,312</td>
</tr>
<tr>
<td>2007</td>
<td>224</td>
<td>154</td>
<td>146</td>
<td>154</td>
<td>1,308</td>
</tr>
<tr>
<td>2008</td>
<td>240</td>
<td>225</td>
<td>123</td>
<td>157</td>
<td>1,369</td>
</tr>
<tr>
<td>2009</td>
<td>285</td>
<td>189</td>
<td>149</td>
<td>250</td>
<td>1,347</td>
</tr>
<tr>
<td>2010</td>
<td>212</td>
<td>258</td>
<td>215</td>
<td>291</td>
<td>1,610</td>
</tr>
<tr>
<td>2011</td>
<td>355</td>
<td>451</td>
<td>174</td>
<td>272</td>
<td>2,193</td>
</tr>
<tr>
<td>2012</td>
<td>343</td>
<td>249</td>
<td>277</td>
<td>428</td>
<td>2,051</td>
</tr>
<tr>
<td>2013</td>
<td>165</td>
<td>330</td>
<td>187</td>
<td>370</td>
<td>1,853</td>
</tr>
<tr>
<td>2014</td>
<td>128</td>
<td>284</td>
<td>183</td>
<td>429</td>
<td>1,665</td>
</tr>
<tr>
<td>2015</td>
<td>204</td>
<td>298</td>
<td>254</td>
<td>375</td>
<td>2,044</td>
</tr>
<tr>
<td>2016</td>
<td>147</td>
<td>209</td>
<td>192</td>
<td>505</td>
<td>1,740</td>
</tr>
<tr>
<td>2017</td>
<td>185</td>
<td>247</td>
<td>238</td>
<td>378</td>
<td>2,093</td>
</tr>
</tbody>
</table>

Source: The authors’ own development based on the TEMPO database of INS (2018)

Conclusions and further developments

Legislative changes made since 2000 have reshaped the sports field. However, despite an upward trend in resources (in terms of number of sports sections, athletes holding sports cards, sports coaches and referees), the outputs are either on a downward trend (as for the results at the Olympic Games) or do not have a clear upward or downward trend (as for the results at international competitions other than the Olympic Games).

Given that sports performance requires, on the one hand, preparation time, and on the other hand, a significant selection base (according to the specificity of sport branches and the studies on the performance capacity per sport branch, correlated with other indispensable studies on the bio-psycho-physiological abilities of the population and the measurements of motricity) and an appropriate institutional and competitive system, we conclude that the reshaping of the field through the new legislation: (1) has insufficiently taken into account the tradition, the positive aspects that led to the achievement of notable results in the communist period; (2) does not sufficiently configure liability in relation to sports performance.

The fact that the results at international competitions other than the Olympic Games do not have a clear upward or downward trend should be deepened in further research, in terms of sports federations and allocated resources in order to identify: (1) what sports federations benefited from a wider selection base; (2) what sports
federations kept elements of tradition together with elements of novelty in sports training; (3) what sports federations benefited from augmented financial resources.

References


STUDY ON BEHAVIOURAL RESPONSIVENESS TO STRESS, SELF-ESTEEM AND LEISURE ACTIVITIES IN ADOLESCENTS

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Abstract. In this research, we analysed the relationship between behavioural reactivity and leisure activities practiced by adolescent athletes. The participants in the research are 50 teenage students: 24 volleyball players (13 males and 11 females) and 26 footballers (18 males and 8 females) enrolled at the ‘Mihai I’ Technical College in Bucharest. This research was carried out in February 2019. As research methods, we used three instruments: the 28-item Behavioural Reactivity Test developed by Friedman and Rosenman to identify psychological vulnerability to stress; the Rosenberg Self-Esteem Scale; we developed an 11-item questionnaire focusing on motivation for sports, the influence of practicing sports as leisure activities. Active leisure time can help optimise the management of stressors, increase the level of self-esteem and implicitly improve the adolescents’ quality of life. The main results aim to see to what extent vulnerability to stress factors (eustress, distress) can be influenced by self-esteem and whether there are differences between practiced sports (volleyball or football) and behavioural types A and B identified by Friedman and Rosenman. Through this study, we also want to see to what extent behavioural responsiveness to stress influences the leisure activities preferred by the students participating in this research.

Keywords: students, behavioural reactivity, leisure activities, stress, self-esteem.

Introduction

Building a leisure culture is a necessity by the fact that the activities carried out during free time can contribute to personality formation and meeting social requirements, the inappropriate use of spare time having an impact especially on children and adolescents.

The relationship between behaviour, habits and health is one of the many factors that influence the individual’s lifestyle and quality of life. Brehm (2015, p. 15) noted that heart disease ranked first among the causes of mortality in the United States in 2010 and pleaded for a healthy lifestyle where physical activity should be a habit. According to the World Health Organization (2018), this trend has continued and therefore ischemic heart disease and stroke are the world’s biggest killers, summing 15.2 million deaths in 2016. These diseases are leading causes of death globally in the last 15 years.

Teodoru (2018, p. 122) notes that the perception of free time in each individual’s consciousness has changed, and free time has become particularly precious. Nowadays, people have become free-time spenders, and this is not suitable for our needs.

Epuran (1976, p. 80) states that the dynamics of adolescence, when the fundamental personality features of the young person are outlined, explains the multiple directions in which children’s play evolves at this age, making the transition to the games, entertainment and recreational activities of young adults. Also Epuran (2013, p. 308) claims that most authors, especially sociologists and psychologists, agree that free time is what the individual has left after satisfying the requirements of the profession and the vital and social needs (rest, nutrition, social and administrative obligations).

Being active influences the level of self-esteem – a person’s judgment about his or her own value. Self-esteem is the self-evaluating part of self-perception, the judgment that children issue about their overall value. Self-esteem is based on the growing cognitive ability of children to describe and define themselves.

The self-esteem level begins to crystallise at the learning age, when children experience self-awareness. It becomes clearer as the person develops his/her cognitive abilities and faces the developmental tasks of childhood, adolescence and then adulthood. Self-consciousness is one of the fundamental dimensions of the individual’s intellectual and moral personality. Its formation is a long process that begins with the change in the body pattern of the first childhood and ends in adolescence, when it includes the individual relating to both him/herself and the others not only at a certain time in an isolated situation, but in the dynamics of social activity.

Friedman and Rosenman (1974), two cardiologists from San Francisco, observed that their patients suffering from coronary artery disease had some common traits, which has led to the Type-A behaviour pattern. So, they developed a structured interview applied to 3524 volunteers. The obtained results led them to publish, in 1974, a book about the relationship between behaviour and heart disease. The two researchers have shown that there is a close link between stress, the cardiovascular disease rate and the type of personality. They identified two major types of personality, A and B, and an intermediate type, AB.
The personality type has an influence on how the individual responds to stress and changes the impact of stress on the body. People with type A personality are characterised by restlessness, agitation, have a counter-clockwork style. Also, they focus on superior achievements, are competitive, aggressive, intolerant and stressful, are good athletes, speak fast in a high tone and are in a hurry. Iamandescu (2002, p. 53) believes that this type of people are true stress collectors and possess mechanisms of metabolic conversion of the psychogenic factor into disorders or psychosomatic diseases.

People with type B personality are on the opposite side. Friedman and Rosenman (1974) state that people with type A personality have a risk four times higher than those with type B to get sick, which leads to increased body wear. People with type B personality have lower energy potential than those with type A and have a more easy-going attitude. They are more relaxed, happy with their lives, avoid competitive situations if they have a choice, are calmer and slower.

Predoiu (2016, p. 57) identifies three steps in adjusting to stress:

- initial (primary) assessment: the hazard perception process;
- secondary assessment: the process whereby the plan of a potential response to the hazard appears;
- the coping mechanism itself, more precisely the implementation of a response.

According to Birkenbihl (2000, p. 111), regardless of the behavioural type of stressors, we need to learn to enjoy stress and this goal can be reached in four ways: by performing eustress-generating activities, by searching for eustress within the family, by collecting eustress through success and by living affective eustress. The practice of physical activities and sports, the achievements on various planes, a relationship of affection and effective communication with family and friends, all of this contributes to improving self-image, developing effective mechanisms to combat negative stress (distress), being happier and healthier.

The purpose of our research is to see whether vulnerability to stress factors (eustress, distress) can be influenced by self-esteem, whether there are relevant differences between practiced sports (volleyball or football) and behavioural types A and B identified by Friedman and Rosenman (1974), but also to see whether behavioural responsiveness to stress influences the leisure activities preferred by the students participating in this study.

Material and methods

Participants

The research was conducted with 50 adolescents aged 16 to 18 years, practicing football or volleyball (24 volleyball players - 13 males and 11 females and 26 footballers - 18 males and 8 females). The participants are enrolled at the “Mihai I” Technical College in Bucharest.

Procedure

The research was carried out in February 2019. The research methods used are: documentation, observation, mathematical and statistical data analysis and interpretation, graphical method. Three questionnaires were applied: one regarding the time spent on leisure activities, a 10-item Likert-type scale, namely the Self-Esteem Scale developed by the sociologist Rosenberg, and the Type A and B Behaviour Test developed by Friedman and Rosenman. The responses were anonymous and targeted closed and open questions.

Results

The obtained data were analysed, statistically processed and tabulated. Results and conclusions were drafted based on the findings analysed through Microsoft Office Excel.

Table 1. The ranking of preferred leisure activities

<table>
<thead>
<tr>
<th>Leisure activities</th>
<th>Sum</th>
<th>Average</th>
<th>Ranking (1 - most commonly used activity, 8 - least used activity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practicing sports activities (outside physical education classes)</td>
<td>172</td>
<td>3.44</td>
<td>1</td>
</tr>
<tr>
<td>Meeting with friends</td>
<td>173</td>
<td>3.46</td>
<td>2</td>
</tr>
<tr>
<td>Using social networks (Facebook, Instagram, WhatsApp, etc.)</td>
<td>176</td>
<td>3.52</td>
<td>3</td>
</tr>
<tr>
<td>Listening to music</td>
<td>199</td>
<td>3.98</td>
<td>4</td>
</tr>
<tr>
<td>Playing on the computer or phone</td>
<td>195</td>
<td>3.9</td>
<td>5</td>
</tr>
</tbody>
</table>
As regards leisure activities (Table 1), by calculating their average, we find that practicing sports activities (outside physical education classes), meeting with friends and using social networks are on top three of the most preferred by the surveyed adolescents. Watching TV shows/movies, reading books and participating in cultural activities (theatre, opera, concerts, cinema) are not among the most commonly practiced activities.

Table 2. *The type of behavioural reactivity in relation to the practiced sport for male gender and the level of self-esteem*

<table>
<thead>
<tr>
<th>Male gender (n = 31)</th>
<th>Type AB High level of self-esteem</th>
<th>Type AB Average level of self-esteem</th>
<th>Type A High level of self-esteem</th>
<th>Type A Average level of self-esteem</th>
<th>Type B High level of self-esteem</th>
<th>Type B Average level of self-esteem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football (n = 18)</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Volleyball (n = 13)</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

As regards male athletes practicing football and behaviour A, no important differences in self-esteem are found, which means that we cannot determine the probability that they have a certain (medium or high) level of self-esteem. All we can say about this aspect is that none of the participating subjects has a low level of self-esteem. Hence the conclusion that practicing physical exercise and sport contributes to an optimal level of self-esteem. We also note that the 18 male football players are more likely to have type-B rather than type-A behavioural reactivity (11 of them having type-B behavioural responsiveness). The majority of volleyball male adolescents participating in this study have type-B behavioural reactivity (8 out of 13) and an average level of self-esteem (6 out of 8). So we could say that teenager volleyball players involved in this study are more likely to have an average level of self-esteem. We also find that 19 out of the 31 male athletes have type-B behavioural reactivity. We can see that there is a higher probability for male students from “Mihai I” College who practice volleyball or football to have rather the type B of cross-reactivity to stress. (Table 2)

Table 3. *The type of behavioural reactivity in relation to the practiced sport for female gender and the level of self-esteem*

<table>
<thead>
<tr>
<th>Female gender (n = 19)</th>
<th>Type AB High level of self-esteem</th>
<th>Type A Average level of self-esteem</th>
<th>Type A High level of self-esteem</th>
<th>Type A Average level of self-esteem</th>
<th>Type B High level of self-esteem</th>
<th>Type B Average level of self-esteem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football (n = 8)</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Volleyball (n = 11)</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

We can conclude, on the basis of the obtained results, that the female athletes participating in this study, who practice football and have type-A behavioural reactivity, have a high level of self-esteem. In the case of girls practicing volleyball, we find that 3 of them have type-AB behavioural reactivity and each of them has high self-esteem. Three out of the 5 subjects with type A reactivity have high self-esteem. (Table 3)

Table 4. *Leisure time activities related to behavioural responsiveness to stress*

<table>
<thead>
<tr>
<th>Leisure activities</th>
<th>Type AB</th>
<th>Average for type AB</th>
<th>Type A</th>
<th>Average for type A</th>
<th>Type B</th>
<th>Average for type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playing on the computer or phone</td>
<td>29</td>
<td>5.8 (VII)</td>
<td>80</td>
<td>3.81 (III)</td>
<td>86</td>
<td>3.58 (III)</td>
</tr>
<tr>
<td>Using social networks (Facebook, Instagram, WhatsApp, etc.)</td>
<td>26</td>
<td>5.2 (VI)</td>
<td>63</td>
<td>3 (I)</td>
<td>87</td>
<td>3.63 (IV)</td>
</tr>
</tbody>
</table>
Conclusions

None of the participants in the study has a low level of self-esteem, which shows once again the benefits of practicing exercise and sports and the fact that they contribute to an optimal level of self-esteem and quality of life.

The use of online networks (Facebook, Instagram, WhatsApp, etc.) tends to take on more and more time and be in the top of preferences as a socialisation method. This is true at least for athletes who have an average level of self-esteem, while athletes who have a high level of self-esteem prefer to socialise face to face. This does not mean that they do not socialise online (this option is ranked third among the preferences of participants who have a high level of self-esteem). Needless to say that it is time for a change, in which offline communication needs to reaffirm its place in people’s lives.

In the top of preferences of the subjects with type-AB behavioural reactivity, the most commonly used leisure methods are: practicing sports activities followed by socialising with friends, and third, listening to music. Those who have type-A behavioural reactivity prefer the following leisure activities: using social networks to communicate followed by socialising with friends. The third place in the top of preferences is playing on the computer or phone and watching TV shows/movies. Regardless of the type of behavioural responsiveness to stress, the participation in cultural activities (theatre, opera, concerts, cinema) is on the last place among the subjects’ preferences. We also find that reading books is on the penultimate place in the top of preferences for both those who have type-A and type-B behavioural responsiveness. For those with type AB, reading books is on the 5th place, before the use of social networks, playing computer and phone games and cultural activities. (Table 4)

Table 5. Leisure activities related to the level of self-esteem

<table>
<thead>
<tr>
<th>Leisure activities</th>
<th>Average level of self-esteem</th>
<th>Average function for high level of self-esteem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playing on the computer or phone</td>
<td>109</td>
<td>4.19 (IV)</td>
</tr>
<tr>
<td>Using social networks (Facebook, Instagram, WhatsApp, etc.)</td>
<td>85</td>
<td>3.27 (I)</td>
</tr>
<tr>
<td>Watching TV shows/movies</td>
<td>112</td>
<td>4.31 (V)</td>
</tr>
<tr>
<td>Listening to music</td>
<td>98</td>
<td>3.77 (III)</td>
</tr>
<tr>
<td>Reading books</td>
<td>155</td>
<td>5.96 (VI)</td>
</tr>
<tr>
<td>Participating in cultural activities (theatre, opera, concerts, cinema)</td>
<td>181</td>
<td>6.96 (VII)</td>
</tr>
<tr>
<td>Meeting with friends</td>
<td>98</td>
<td>3.77 (III)</td>
</tr>
<tr>
<td>Practicing sports activities (outside physical education classes)</td>
<td>90</td>
<td>3.46 (II)</td>
</tr>
</tbody>
</table>

(Ranking: I = first place; VIII = last place)

Regarding leisure activities related to the level of self-esteem, we find that the most used activities by subjects with an average level of self-esteem are: socialising via internet (Facebook, Instagram, WhatsApp, etc.), sports activities (outside physical education classes), spending time with friends and listening to music. As to the participants who have a high level of self-esteem, we find that the first place is taken by spending time with friends followed by practicing sports activities and computer or phone games. Participants who have a high level of self-esteem prefer socialising outside Internet followed by practicing sports and playing on the computer or phone. (Table 5)
Most male athletes have type-B behavioural reactivity (19 out of 31), meaning that they have high resilience to stress. Most female athletes have type B behaviour (11 out of 19), which means that they have a higher risk to get ill than those with type B. Having a competitive life, their response to stress might make them risk their health. The fact that they usually practice physical activities helps them to have an optimum level of self-esteem and cope with daily challenges. Spending a lot of time on socialising online is a risk for their physical and mental health, which might lead to a sedentary lifestyle. It is a lucky thing that these adolescents are aware of the benefits of an active lifestyle brought by the regular practice of physical activity and sports.

Reading books is not one of the favourite activities for the participants of this study. The fact that students do not read many books could also have several reasons, like because there are many digital distractions, so reading books has not become a habit for them. This might be a starting point for further research.

Participation in cultural activities is on the last place in the preferences of teenagers participating in this study: the theatre, opera and concerts are not of major interest to them. This may have a variety of reasons, such as the fact that participating in this type of activity involves allocating a time they do not have or have not yet found those theatre or opera pieces that they like particularly. That is why we consider it necessary and timely to carry out activities under the “School otherwise” programme, in which the pressure of time disappears, the bell forgets to call, and the clock no longer stifles the press. Within this programme, students are eager to participate in various activities, to experience and have the opportunity to socialise and learn outside schools via extracurricular activities that support alternative education through informal activities during 5 days.

Authors’ contributions

All authors contributed equally to this article and should be considered as main authors.

References

ETIOPATHOGENESIS OF AUTISM – A MULTIFACTORIAL APPROACH

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Abstract. Autism is a developmental disorder of neurobiological origin and is considered one of the most severe neuropsychiatric disorders of childhood. Autism is the central disorder within a whole spectrum of developmental disorders and is known under the name of autism spectrum disorders or pervasive developmental disorders. They have a wide range of manifestations presumed to be the result of a developmental dysfunction of the central nervous system or a genetic dysfunction. Common symptoms of autism include repetitive actions, limited contact and communication with other people and very restricted interests. Its specific causes are still unknown. According to the definition given by Gillberg (1999), which contains few but meaningful words, autism is a multifactorial biological condition mainly due to genetically determined or subsequently acquired brain lesions, with a relatively characteristic neurocognitive profile but with no pathognomonic symptom in an absolute way. An extremely important aspect for this pathology is that one cannot speak of a single cause but rather of a causal chain. In this regard, Frith, Morton and Leslie (1991) believe that the discussion on the etiopathogenesis of autism is generally structured on three levels: genetic causation, neurobiological cause and behavioural causes. In the following, we shall take over this way of structuring the discussion, with special emphasis on the first two causal factors, namely the genetic and neurobiological ones.

Keywords: autism, genetics, neurobiological causes, abnormalities.

Introduction

From a genetic point of view, autism is considered an extremely heterogeneous disease characterised by marked variation in the phenotypic expression (Junaid & Pullarkat, 2001). Its transmission from parents to children does not follow the classical pathways, namely the autosomal recessive, autosomal dominant or X-linked ones. In most cases of autism, it is about polygenic or oligogenic inheritance. However, the chromosomal localisation of the genes responsible for autism spectrum disorders is not clearly known.

One of the latest approaches to the issue of autistic etiopathogenesis, from a genetic perspective, is represented by the study of proteomes. They are defined as the sets of proteins thought to be expressed and modified by the cell’s genome (Lauritsen & Ewald, 2001). Modern research strategies based on the study of proteomes are mainly focused on analysing brain proteins in order to identify variants of newly emerging or completely missing proteins in autistic patients with a view to collect information about the genes that cause the disease. Although much is expected from the new approach, the lack of brain tissue belonging to autistic people is a major obstacle to the advancement of research in this direction.

Regarding the neurobiological causes of autism, estimates show that approximately 90% of autistic children have some form of anatomical or functional brain dysfunction. But so far, no unique, specific, universally identifiable abnormality has been detected among these children. In fact, almost every brain neuronal system has been proposed at one point in time as the major cause of autism. Neuroimaging studies (CAT-scan, MRI-Scan, PET-scan, SPECT-scan) have constantly identified various abnormalities, but have failed to select the anatomical and functional disturbance specific to autistic pathology.

In general, neuroanatomical formations such as the medial temporal lobe and dorsolateral prefrontal cortex, as well as related limbic structures (Dawson et al., 1998), are thought to be involved in the etiopathogenesis of the disease in question.

Current level of knowledge reflected in the literature

Although great importance is currently given to research on the genetics of autistic pathology, the role played by environmental factors in shaping the influence of genetic factors should not be overlooked either. An extremely interesting study conducted by Spiker et al. (2001) has shown that, in families with more than one child with autism (multiplex families), birth order has an influence on both verbal and nonverbal IQ scores. Thus, the first-born commonly has a higher nonverbal IQ score than the second-born child, but also much lower verbalisation skills.

Moreover, the undeniable family aggregation in the case of autism does not exclude the involvement of environmental factors in the manifestation of this pathology, knowing that their influence is equally felt by members of the same family. Experts talk about the role of viral or bacterial infections in the etiopathogenesis of
the disease, about the possible involvement of certain types of vaccines or different exogenous toxins (mercury is most often mentioned in specialised studies), etc.

Among non-genetic (exogenous) factors, viral infections and their involvement in the production of autism have been particularly studied over time. In this regard, a link between autism and infections with rubella virus, cytomegalovirus or herpes simplex has been indicated as possible (Korvatska et al., 2002), but categorical evidence is still lacking.

The recently reported connection between certain antiviral vaccines (the most commonly mentioned in the literature is the anti-rubella/measles/mumps vaccine) and the development of autistic symptomatology is also an extremely debated topic. In this respect, it is not essentially about incriminating a possible immunologic response following vaccination (which, in any case, is considered to be much weaker than the one following direct infestation), but rather about the toxic effect of some chemical substances containing Thimerosal (a mercury-based preservative).

**Topic addressed**

A particularly important problem in addressing autistic etiopathogenesis, from a neurobiological perspective, is the one raised by the association between autism and epilepsy. It is known that 20% of autistic people experience non-febrile convulsions before the age of 3 years, and another 15%-20% of them usually develop epileptic seizures at puberty. Moreover, a large number of autistic people have abnormal EEGs, which typically indicate bilateral brain abnormalities without a specific focus (Schultz & Klin, 2002). Especially partial complex seizures, namely infantile spasms, are considered to be characteristic of autistic people (Gillberg, 1999).

Another extremely interesting aspect is the identification of an increase in brain volume with a percentage ranging from 5% to 10% in autistic people (Salmond et al., 2003). Clinically, this is diagnosed by measuring the occipitofrontal circumference, which must be two standard deviations above the age-appropriate average to allow for the diagnosis of macrocephaly. This condition is diagnosed in about 25%-30% of autistic children (Laurisens & Ewald, 2001), in whose case, the basic autistic symptomatology is typically associated with hyperactivity and attention deficit disorders.

It seems that the change in brain volume is considerably influenced by age. This change is much more pronounced in childhood and is mainly attributed to the white matter. Possible explanations for the white-matter volume expansion are linked to either abnormal axonal density accompanied by myelination disorders, which may cause impaired connectivity functions, or abnormal glial proliferation, which does not affect interneuronal connectivity. To check these hypotheses, specialised studies have used the DTI (Diffusion Tension Imaging) exploratory technique, thus proving that the structure of the brain’s white matter is particularly affected in the cortical regions traditionally considered responsible for the formation of social skills (especially those related to facial expression recognition (fusiform gyrus and superior temporal sulcus) and those involved in the perception of another person’s internal status (anterior cingulate cortex, amygdala, ventromedial prefrontal cortex) (Barnea-Goraly et al., 2004). White matter tracts connecting the cortical regions responsible for the development of a theory of mind have also been identified as aberrant: ventromedial prefrontal cortex, anterior cingulate cortex, temporoparietal junction, superior temporal sulcus, amygdala (Szlag et al., 2004).

Another theory regarding the nature of autism-specific neurological dysfunctions assumes that, although the manifestation of autism spectrum disorders (affecting the social, language and behavioural skills) involves damage to several neuronal systems, it is still possible for the initial impairment to be localised in a specific brain area. Due to the intimate interdependence of early developmental processes (Schultz & Klin, 2002), this localised deficit also leads to functional disturbances in the brain regions to which it is functionally linked, thus influencing the appearance of deviations in many other development areas.

In order to understand the role of specific neuroanatomical defects in determining autistic symptomatology, it is also important to identify the moment when disturbances occur. In other words, it is important to find out not only “where,” but also “when” the deficits in question occur. Research in this area shows that there are two, possibly three vulnerable periods. The first falls between the 4th and 5th week of gestation, the second occurs about half of the intrauterine life, and a possible third period is in the second year of life (Gillberg, 1999). However, there are studies showing that cytomegalovirus infection in the last trimester of pregnancy might also be responsible for the emergence of autistic symptomatology (Yamashita et al., 2003).

An interesting topic of debate refers to the brain formations presumed to be involved in autistic pathology, namely the limbic system, amygdala and nerve formations that are functionally attached to it, specifically the frontal and temporal cortex. This is mainly due to the involvement of nerve structures in controlling and modelling
emotional processes, as well as producing social behaviour. The results of biopsies performed on the aforementioned areas have identified abnormalities in the density, size and dendritic arborisation of neurons in the limbic system (Ohnishi et al., 2000).

Other nerve formations presumed to be involved in the emergence of autistic symptomatology are the superior temporal gyrus and the left prefrontal cortex. They have been identified by both studies analysing the EEG records of autistic patients and brain imaging studies as regions more or less affected by autistic pathology. It seems that especially the damage to one of the two regions plays an extremely important role in the formation of a certain behavioural pattern. Thus, autistic patients exhibiting communication and social interaction disorders showed abnormal blood flow in the left prefrontal medial region. Autistic patients, essentially characterised by stereotypical interests and concerns, as well as extremely low tolerance for change, have abnormalities in the right temporal medial lobe, from the standpoint of brain neuroanatomy.

Relating to this topic, specialised studies usually recall abnormal serum levels of endogenous monoamines and opioids. It is thus considered that one third of autistic people have increased blood levels of serotonin. In 1985, Told and Cinarelli first reported the existence of serotoninergic anti-receptor antibodies in the brains of autistic people (Latif, Heinz, & Cook, 2002). In addition, it is currently known that, in the case of autistic patients, the feedback allowing for the control of serotonin levels by plasma mechanisms that inhibit the activity of serotonin receptors is equally affected. Unlike autistic patients who also associate mental retardation, non-autistic mentally retarded people do not exhibit these serotoninergic anti-receptor antibodies, showing instead a decrease in the number of lymphocyte serotoninergic receptors. This opens the way to identifying possible biological markers that allow for differentiating autism from mental retardation and provide information on plasma serotonin levels, the identification of serotoninergic anti-receptor antibodies, the number of lymphocyte serotoninergic receptors (Latif et al., 2002).

Possible causes of autistic pathology also involve discussing about glial proteins and gangliosides, whose concentration has been found to be three times higher in autistic people than in the normal population. This suggests the existence of an abnormal synaptic turn-over in autism, which is probably autoimmune-induced. The identification of anti GFA-p (glial fibrillary acidic protein) autoantibodies in autistic patients, but not in those with mental retardation, makes an additional argument in this regard (Gillberg, 1999).

Another relatively common electrophysiological disturbance among autistic people is caused by a hypersecretion of pineal melatonin, which produces a cascade of biomechanical effects including a corresponding hyposecretion of pituitary proopiomelanocortin (POMC), as well as a hypersecretion of hypothalamic opioid peptides and serotonin. From the perspective of these findings, autism reflects a functional disturbance in the pineal-hypothalamic-pituitary-adrenal axis. An auxiliary effect of the dysfunction on this hormonal axis is a decrease in both the secretion of pituitary beta endorphins and the concentration of adrenocorticotrophin hormone (ACTH) (Chamberlain & Herman, 1990).

An interesting hypothesis made by Green et al. (2001) relates autistic defects, especially those regarding social interaction, to a decrease in plasma oxytocin levels, which is often encountered in autistic patients. It is well known that the oxytocinergic system (which involves both the limbic structures and other brain areas) controls maternal behaviour, child’s separation anxiety and sexual behaviour. Therefore, autistic symptomatology might partially result from disturbances existing in the brain process of oxytocin secretion, possibly also due to a genetic defect (Korvatska et al., 2002).

Another interesting but less explored hypothesis refers to the existence of an iron deficiency, which is specific to autistic children. Its important role in both myelogenesis and the higher efficiency of nerve fibre conductivity makes this iron a possible candidate able to explain the frequent co-diagnosis of mental retardation and intestinal dysfunctions, considered to be typical for autistic children.

Conclusions

Concerning the neurobiological causes of autism, although there is currently a consensus on their existence, they are not yet clearly identified. Identifying the period of vulnerability for the occurrence of these neuronal defects, namely the prenatal or postnatal one, may have important consequences in understanding the mechanisms of their production. Thus, one might find out whether it is about a disturbance in the neuronal or glial proliferation processes, neuronal migration processes or apoptosis processes.

The studies performed so far seem to suggest a prenatal origin of the disease, which is mainly caused by the impairment of neuronal migration processes characteristic of foetal cortex development. In addition, the identification of a low number of Purkinje cells in the cerebellum seems to support the same hypothesis.
(Ghaziuddin et al., 1999). However, it should be mentioned that such abnormalities are specific to autistic people who associate basic symptomatology and mental retardation, and less to those whose IQ scores are within normal limits (Schultz & Klin, 2002).

Recent studies provide obvious clues about the existence of abnormalities in synaptic connections, particularly the limbic system and brainstem. The main challenge is to make a proper correspondence between circumscribed relatively small anatomical brain deficits and an extremely large number of behavioural abnormalities.

It is thought that the increase in cranial volume negatively affects especially the interconnectivity between highly-specialised neural systems, thus leading to the production of fragmented mental processing patterns. An additional argument in favour of the stated hypothesis is that the corpus callosum, the main interconnected brain structure, is reduced in volume in autistic patients (Schultz & Klin, 2002). It is thus argued that the main problem related to the development and maturation of nerve structures mostly concerns the connective brain structures. Therefore, if for the normal brain, the development process results in the production of highly specialised regions, but which are at the same time functionally integrated through multiply specialised links with similar brain areas, for the autistic child, the development of nerve structures results in obtaining highly-specialised functional regions, but which are isolated, are not integrated into global brain functioning (Brock et al., 2002).

**Authors’ contributions**

All authors contributed equally to this study and should be considered as main authors.

**References**


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