control group of an average score of 0.6 cm lower than the initial testing.
At the final testing of driving indicators, the progress was obvious for the experimental group showing higher average values between tests with: 5.4 repetitions to test abdominal strength, 4.1 repetitions to test back strength, 6.5 repetitions to test the strength of lower limbs, and 6.5 repetitions to test the strength of arms.
The progress of the experiment group was evident both between the two tests of the same group, and compared with the results in the tests of the control group.

**CONCLUSIONS**

1. After processing and interpreting the data drawn from comparing the two groups of teenage girls of 14-16 years old, the hypothesis is confirmed that maintenance aerobics exercises have a major role in obtaining a harmonious physical development, contribute to the formation and development of the motor skills baggage, and reduce and eliminate excess body fat.
2. Maintenance aerobics exercises help to correct the posture and harmonious formation, and it can be practiced at any age depending on the level of training of individuals.
3. Aerobics exercises have also a significant role in building relaxation capacity of muscles and mind, creating good mood for individuals, and also ensuring confidence and self-esteem.
4. By using aerobics exercises, it improves the health of individuals and it has a significant role in correcting poor attitudes or deficiencies caused by incorrect body posture.

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# ON THE INFLUENCE OF AEROBIC GYMNASTICS EXERCISES IN STRESS PREVENTION IN ADOLESCENCE (17 – 18 YEARS OLD STUDENTS)

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**Abstract**
*The present paper starts from the assertion that using methods and means specific to aerobic gymnastics in the education process for young students of 17-18 years of age might accentuate the positive influences on their balanced physical and aesthetic development and, at the same time, will help in the development of personality by increasing self-confidence and stimulating self-awareness. In turn, these may lead to increases in school performance through eradication or limitation of the stress factors specific to adolescence.*
**Keywords:** *aerobic gymnastics, adolescents, high school, prevention, stress*

**INTRODUCTION**

The increase in the rhythm of society evolution, the volume of tasks and accelerated dynamics of social environment claim more and more adaptation availability of the human body, which determines psychic stress. From this perspective, one may mention day-by-day stress, environmental stress,

stress generated by family, school, job, etc. (Zeană, D.C, 1998.)

***School stress*** can be defined as the most damaging physical and psychic response that occurs when school requirements do not suit the student's resources, capabilities or needs. According to a number of scholars (Băban, A., Alexa, L., Derevenco, P., 1988), its causes may be systematised as follows: *type 1* causes: *recent events in school (*major timetable changes or changes in the requirements for certain subject, overloaded schedule, etc.); *type 2: recent events outside the school* (social life restrictions, severe diseases or the death of a beloved person, etc.); *type 3: day-by-day school circumstances* (too many assignments in short time, conflicts between classmates and teachers, confusing responsibilities, etc.); *type 4: day-by-day circumstances outside the school* (apprehension and concern for personal stability, anxiety provoked by information overload, etc.).

## OBJECTIVES

Using exercises of aerobic gymnastics during physical education classes for students aged 17-18, as well as during their independent activities, helps attain the following objectives: balanced physical growth, correct posture, improvement in the level of segment coordination, increase in the efficiency of motor acts, formation of the ability to aesthetically perform movements and, last but not least, inducement of good spirits, improvement of the ability to relax – both physically and psychically – and elimination of stress.

## ASSUMPTION

The grounds for the ***working hypothesis*** are as follows: using methods and means specific to sports and physical education, carefully selected in accordance with physical, psychic and motor development peculiarities of 17-18 years old students may positively influence their school performance by reducing or eliminating the stress factors specific to adolescence.

## MATERIALS AND METHODS

### *a. Research protocol*

The research has been conducted in the classrooms and the gym hall of "Al. I. Cuza" High School, Galați, during 15.09.2012-15.03.2013 (a 6-month period), one class per week/ 50 minutes each.

### *b. Subjects*

The sampling consists of 128 students (89 girls and 39 boys) in the $12^{th}$ grade, aged between 17 and 18 years. Considering the gender distribution, the feminine gender is predominant– 69.6%, the males group representing only 30.4%.

### *c. Groups (grades)*

All the five classes of the senior year have been included in the experiment, irrespective whether their students were specialising in humanities or sciences: Mathematics-Computer Science (bilingual), Natural Science, Philology (bilingual, German and English) and Philology (bilingual, French and English). The students have had access to similar learning conditions and equipment.

### *d. Evaluation tests*

***The burnout syndrome assessment questionnaire*** (25 questions with 5 predetermined choices). The students could only opt for one choice, in relation to the importance they grant to the issues tackled and their personal opinion.

The questionnaire has aimed at assessing the teenagers' behaviour through three different dimensions: the first set of 9 questions focused on determining the level of emotional exhaustion; the next 6 questions concerned the depersonalisation level of the interviewee (lack of confidence and self-esteem, degradation of relationships or dependence on others); the last 10 questions assessed the self-assessment of personal accomplishment (tendency of negative self-assessment of abilities and professional capabilities).

The assessment and interpretation of the answers provided has been made as follows:

- For the questions 1, 2, 3, 4, 5, 6, 9, 11, 12, 14, 15, 16, 17, 18, 22, 24, 25, the points have been granted in direct ratio to the choice made, thus: choice a=1 point, choice b=2 points, choice c=3 points, etc.
- For the questions 7, 8, 10, 13, 19, 20, 21, 23, the number of points granted has been in inverse ratio to the position of the choice in the grid, thus: for choice a=5 points, for choice b=4 points, for choice c=3 points, etc.

The recorded points total represents the sum of the points scored for each dimension, which amounts to a total that has been interpreted in accordance with the values depicted in table 1.

**Table 1**

| LEVELS OF PROFESSIONAL EXHAUSTION ON DIMENSIONS | | |
|---|---|---|
| **Emotional exhaustion** | | |
| 9 – 18 points | 19 -27 points | 28 – 45 points |
| low level | medium level | high level |
| **Depersonalisation** | | |
| 6 – 12 points | 13 -18 points | 19 – 30 points |
| low level | medium level | high level |
| **Decrease in personal accomplishment** | | |
| 10 -20 points | 21 – 30 points | 31 -50 points |
| low level | medium level | high level |
| **total:** 25 -50 points (low level), 51 – 75 points (medium level), 76 – 125 points (high level) | | |

The choices that the students made have provided a significant amount of information concerning their opinions on situations and factors that trigger stress in adolescence - table 2.

**Table 2 Models of questions for assessing the stress degree in adolescents (17-18 years old**

| **Determining the level of emotional exhaustion** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **No.** | **Question** | **Choices** | **Choice value** | **T.I. No. of answers** | **Percentage %** | **T.F. No. of answers** | **Percentage %** |
| **1.** | Do you feel emotionally exhausted? | a. infrequently | 1 | **7** | *5.4* | **18** | *14.0* |
| | | b. seldom | 2 | **16** | *12.5* | **62** | *48.4* |
| | | c. sometimes | 3 | **54** | *42.1* | **31** | *24.2* |
| | | d. often | 4 | **48** | *37.5* | **15** | *11.7* |
| | | e. very often | 5 | **3** | *2.3* | **2** | *1.5* |
| **2.** | At the end of the day, do you feel like a boiled rag? | a. infrequently | 1 | **5** | *3.9* | **19** | *14.8* |
| | | b. seldom | 2 | **17** | *13.2* | **58** | *45.3* |
| | | c. sometimes | 3 | **75** | *58.5* | **27** | *21.0* |
| | | d. often | 4 | **26** | *20.3* | **18** | *14.0* |
| | | e. very often | 5 | **5** | *3.9* | **6** | *4.6* |
| **3.** | Do you feel tired in the morning when you wake up and have to go to school? | a. infrequently | 1 | **10** | *7.8* | **33** | *25.7* |
| | | b. seldom | 2 | **24** | *18.7* | **48** | *37.5* |
| | | c. sometimes | 3 | **58** | *45.3* | **29** | *22.6* |
| | | d. often | 4 | **29** | *22.6* | **15** | *11.7* |
| | | e. very often | 5 | **7** | *5.4* | **3** | *2.3* |
| **Determining the depersonalisation level** | | | | | | | |
| **1.** | Do you communicate with your classmates as if you communicated with inanimate objects? | a. infrequently | 1 | **18** | 14.0 | **23** | 17.9 |
| | | b. seldom | 2 | **43** | 33.5 | **59** | 46.0 |
| | | c. sometimes | 3 | **37** | 28.9 | **27** | 21.0 |
| | | d. often | 4 | **24** | 18.7 | **17** | 13.2 |
| | | e. very often | 5 | **6** | 4.6 | **2** | 1.5 |
| **2.** | Have you become tougher in the relationships with the others lately? | a. infrequently | 1 | **5** | 3.9 | **14** | 10.9 |
| | | b. seldom | 2 | **17** | 13.2 | **43** | 33.5 |
| | | c. sometimes | 3 | **57** | 44.5 | **40** | 31.2 |
| | | d. often | 4 | **31** | 24.2 | **23** | 17.9 |
| | | e. very often | 5 | **18** | 14.0 | **8** | 6.2 |
| **3.** | Are those you | a. infrequently | 1 | **22** | 17.1 | **33** | 25.7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | come across with in school uninteresting people? | b. seldom | 2 | **33** | *25.7* | **48** | *37.5* |
| | | c. sometimes | 3 | **37** | *28.9* | **29** | *22.6* |
| | | d. often | 4 | **29** | *22.6* | **15** | *11.7* |
| | | e. very often | 5 | **7** | *5.4* | **3** | *2.3* |
| **Determining the level of decrease in personal accomplishment** | | | | | | | |
| **1.** | Do you have periods when you feel out of your depths? | a. infrequently | 1 | **16** | *13* | **23** | *18* |
| | | b. seldom | 2 | **25** | *20* | **36** | *28* |
| | | c. sometimes | 3 | **39** | *30* | **33** | *26* |
| | | d. often | 4 | **42** | *33* | **31** | *24* |
| | | e. very often | 5 | **6** | *4.7* | **5** | *4* |
| **2.** | Nothing happens as you wish? | a. infrequently | 1 | **18** | *14* | **26** | *20* |
| | | b. seldom | 2 | **24** | *19* | **34** | *27* |
| | | c. sometimes | 3 | **43** | *34* | **39** | *30* |
| | | d. often | 4 | **26** | *20* | **21** | *16* |
| | | e. very often | 5 | **17** | *13* | **8** | *6* |
| **3.** | Can you find the correct solution in conflict situations? | a. infrequently | 5 | **8** | *6.3* | **5** | *4* |
| | | b. seldom | 4 | **19** | *15* | **13** | *10* |
| | | c. sometimes | 3 | **46** | *36* | **38** | *30* |
| | | d. often | 2 | **41** | *32* | **54** | *42* |
| | | e. very often | 1 | **14** | *11* | **18** | *14* |

If at the beginning of the study, the answers in this questionnaire had indicated an average of the emotional exhaustion level towards the margin of the general mean value (27.23 out of 28), after applying the experimental curriculum of training with methods of aerobic gymnastics, a significant increase in the prevention and elimination of stress was recorded, the final mean value being of 22.99 points, an ideal value for emotional involvement in day-by-day activities.

After applying the experimental curriculum of training with methods of aerobic gymnastics for adolescents (17-18 years old), the results obtained from the choices made for the first 6 questions for determining ***the depersonalisation level*** have indicated a slight improvement in this segment; nevertheless, more effort must be put in this education dimension (fig. 1).

For the questions asked in order to determine the level of ***decrease in personal accomplishment***, the students' choices in the initial target have indicated an acute lack of confidence, as well as a blurred vision on their options and chances of personal accomplishment.

If the results recorded in the initial testing had placed the group close to the highest level of the mean value (28.77, the mean value =30 points), after applying the experimental curriculum of training with means specific to aerobic gymnastics, in the final testing the mean value decreased to 24.60 points, which indicates confidence in what future accomplishments are concerned, as well as a significant improvement in their vision of future accomplishments (fig. 2).

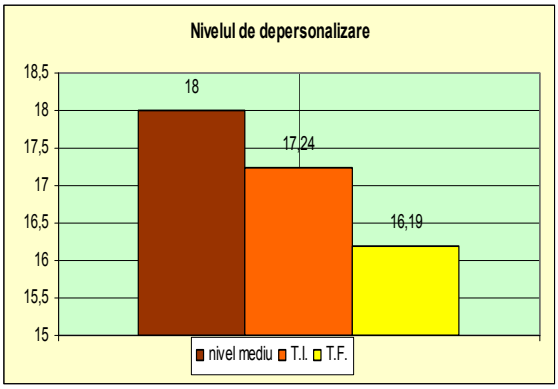


Fig. 1. Comparative chart of the mean value of adolescents' depersonalisation level

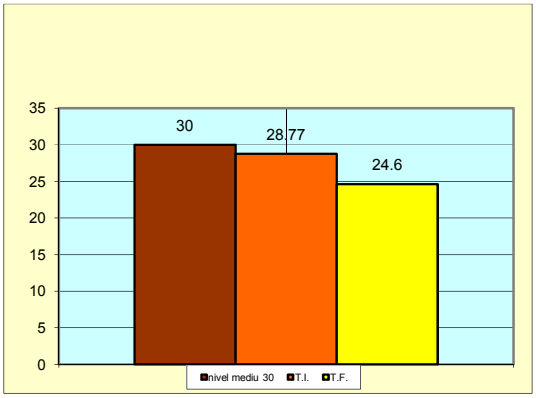


Fig. 2. Comparative chart of the mean value of the level of decrease in personal accomplishment

***e. Complex exercises models***Following the analysis of the results recorded in the initial testing, an experimental curriculum has been drafted and implemented. It consists in physical exercise of aerobic gymnastics in view of acquiring balanced physical growth, an aesthetic and correct posture, for losing weight, but especially for avoiding or removing the state of stress in adolescents (17-18 years of age).

The experimental training programme with means and methods of aerobic gymnastics has been structured in three exercise sets carried out for a 6-month period (8 weekly cycles/ 8 classes for each set, 30 exercises/ each set, 50 minutes, various difficulty degrees – as shown in Table 3).

**Table 3 Models of aerobic gymnastics exercises**

| **Aerobic gymnastics programme no.1 – low difficulty** |
|---|
| 1. Ankle flexion, standing, with:<br>• outwards raised arms scissors, down, back down and combined, 2x8 times;<br>• outwards raised arms scissors, 2x8 times;<br>• raised arms scissors, 2x8 times;<br>• raising arms lateral at shoulders level, 2 x 8 times;<br>2. Running, lifted knees, 2x8 times;<br>3. Running with outwards stretched legs scissors, 2x8 times;<br>4. P.I. Straddle, bent arms, hands on hips :<br>• head flexion and extension, 2x8 times ;<br>• head curling to the right and to the left, 2x8 times ;<br>• head rotation to the right and to the left, 2x8 times;<br>5. P.I. Sitting, palms backwards, legs raised at 45°:<br>• scissors jumps in sagittal/ lateral plane, 2x2x8 times |
| **Aerobic gymnastics programme no.2 – medium difficulty** |
| 1. Ankle flexion with:<br>• gradually lifting arms outwards 2 x 8 times;<br>• simultaneously lifting arms upwards, 2x8 times;<br>• gradually lifting arms lateral - upwards, 2x8 times;<br>• arms extensions lateral, 2x8 times;<br>• arms extensions upwards, 2x8 times;<br>2. Running swinging legs backwards, 2x8 times<br>3. P.I. Straddle, raised arms:<br>• alternative lateral body bending simultaneously with lifting arm on the bent side, up, lateral, opposite arm, downwards, 2x8 times;<br>4. P.I. On knees, palms on the floor :<br>• alternative balancing legs with the knee bent outwards and extended backwards, 2x8 times<br>5. P.I. Lying with face down, lifted arms:<br>Body extension lowering the arms, lateral, 2x8 times |
| **Aerobic gymnastics programme no.3 – high difficulty** |
| 1. Ankles flexion, arms extended outwards:<br>• outwards small arms rotations, interior/exterior, 2x8 times;<br>• outwards short arms scissors in sagittal plane (upwards-downwards), 2x8 times ;<br>• outwards wide arms scissors in sagittal plane, 2x8 times;<br>• short arms rotations exterior/ interior, 2x8 times ;<br>• large arms rotations exterior/ interior, 2x8 times;<br>2. Lateral jumps from standing to straddle, with bending and outwards stretching arms, 2x8 times ;<br>3. P.I. Straddle, bent arms, hands on the backhead:<br>• lateral plane body bending, right/left bending knees, 2x8 times;<br>• outwards body bending, stretching arms, lateral plane, 2x8 times;<br>4. P.I. On the knees, palms outwards on the floor:<br>• alternative bent legs rotation in lateral, 3x8 times;<br>• alternative legs rotation in lateral, 3x8 times;<br>• outwards-backwards alternative bent legs rotation, 2x2x8 times;<br>• backwards - lateral alternative balancing of the extended legs, 2x2x8 times<br>5. P.I. Lying with face down, lifted arms:<br>• back extension with alternative lifting opposite leg and arm, 2x8 times |

## CONCLUSIONS

1. The study of the literature in the field on the issue of stress has revealed that the experts' interest in this question is limited when it comes to stress prevention in adolescence, irrespective whether they are teachers, educators, psychologists or physicians.
2. School curricula are overloaded, and the graduation exams and higher education admission exams take place in a very short period of time.
3. After processing and interpreting the data recorded, the assumption that stress can be prevented by using aerobic gymnastics has been proven valid.
4. The stressful states and situations can be controlled and positively influenced through

physical exercise, with regard to age peculiarities in the case of adolescents (17-18 years of age).

5. The comparative analysis of the results recorded when applying the initial testing and those recorded in the final testing have emphasised the positive influence of physical exercise, as means of improving communication among youths (socialising) through their massive and constant and wilful participation in same sports activities. This situation has led to the development of relationships which positively influence the day-by-day activity at and outside the school.

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# STUDY ON THE ACTION OF TACTILE AND STRENGTH SENSORS IN DETERMINING THE BALL FORCE ON THE VOLLEYBALLERS' FOREARMS

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**Abstract**

*In the previous issues of the magazine we described the computerised apparatus for the acquisition and assessment of the two-handed pass from below in volleyball, stressing the typology and efficiency of the sensors that constitute the hardware of the apparatus.*

*The present paper aims at analysing the strength sensor, evincing its utility in executing the pass and in the takeover from attack and service.*

*To develop the project "Computerised apparatus for the acquisition and assessment of the two-handed pass from below", efforts were made to detect and measure the ball force exercised on the player's forearms in executing the takeover from attack and service. Thus, it may be assessed if the forces are equal on both forearms at the moment the ball is hit.*

**Key words***: Sensors, force, voleyball, forearms.*

**INTRODUCTION**

In the early stages of acquisition of a new technical procedure, the formation of the psycho-motor representation is accompanied by major biomechanic deviations from the model. It is the topic of a lot of research trying to prevent and eliminate the most serious deviations which prove harmful by denaturing the form and the content of the motor form.

**CONTENT**

The analysis of specialised literature in the field (Larionescu, 2012) led to the conclusion that a thorough examination of a technical procedure means dividing it into its components, to be analysed separately. Similarly, these stages or sequences within the same procedure may illustrate the subject's technical level, as well as the execution errors, constituting a real reference point for the examiner (Larionescu, 2012).

Thus, technically speaking, the most important issue is to eliminate errors, their causes being complex and varied. They may be differentiated according to the action sequences, being all caused by the subject(s) generating the errors.

The most important moment in executing the two-handed takeover from below from attack or service is the movement when the ball meets the hands and the post-hit follow-up. The requirements for these are: high availability, extended arms with the formation of a plane surface, advancement towards the ball, and hit amortization. At the same time, the place of contact is of utmost importance, most