concentric muscle contraction, which represented SSC (12). A single cycle of the stretch reflexes in force enhancement during SSC exercises (30, 31), we insisted on the immediate transition between stretch and shortening phases in every exercise. The strength training program was conducted under the author supervision. Statistical analyses were carried out with SPSS statistical package ver. 12 (Chicago, IL, USA). All values were expressed as mean ± standard deviation (SD). Statistical evaluation was performed by Student’s t test for paired observations, one-factorial and two-factorial analysis of variance. The differences were considered to be significant when p value was less than 0.05.

RESULTS

Anthropometric features of the subjects included in the investigation and isometric strength measurements are shown in Table 1 (means±SD). The results of the maximal isometric force (Fmax) for the leg extensors (LEG test) and the calf muscles extension (CALF test) are shown in Figure 2. The results of specific biomechanical parameters are shown in Table 3.

DISCUSSION

A motor structure of the jump-technique in basketball as an athletic task. The results of the biomechanical parameters are in the line with the results of the similar studies (32, 33) performed on different samples. The results of the biomechanical analyses showed that this protocol has not influenced the coordination of the skill of jump in young athletes. The results of statistical analysis show that difference wasn’t statistically significant (Manova: Wilkins lambda=0.68). The applied training program did not negatively influence the coordination of the skill of jump in these athletes.

The only observable difference was variable in height of center of mass at release. The increase in HCM at release from 1.17 cm to 1.19 cm and ball height (BH) at release from 2.37 to 2.39 shows that in lower body muscle strength and in height of vertical jump had positive transfer on the height of the center of the body mass at release and height of the ball at release in analyzed basketball technique. Although the difference is not statistically significant, it shows that applied strength training program had the strongest influence on the targeted variable.

The applied training for strength development had lead to increase in maximal isometric force (Fmax) registered during maximal voluntary contraction. The test of leg extensor muscles (LEG test) has indicated increase in Fmax for 12% (177.95 kg pre vs 201.9 kg post), while the test of calf muscles (CALF test) indicated an increase of 12% (281.5 kg pre vs 306.4 kg post).

**Table 1. Anthropometric characteristics and results of isometric muscle force of subjects.**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>INITIAL MEASURE (Mean±SD)</th>
<th>FINAL MEASURE (Mean±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>16 ± 5.8</td>
<td>16 ± 5.8</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>190.7 ± 7.9</td>
<td>190.7 ± 7.9</td>
</tr>
<tr>
<td>Body Weight (kg)</td>
<td>66.8 ± 11.6</td>
<td>70.1 ± 10.9</td>
</tr>
<tr>
<td>Fat mass (%)</td>
<td>15.9 ± 4.8</td>
<td>15.9 ± 4.8</td>
</tr>
<tr>
<td>Fat free mass (kg)</td>
<td>11.0 ± 7.3</td>
<td>10.89 ± 9.96</td>
</tr>
<tr>
<td>LEQ (kg)</td>
<td>177.9 ± 60.3</td>
<td>203.9 ± 62.7</td>
</tr>
<tr>
<td>CALF (kg)</td>
<td>112.6 ± 28.2</td>
<td>120.8 ± 22.4</td>
</tr>
<tr>
<td>Jump height (cm)</td>
<td>291.5 ± 15.5</td>
<td>266.4 ± 16.4</td>
</tr>
</tbody>
</table>

**Table 2. The results of the selected biomechanical parameters.**

<table>
<thead>
<tr>
<th>BIOMECHANICAL VARIABLES</th>
<th>WA</th>
<th>EA</th>
<th>HA</th>
<th>KA</th>
<th>AA</th>
<th>BMR</th>
<th>Body Height (cm)</th>
<th>Body Mass (kg)</th>
<th>Fat mass (%)</th>
<th>Fat free mass (kg)</th>
<th>LEQ (kg)</th>
<th>CALF (kg)</th>
<th>Jump height (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINIMUM MEASURE</td>
<td>127.38–171.32</td>
<td>123.19–170.49</td>
<td>101.47–157.21</td>
<td>107.29–156.37</td>
<td>127.38–149.04</td>
<td>127.21-143.22</td>
<td>22.26–82.21</td>
<td>201.7–100.92</td>
<td>11.03–139.88</td>
<td>15.56–8.98</td>
<td>121.12–47.37</td>
<td>2.12–2.53</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1. Results of the maximal isometric force (Fmax) for LEG and CALF tests on initial and final testing.**

**Figure 2. The results of specific biomechanical parameters.**

**Table 3.**
intermediates above functional capability of cellular antioxidants may lead to natural fluctuation of important macromolecules, and it represents the molecular basis of many diseases including inflammation processes, cardiovascular alterations and cancer (4). Reactive oxygen species (ROS) are molecules generated inadvertently among various cellular metabolic activities. In mammalian cells, mitochondria are the major intracellular source of ROS generation (4). The overproduction of ROS can result in detrimental cellular damage including lipid peroxidation, DNA adduct formation, protein oxidation and enzyme inactivation that ultimately lead to cell death. Diverse cellular ROS, such as superoxide (O2•−) and hydrogen peroxide (H2O2), and hydroxyl radical (OH•), have long been held as the harmful by-products of life of an aerobic environment. ROS are highly reactive and potentially toxic compounds capable of modifying and damaging several types of cellular macromolecules including lipids, proteins and DNA, ultimately leading to cytotoxicity and mutagenesis (4). Therefore, cells have evolved elaborate defense systems to counteract the toxic effect of ROS. These include both nonenzymatic (glutathione, pyridine nucleotides, ascorbate, retinoic acid, thioredoxin and tocopherol) and enzymatic (such as superoxide dismutase, catalase, glutathione peroxidase and peroxidases) pathways that limit the rate of oxidation and thereby protect cells from oxidative stress (5, 6). Notwithstanding, evidence is accumulating that ROS or their signaling intermediates above functional capability of cellular antioxidants may play a central role in this process. Considering all previous findings, in the present study we investigated the activities of antioxidant enzymes in lymphocytes and in plasma of both CLL patients and healthy subjects in order to gain a comprehensive view about the status of their antioxidant defenses machinery.

**MATERIAL AND METHODS**

**Patients and controls**

Forty-six B-CLL patients were included in the study (22 males, 14 females, range 51–82 years: mean ± SD, 66.5 ± 6.9 years) and 32 healthy subjects were used as a control group (17 males, 15 females, range 49–80 years: mean ± SD, 65.3 ± 7.6 years). B-CLL was diagnosed according to standard clinical and laboratory criteria. CLL patients had no other pathological characteristics such as myeloma, diabetes or any other type of neoplasia (18). There were 10 in stage 0, 15 in stage I, 13 in stage II and 8 in stage III. B-CLL patients were divided into two groups, early (0–1; 25 patients, range 54–82 years: mean ± SD, 67.7 ± 9.2 years) and late stages (II + III; 21 patients, range 51–78 years: mean ± SD, 64.6 ± 8.5 years). Most of the patients were newly diagnosed cases. Early diagnosed patients did not receive any antileukemic therapy at least six months prior to the investigation. In order to prevent any possible alteration and influence on the outcome of the study, patients having either infectious disease or other conditions were excluded. All subjects (both patients and controls) were non-smokers who did not receive any systemic or topical treatmentdrug prior to initiation of investigation that could have affected defense mechanism of antioxidant. None of the patients and controls had alcohol abuse problems or performed regular exercise other than daily activities. The local Ethics Committee approved the study and all subjects gave the written informed consent prior to the study, according to the Declaration of Helsinki.

**Blood sampling**

All blood samples were obtained in the morning at the same hour, following 12 hours of fasting, and collected in polystyrene tubes. Heparinized venous blood (10 ml) Improvement of the maximal muscle strength of the leg extensors and flexors was provided as a protocol of training studies, shows that stretch-shortening cycle exercise can improve performance in vertical jumping, long jumping, sprinting and sprint cycling. It also appears that a relatively small amount of stretch-shortening cycle exercise training is required to improve performance in these tasks (14–19). It has been demonstrated that muscle jump performance can be increased in response to plyometric training lasting from 4–12 weeks. The use of the plyometric method has emphasized the need to study the possibilities of its use in the training of young athletes in the development of vertical jumping and, it is not surprise that there is still some doubt among coaches that strength and power training in young athletes has a negative effect on technical performance. This is the main reason why they have usually avoided strength training for young athletes (15). It has been demonstrated that muscle jump performance can be increased in response to plyometric training lasting from 4–12 weeks. The use of the plyometric method has emphasized the need to study the possibilities of its use in the training of young athletes in the development of vertical jumping and, it is not surprise that there is still some doubt among coaches that strength and power training in young athletes has a negative effect on technical performance. The most important and most commonly used technique in stretch-shortening cycle exercise was measured using high speed cameras and angular acceleration and velocity in vertical jumping were measured using a potentiometer coupled with motion analysis software system (KAVideo), San Francisco, USA. The coordination pattern was presented and analyzed with biomechanical parameters of basketball technique. Anthropometric apparatus was used to gain a comprehensive view about the status of their antioxidant defenses machinery.

**Subjects and METHODS**

The subjects of this study (n=21) were young basketball players from the University of Belgrade and who played in the third league. None of the players had alcohol abuse problems or performed regular exercise other than daily activities. The local Ethics Committee approved the study and all subjects gave the written informed consent prior to the study, according to the Declaration of Helsinki.

All blood samples were obtained in the morning at the same hour, following 12 hours of fasting, and collected in polystyrene tubes. Heparinized venous blood (10 ml)
THE EFFECTS OF STRETCH-SHORTENING CYCLE EXERCISE PROGRAM ON COORDINATION PATTERNS IN YOUNG ATHLETES

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ABSTRACT

The study was con...
To understand the overall status of antioxidant enzyme machinery in both CLL patients and control subjects, we studied the activities of antioxidant enzymes in both lymphocytes and plasma from both groups. The results obtained in patients and control group were summarized in Table 1 and Table 2, respectively. As seen from Table 1, there were important changes in the activities of antioxidant enzyme in lymphocytes comparing CLL patients with controls. SOD activity was significantly reduced in both CLL-groups: the decrease is about 40% in early stage and more than 60% in advanced stage. Catalse activity was decreased more than 35% in early stage and more than 65% in advanced stage, while Gpx activity was decreased above 50% in early stage and about 80% in advanced stage. The results for plasma measurement of antioxidant enzyme activities were shown in Table 2. Slightly increased plasma SOD and Gpx activities in both stages were not significantly different from the controls, while plasma CAT activity was increased in advanced CLL stage more than 85% compared to normal, healthy subject.

**DISCUSSION**

A disturbance of oxidative metabolism is a common feature of transformed tumor cells (23). Both the alterations of antioxidant enzymes and increases in the production of oxygen reactive species have been described to contribute to tumorigenesis (24). As a result, higher rates of lipid peroxidation (25) and different forms of DNA base damage and by the decrease of antioxidant enzyme activities (27). Although some possible mechanisms through which oxidative stress exerts a regulatory role in tumor result from increased oxidant production or from failure of antioxidant systems (23, 30, 31). Although important changes in cellular redox homeostasis have been documented during tumor growth in experimental models, such variations have not yet been demonstrated in humans. Most of the difficulties encountered in these studies are related to the complexity of the biochemical pathways that regulate the cellular redox balance (32). A wide variety of oxidizing molecules such as ROS and/or depleting agents can alter the redox balance in the cell. The data reported in the literature on antioxidant molecule and enzymes in different human cancer types are controversial.

The present study investigated the SOD, CAT and Gpx activities in both lymphocytes and plasma of CLL patients in order to obtain a comprehensive view of the cancer patient antioxidant enzyme machinery. The aim was to determine their predictive, i.e., prognostic role for disease outcome. Such studies may provide clues on the mechanism through which oxidative stress may influence tumor growth and its clinical progression. The result of the present study showed that activities of antioxidant enzymes of interest were significantly lower in lymphocytes of CLL patients while there was an important increase in plasma CAT activity. Also, there is an increasing trend of activities of SOD and of Gpx in plasma, but of no statistical importance. The levels of all antioxidant enzymes investigated were decreased in lymphocytes in both CLL groups compared to control subjects. This result is in accordance with the observed decrease of two enzymes, SOD and CAT, as demonstrated earlier in CLL (27), in children with acute lymphocytic leukemia (26), in humans colorectal carcinoma and other tumors (33). However, the decreased activity of Gpx in lymphocytes demonstrated in our results is in contrast to the previous research (27, 34). The observed decrease in enzyme activities in lymphocytes was found in both early and advanced stages of disease. Therefore, the decrease in activities is progressively enhanced by the disease stage. Thus, the lower enzyme activity is directly proportional to the increased stage of the disease. Decreased levels of SOD, CAT and Gpx may cause the accumulation of superoxide anions and H$_2$O$_2$ in tumor cells (33, 35). Moreover, lipid peroxidation (LP), as one of the main effect of oxidative stress in cells, induces the increase of MDA concentrations. In addition, LP can be generated either due to an excessive action of pro-oxidants or due to the reduced functional activity of antioxidant defense machinery (24). Due to the decreased activity of antioxidant enzymes in lymphocytes, specifically Gpx, there is an increase in LP in malignant cells leading to the rise of the MDA concentrations in plasma, as already documented in the our previous work (35). It has been claimed that MDA acts as a tumor promoter and co-carcinogenic agent due to its high cytotoxicity and inhibitory action on protective enzymes (36, 37). Therefore, the possible explanation for the decrease of the activities of SOD, CAT and Gpx in lymphocytes of CLL patients could be due to the inhibitory effect of MDA on protective enzymes. On the other hand, in the case of severe oxidative stress there is an intensive production of ROS that overcome antioxidant capacity of the cells. This phenomena consequently leads to the breakdown of the all antioxidant defense machineries that is manifested as a decrease of the activities of protective enzymes, including SOD, CAT, Gpx. Alternatively, it is possible that the antioxidant system is impaired as a consequence of an abnormality in the antioxidative metabolism due to the cancer process (32).

To date, no previous studies have ever demonstrated the activities of the antioxidant enzymes both in lymphocytes and plasma of CLL patients. Thus, in order to obtain a comprehensive view of the antioxidant enzyme machinery in CLL patients, besides the usual measurement of antioxidant enzyme activities in lymphocytes, we have also examined their activities (SOD, CAT and Gpx) in plasma of CLL patients of both early and advanced stage and compared them to healthy subjects of similar age.
hypertrophy of the paranasal cavity mucous membrane, become clinicopathologically significant, thus leading to auxiliary diagnostic means in the orbital complications diagnostic algorithm of rhinosinus origin. Retrobulbar neuritis, in the material used, occurred as the most frequent complication and, in this, it was mostly brought about as a consequence of sphenoiditis and retro ethmoid cell inflammations. Since X-ray ocular image was insufficient, conducting of CT or MRI diagnostic was necessary. In the temporary approach with orbital complications of synonasal origin, it also necessary, besides the neural, sinusus status, to have in depth insight into the process spread within the orbit, where, unlike the reattachment of eye ball and its MR structures, we have presented with previous data (12-19).

Therapeutic approach with children implies administering high dosage of antibiotics, internal corticosteroids, local administering of decongestives, and with adults, if subjective and objective improvement did not occur within the course of the first 24–48 hours after administering high dosage of antibiotics, surgical approach in treating similar complications is to be applied.

In conclusion, orbital complications of rhinosinus inflammatory origin, although rare, occupy special place in otorhinolaryngology both from diagnostic and therapeutic aspect. They occur as the consequence of acute sinusitis with children and chronic sinusitis exacerbation with adults. X-ray occipitomental open-mouth imaging is mostly insufficing and, in this, it was mostly brought about as a consequence of sphenoiditis and retro ethmoid cell inflammations. Since X-ray ocular image was insufficient, conducting of CT and MRI diagnostic was necessary. Taking swabs from middle nasal corridor has proven to be a useful diagnostic means both with children and adults, and inflammatory processes on determining adequate antibiotic treatment and in that way decreasing the need for surgical interventions. Complication prevention is based on the adequate and opportune acute sinusitis treatment with children, as well as chronic process rehabilitation (allergies, polypos, cysts) with adults.

**REFERENCES**

While examining the clinical picture of syno orbital complications with children and adults in this paper, a difference in symptomatology and form of orbital complication was observed (table 4).

In the X-ray image we observed the homogenous intensive shadow in 83.33% of the cases, while with the adults both homogenous intensive and homogenous non-intensive shadows were observed in the X-ray image. With fifteen (83.33%) out of the total of 18 children, the X-ray finding was the homogeneous intensive shadowing, the homogenous non-intensive shadowing occurred with two patients, and the level shadow in the maxillary sinus with one patient. With 7 (50%) out of the total of 14 adult patients, there occurred the homogenous intensive shadowing, while homogenous non-intensive shadowing occurred with 6 patients, and the level-shadow in the frontal sinus with 1 patient (figure 2).

Figure 2: Comparative analysis of shadow intensity on X-ray images of paranasal sinus.

In 29 cases out of the total of 32 patients (90%) the swab pathogen was isolated from the middle nasal corridor. The most frequently isolated bacteria with the adults were Streptococcus catarrhalis, 8 cases (47.06%), Haemophilus influenza, 6 cases (35.29%), and Streptococcus pneumoniae, 3 cases (17.65%), respectively (figure 3).

Figure 3: Isolated bacteria in middle-nasal corridor swab.

With all of the patients pathogenic germs were isolated, mononucleosis was found in the middle nasal corridor swab, whereby the most common pathogen was Streptococcus pneumoniae (13 patients), while Haemophilus influenza and Moraxella catarrhalis were equally presented (8 patients each). With children Moraxella catarrhalis was the most widely isolated bacterium (in 8 cases or 47.06%), then Haemophilus influenza in 6 cases (35.29%), while with adults Streptococcus pneumoniae was by far the most frequently isolated one (in 10 cases or 83.33%) (figure 4). Isolated bacteria were significant in the antibiotic treatment with orbital complications approach. High percentage findings of Moraxella catarrhalis with children was the probable cause for the complication occurrence (8-18), since Moraxella produces resistance towards beta lactam antibiotics (penicillin antibiotics and cephalosporine antibiotics).

DISCUSSION

Inflammatory processes in the orbit of rhinosinus origin, occur with somewhat different clinical picture with persons belonging to different age groups, as well as with altered courses of propagation and infection spreading from paranasal cavities depending on patient's age.

Diversities encountered upon in clinical observations of the same complications which occur with children and adults are based on overall and local physiopathological characteristics of patient's age, whereby it is to be noted that with children the evolution of all paranasal sinuses is terminated. With children the illness is of a peracute form, which is explained by the instability of humoral and cellular defense mechanism and poor resistance to viral and bacterial infections, so that the occurrence of syno orbital complications is usually preceded by some viral infection of upper respiratory tract, and orbital complications usually occur within the period of approximately 5–8 days after the acute sinusitis onset (3). With adults the occurrence of orbital complications is most frequently the consequence of chronic inflammatory process exacerbation in sinuses, or the latter were the consequence of recurrent acute sinusitis, and the inflammatory process progression is always direct and accompanied by bone wall microdestruction, whereas with children the inflammatory process almost always spreads from sinuses to orbit visually and lymphatically (8-10).

Syno orbital complications with children in 88.89% of the cases occurred due to the acute sinusitis (n=16/18) (table 3), which concurs with scientific literature data. Complications were preceded by some of the viral infections: morbilli, influenza, viral infections of upper respiratory tract, as well as allergies. The occurrence of inflammatory process in the orbit with children bore season characteristics, while with adults syno orbital complications were not seasonal (3, 10).

Each of these complications was of a different degree and severity, but their common characteristic was highly uncertain prognosis. In making the diagnosis, close cooperation with ophthalmologists and pediatricians (with children) was presented, which facilitated the most adequate treatment procedure. The basis for making the diagnosis was anamnesis, clinical picture, clinical otorhinolaryngological examination, biochemical blood test and X-ray imaging. The number of affected sinuses was not in relation with the type of the complication, but it made the clinical picture more severe. Generally speaking (18), the...