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FUNCTIONAL CONDITION OF THE RESPIRATORY SYSTEM AND RELATIONSHIP WITH A PHYSICAL WORKING CAPACITY OF ATHLETES – FOOTBALL PLAYERS

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ABSTRACT

In this article it was investigated the indicators of the functional state of the respiratory system in athletes-players. It is considered that excessive physical activity places increased demands on the oxygen supply of the body, particularly, respiratory system. It was studied functional state of the respiratory system, taking into account the degree of physical performance of an athlete. The study was carried out at 300 football players. Age of football players ranged from 18 to 25 years. Athletes, football, depending on the degree of physical performance were divided into the following groups: with high, above average, average, below average and low performance. The results of the conducted studies of the respiratory function in athletes-football players compared with the performance of the respiratory function in the control group shows a clear difference. The FVC index in the studied football players alone is 17.4% higher than in the control group. Therefore, in football players, there is a relatively quick response from the respiratory system to physical activity. This is apparently due to the "training of the respiratory system", which promotes an accurate and adequate "fit" of the level of pulmonary ventilation to the metabolic needs of the athlete's body during normal activities and the associated energy costs. Respiratory system in athletes-football players, like other functional-metabolic systems of the body, is being rebuilt in the process of adaptation to ever-increasing physical exertion and acquires a more economical use of reserve resources to compensate for energy costs and ensure normal life activity body athlete.

KEYWORDS: Respiratory function; athletes; football players; forced expiratory volume in 1 second, forced vital capacity; lung capacity; EVC; IVC.

INTRODUCTION

It is known that the respiratory system plays a strategic role in ensuring the supply of oxygen to working muscles and in removing carbon dioxide from the body,[1] which allows the body to maintain gas homeostasis not only under extreme conditions, but also under conditions of high physical exertion. Low functional activity of this system significantly affects the physical and mental performance, reducing the body's resistance to harmful factors and psycho-emotional stress.[2,3] Therefore, the study of this issue is very relevant for professional athletes involved in various sports, with different motor load. Of particular importance is this issue in those sports that place increased demands on aerobic capabilities.[4] These sports include football.

In connection with the above, we have studied the indicators of the functional state of the respiratory system in athletes-players. Considering that excessive physical activity places increased demands on the oxygen supply of the body, in particular, the respiratory system, we have studied the functional state of the respiratory system, taking into account the degree of physical performance of an athlete.

The purpose of the study: the study and evaluation of indicators of respiratory function in athletes, football, depending on their physical performance and playing roles.

MATERIALS AND METHODS

The study was carried out at 300 football players. Age of football players ranged from 18 to 25 years. Athletes, football, depending on the degree of physical performance were divided into the following groups: with high, above average, average, below average and

low performance. Considering that the athletes-soccer players during the game in the field perform different physical activity tasks by us in each group on physical performance, they are still divided according to the game role into goalkeepers, defenders, midfielders and forwards.

The function of external respiration was studied in athletes at rest on a spirometer "BTL-08 Spiro". As indicators of respiratory function, forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), forced expiratory flow at 75%, 50% and 25% vital capacity of the lungs (MOC75, MOC50, MOC25), lungs capacity (LC), vital capacity of the lungs on the inhale and exhale (EVC, IVC), maximum ventilation of the lungs (MVL). Evaluation of physical performance was performed by conducting an ECG study before and after individually calculated load. The controls were indicators of the function of external respiration of 19 healthy volunteers, students of the medical institute, of corresponding ages.

RESULTS AND DISCUSSION

The results of the conducted studies of the respiratory function (RF) in athletes-football players compared with the performance of the respiratory function in the control group shows a clear difference. The FVC index in the studied football players alone is 17.4% higher than in the control group. Therefore, in football players, there is a relatively quick response from the respiratory system to physical activity. This is apparently due to the "training of the respiratory system", which promotes an accurate and adequate "fit" of the level of pulmonary ventilation to the metabolic needs of the athlete's body during normal activities and the associated energy costs.[4,5]

The study of a different respiratory system index in athletes-football players - FEV1, measured in relative rest conditions, shows that its value exceeds the control value by 18.0%. This indicates a relatively high ability of the respiratory muscles in the examined athletes to exhale for the first second.

The study of the indicators of the forced flow in the studied athletes depending on the specific proportion of the forced vital capacity of the lungs also indicates the presence of a certain difference between the control groups. At that, the value of MOC75 exceeds the values of control by 24%, MOC50 - by 15% and MOC25 - by 18%, respectively. Consequently, in football players, there is a relatively high potential of the bronchial tree in meeting the body's need for oxygen. Since, as a rule, MOC75, it characterizes the speed of the air flow through the small bronchi, MOC50 - according to the middle bronchi, and MOC25 - according to the main bronchi and trachea. At the same time, the most pronounced difference in the value of MOC75 compared to MOC50 and MOC25, apparently, indicates a comparatively higher adaptation of the terminal bronchi

to the functional loads of the athlete-football player compared to other departments of the airways.

We also studied the vital capacity indicators of the lungs during inhalation and expiration (EVC, IVC) in the studied football players. And here there is a higher value of the vital capacity of the lungs both during inhalation and in exhalation. The value of the latter exceeds those in the control group by 31.4% and 13.7%, respectively. Consequently, according to these indicators, the respiratory systems of athletes have higher capabilities than non-professional sportsmen. Indeed, a comparative study of the value of the indicator of MVL in the football players studied shows that the value of the latter for the sportsmen exceeds that of the control group by 27.5%. It follows from this that the respiratory system of the athlete-football player was rebuilt in the direction of the growth of the inhaled air volume due to the constant physical exertion associated with the training process. Since the respiratory system is one of the leading vegetative component of the athlete's organism adaptation to ever-increasing physical loads, increasing its function and often becomes a link limiting the intensity and duration of the development of adaptive reactions of the body. Moreover, the aerobic performance of the body, physical performance, endurance and skill of an athlete[3,6] largely depend on the adequate response of the respiratory system to physical activity (training effect).

Based on the fact that the intensity of the respiratory function is ultimately associated with physical performance, we have measured the respiratory function, taking into account the degree of physical performance of the studied football players.

The results of the studies are presented in Figure 1A, 1B. As can be seen from the data presented, 10.33% of football players' performance was assessed as high, 10.66% - above average, 40.66% - average, 20.33% - below average and 18.0% - low. Therefore, among the studied athletes, football players with high degrees of physical performance were only 1/3 of the athletes. The bulk of the athletes were athletes with an average degree of physical performance.

Analysis of the results of the study of respiratory function indicators, depending on the specified degrees of physical performance, shows that the value of FVC in athletes with low physical performance is lower by 23.8% compared to athletes with high performance, by 25.7% compared to with higher average working capacity, by 21.4% compared with average working capacity, by 15.2% compared with lower average working capacity. Studying the value of another indicator of RF – FEV1 also shows that football players with low physical performance are lower compared to high, above average, average and below average performance levels by 20.8%, 23.3%, 19.6% and 14.4% respectively. A similar picture occurs with respect to

other indicators of respiratory function, in particular, PEV, MOCaver, MOC25, MOC50, MOC75, LC, MVL, EVC and IVC (Fig. 1). Consequently, as physical performance decreases in parallel, the value of the studied parameters related to the respiratory system function decreases as well. It is quite clear that the lower the physical activity and performance, the less the body needs energy substrates, oxygen and, accordingly, respiratory function.
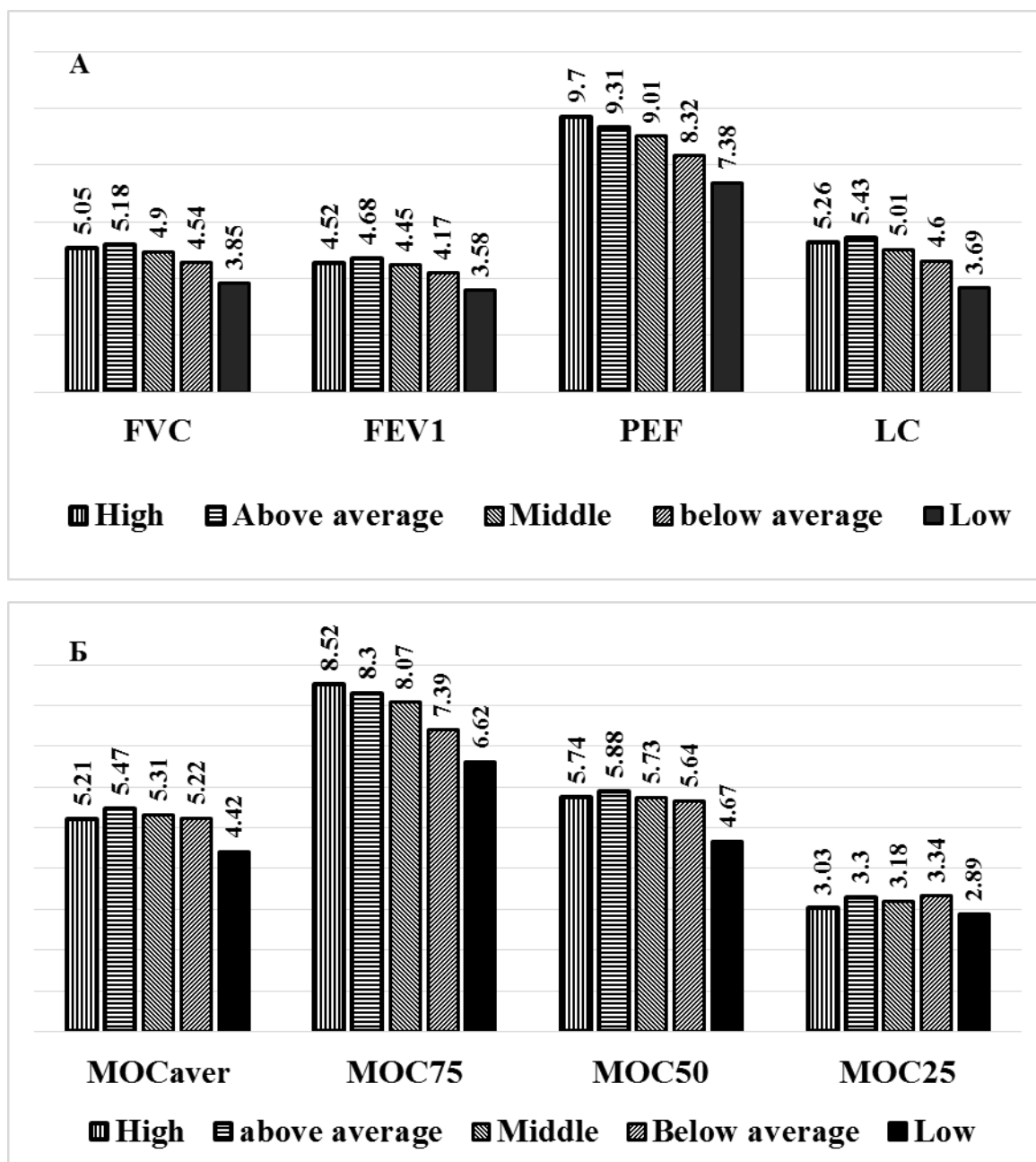

Fig. 1: Indicators of respiratory function in football players, depending on the degree of physical activity.

It should be noted that the role of each player on the field during the game requires different tactical, technical and physical performance. In this regard, it was of particular interest to us to study the indicators of lung function, depending on the role of a football player.

As was shown above, the RF indicators were studied depending on the role played in each group of players, depending on their degree of physical performance. The analysis revealed that goalkeepers among football players were 9.67%, defenders - 35.33%, midfielders - 35.00% and forwards - 20.00% of all sportsmen studied. At the same time, the proportion of goalkeepers among footballers with high, above average, average, below average and low physical performance turned out to be almost the same and amounted to 9.67%, 9.37%, 9.01%, 8.19% and 12, 96%. Therefore, goalkeepers are relatively more common among footballers with low physical performance and less often among footballers with average and below average physical performance.

Defenders, depending on the degree of performance, were distributed as follows: among footballers, high performance - 29.03%, above average - 31.25%, average - 39.34%, below average - 36.06%, low - 31.48%, respectively. Therefore, the defenders are relatively more common among footballers with medium and below average physical performance and less often among footballers with high physical performance. Among footballers with high performance, midfielders and strikers accounted for 38.7% and 22.58%, among footballers with higher average performance - 28.12% and 31.25%, among footballers with average performance - 35.24% and 16.39 %, among football players with lower average working capacity - 36.06% and 19.67%, among football players with low working

capacity - 35.18% and 24.37%, respectively. Consequently, in the groups studied, midfielders and forwards are also represented almost equally, although their share is slightly higher among footballers with higher physical performance and the prevalence of the share of midfielders is traced compared to forwards.

To analyze the dependence of the RF of football players on their gaming lines, 3 groups were singled out according to the degree of physical working capacity, in particular, groups with high, medium and low working capacity.

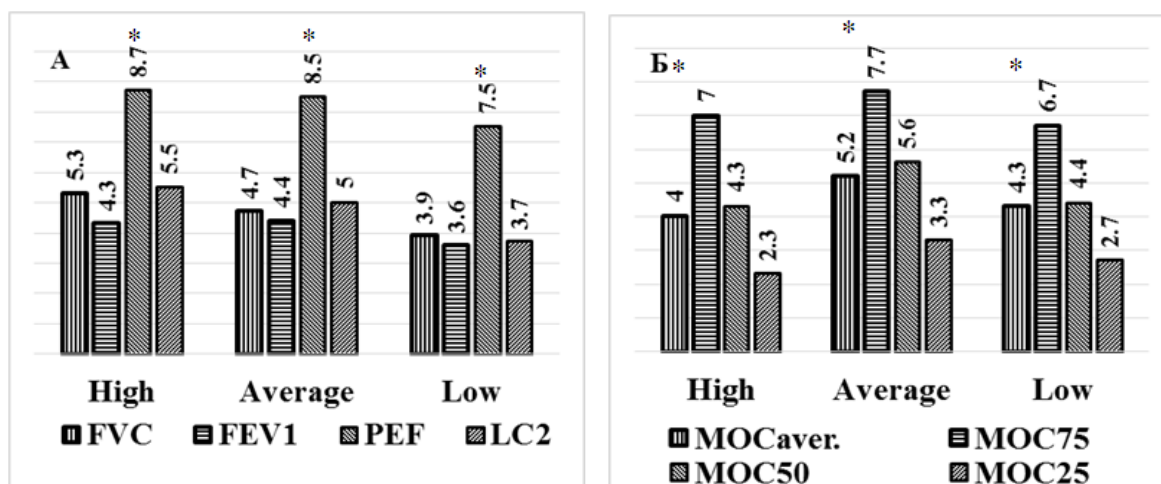The results of studies of this dependence in goalkeeper footballers are presented in Fig.2.

Fig. 2: Indicators of respiratory function in football players goalkeepers, depending on the degree of physical activity (Note: * -P <0.05).

As can be seen from the presented data, the value of FVC in football players with a low degree of efficiency is lower compared to those of average and high efficiency by 18.9% and 43.2%, respectively. Similar shifts take place with respect to the values of FEV1, PEF and LC (Fig. 2A). The value of the speed indices of the respiratory system as MOC (MOCaver, MOC75, MOC50, and MOC25) in players with a given role, as

can be seen from Fig. 2B, indicates the absence of a clear dependence on the degree of physical performance of the players.

The results of studies on the dependence of the function of the respiratory system on the physical performance of players playing defense are shown in Fig. 3A, 3B.
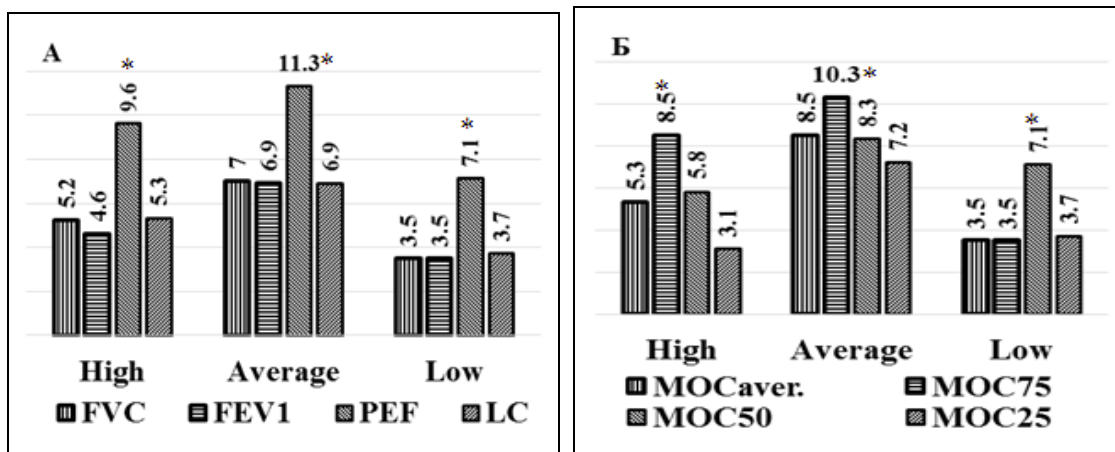

Fig. 3: Indicators of respiratory function in football players defenders, depending on the degree of physical activity (Note: *-P <0.05).

As can be seen from the data presented, there is a definite relationship between the performance of respiratory function and the degree of efficiency. At the same time, the value of such RF indicators as FVC, FEV1, PEF, LC are noticeably higher in defenders with high and medium performance as compared to low performance. Thus, the value of the indicated RF parameters in football defenders with low performance compared with the average performance becomes lower by 100.0%, 97.1%, 59.1% and 86.5%, respectively FVC, FEV1, PEF and LC. An almost similar picture takes place in relation to other indicators of respiratory function (Fig. 3B).

The study of this issue in football midfielders, as can be seen from Fig. 4A, 4B, shows that football players with an average degree of efficiency have the highest values of respiratory function. At the same time, the value of RC in football players with an average working capacity is higher than with a high working capacity by 18.4% and compared to a low working capacity by 52.6%, respectively. The ratio of FEV1, PEF and LC values also shows an identical picture (Fig. 4A). At the same time, the study of the speed parameters of lung function, as can be seen from the data presented in Figure 4B, indicates the presence of a slightly different relationship. At the same time, if the MOCaver value does not have a difference in the degree of working capacity, the MOC75 value increases as the degree of physical working capacity decreases, and the MOC50 value, on the contrary, increases.
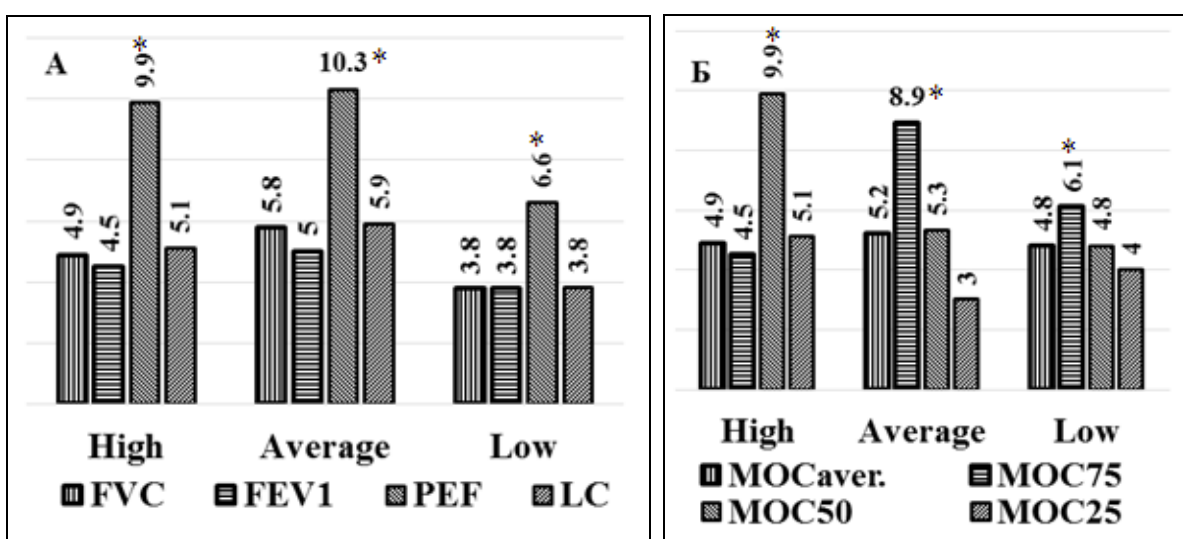

Fig. 4: Indicators of respiratory function in football midfielders, depending on the degree of physical activity (Note: * -P <0.05).

The results of studies on the dependence of the function of the respiratory system on the physical performance of players playing defense are shown in Fig. 5A, 5B.
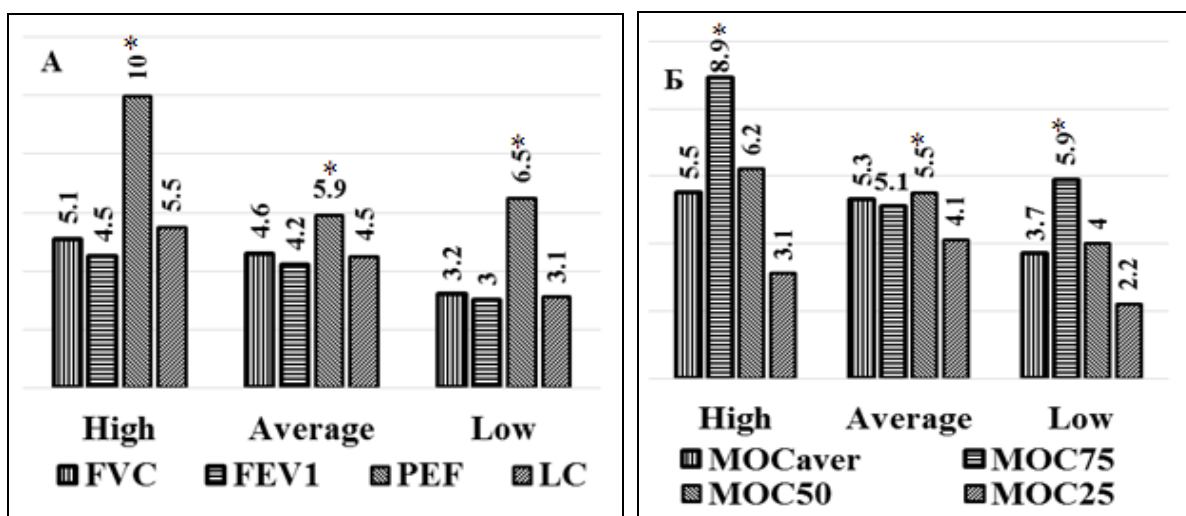

Fig. 5: Indicators of respiratory function in football players forwards, depending on the degree of physical activity (Note: * -P <0.05).

As can be seen from the presented data, among the football players attacking the studied indicators of the functional state of the respiratory system is directly dependent on the degree of physical performance. The lower the degree of physical performance, the lower the value of the studied parameters of respiratory function. This pattern is clearly seen both in relation to the biomechanical and velocity indicators of the functional state of the respiratory system.

CONCLUSION

Thus, the conducted research indicates that the respiratory system in athletes-football players, like other functional-metabolic systems of the body, is being rebuilt in the process of adaptation to ever-increasing physical exertion and acquires a more economical use of reserve resources to compensate for energy costs and ensure normal life activity body athlete. The respiratory system, increasing the power and endurance of the respiratory muscles, contributes to an increase in the volume of inhaled air relative to the functional residual capacity of the lungs and, ultimately, an increase in the body's aerobic performance.

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