



Original Article

Changes in the awareness and understanding of trunk muscle training in high school athletes

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Abstract. [Purpose] This study aimed to compare the results of two questionnaires administered in 2013 and 2020, on the level of awareness and understanding of trunk muscle training. [Participants and Methods] In total, 238 soccer club members in high schools responded to our questionnaire regarding trunk muscle training. Two teams were recruited from the top (top 4), middle (top 16), and bottom levels (first-round losers), according to the prefectural tournament's results in 2019. This questionnaire comprised questions divided into four parts: 1. Prevalence of trunk muscle training; 2. Knowledge of the classification of trunk muscles (local and global); 3. Consciousness of local and global muscles during trunk muscle training; and 4. Knowledge of the role of each muscle. These results were compared to those obtained from the survey in 2013. [Results] A significant difference was observed only in the responses to question 2. Regarding question 2 in 2020, several student-athletes in the top-level teams were aware of muscle classification compared to those in the middle- and lower-level teams. [Conclusion] The number of athletes who understood the classification of trunk muscles increased significantly in 2020. Therefore, in the future, we would need to better educate young athletes concerning the purpose of trunk muscle training and the role of each muscle.

Key words: Trunk muscle training, Survey of awareness, High school soccer players

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INTRODUCTION

Trunk muscle training has been widespread in physical therapy and sport settings for the past several decades. It has been shown that both mobility and stability are vital factors in achieving purposeful movement under gravity in sport settings as well as in daily activities. Trunk muscles are classified as local and global, based on their structure^{1, 2)} One of the aims of trunk muscle training, in recent years, is to strengthen these local muscles.

Local muscles relate to increase intra-abdominal pressure and improve spinal dysfunction such as lower back pain³⁾. Furthermore, local muscle training provides a transient immediate effect in the ability to switch muscle contraction pattern from eccentric to concentric in rebound jump⁴⁾ and a positive effect in vertical takeoff velocity by long-term intervention⁵⁾. In contrast, several studies have described no effects of trunk muscle training on performance^{6, 7)}. Experimental data by Geshiro and Tanimoto showed only a 10% increase in intra-abdominal pressure during trunk muscle training; therefore, they concluded that this training was ineffective in increasing the intra-abdominal pressure⁸⁾.

The effectiveness of trunk muscle training still has no consistent views. This could be caused by different levels of the un-

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derstanding of trunk muscle training among athletes. Liu et al. explained that an adequate understanding of the training task could further facilitate its effectiveness⁹. This is applied to the “principle of consciousness”, which is one of the principles of the training¹⁰. It suggests that athletes should conduct trunk muscle training with appropriate knowledge and understanding, which under conscious how to move own body. Our previous survey on trunk muscle training in 2013 showed that 90% of the participants performed it; however, the percentage of knowledge and understanding was relatively low¹¹. In addition, a large percentage of students-athletes with knowledge and understanding in regards to trunk muscles were belonging in higher competition results team¹².

This study aimed to compare the results of two questionnaires administered in 2013 and 2020 on the knowledge and understanding of trunk muscle training. Our results will contribute toward establishing a method to educate young athletes about trunk muscle training.

PARTICIPANTS AND METHODS

This research followed our previous study methods in 2013¹¹), a cross-sectional study using a self-administered questionnaire with quantitative data. Two high school soccer clubs were selected from the top (top 4), middle (top 16), and bottom levels (first round losers), according to the prefectural tournament’s results in 2019. To recruit respondents, we contacted the six coaches through our colleagues prior to the survey. We visited six clubs to distribute a total of 246 questionnaires. The participants were male soccer players who belonged to the abovementioned teams. Before the survey, the students received a complete verbal explanation of the research aims and methods that would be used to protect their personal information. After obtaining approval from their coaches, the students responded to the questionnaires in the practice setting. The questionnaires were collected immediately, and confidentiality was ensured by the researchers.

The questionnaire included the following questions.

1. Do you perform “trunk” muscle training?
2. Do you know that “trunk” muscles are divided into local and global muscles or inner and outer muscles?
3. Do you know the role of the local (or inner) muscles?
4. Are you aware of the local (or inner) and global (or outer) muscles during training?

For question 1, the respondents answered either “Yes” or “No”. For questions 2 to 4, they chose one of the following: “Yes”, “No”, or “neither”.

The data from the questionnaires in 2013¹¹) and 2020 were classified into two groups, and Pearson’s χ^2 test was performed using SPSS software (version 21.0; IBM, Tokyo, Japan). In addition, regarding the results of 2020, the four questions were compared amongst the three groups: top-, middle-, and bottom-level teams. The level of significance was set at $p < 0.05$. The study was approved by the Ethics Committee of the Kanazawa Orthopaedic & Sports Medicine Clinic (kanazawa-OSMC-2020-003).

RESULTS

The questionnaires were administered to 246 students, of whom 238 (96.7%) responded completely. The mean age of the respondents was 16.5 ± 0.79 . Compared to the results from 2013, the χ^2 test showed a significant difference in the responses to question 2 only. In 2020, the number of athletes who had knowledge of the local and global muscles significantly increased, and the number of respondents who did not know about the muscles decreased (Table 1). There were no significant differences among questions 1, 3, and 4 compared with those in 2013. As for question 2 in 2020, the top teams had a significantly larger number of student athletes than the middle- and bottom-level teams (Table 2).

DISCUSSION

This study investigated the consciousness and understanding of trunk muscle training among high school soccer players and compared the obtained results with those of a previous survey conducted in 2013. The six high school soccer clubs, at which the surveys had been conducted, had incorporated trunk muscle training as a daily practice. The number of participants who were aware of the classification of trunk muscles increased, compared to that in 2013. However, only 29% of the students

Table 1. Question 2. Knowledge of trunk muscle classification compared between years 2020 and 2013

	Yes (I know)	No (I don't know)	Neither	Total
2020	94 (39%)	109 (46%)	35 (15%)	238
2013	46 (33%)	82 (58%)	13 (9%)	141

Pearson’s Chi-square test $\chi^2=6.058$.
 $p < 0.05$.
 $df=2$.

Table 2. Question 2. Knowledge of trunk muscle classification compared among the three study groups

	Yes (I know)	No (I don't know)	Neither	Total
Top 4	50 (50%)	4 (4%)	46 (46%)	100
Top 16	21 (28%)	17 (23%)	36 (49%)	74
First round losers	14 (22%)	13 (20%)	37 (58%)	64

Pearson's Chi-square test $\chi^2=20.328$.
p<0.05.
df=4.

engaged in training to consciously strengthen their local or global muscles. It demonstrated the insufficient understanding of trunk muscle training among young athletes. Notably, a significantly larger number of student athletes in top teams were aware of the classification than the middle and bottom teams. This finding highlights the importance of education.

During trunk muscle training, athletes need to be conscious of the functional characteristics of trunk muscles, which differ with each sport, as well as their morphological characteristics. Previous studies reported that the transverse abdominal muscles contract faster than the outer muscles in physical activities¹³, and the local muscles showed asymmetrical activity in trunk rotation, suggesting the importance of achieving asymmetrical movements¹⁴. These are considered preliminary operations against reaction forces. Furthermore, several studies have found that morphological characteristics are reflected each sport^{15, 16}. Sanchis-Moysi et al. reported that tennis players showed hypertrophy of the upper abdominal rectus on the non-dominant side¹⁵. Moreover, Australian football players had hypertrophy with their iliopsoas on the dominant side and the quadratus lumborum on the non-dominant side¹⁶. Therefore, an optimal trunk muscle training regimen should be selected for each sport to adapt to the specific movement and purpose.

In this study, student athletes' knowledge of muscle classification improved. However, only a few players were aware of the meaning of trunk muscle training. Liu et al. illustrated the effectiveness of training in a group, which could understand and analyze their training tasks⁹. Furthermore, some studies showed higher activity of the motor cortex in skill training with as much consciousness as strength training^{17, 18}. Thus, it is vital to be conscious of muscle activities and aim strategically during training. Future trunk muscle training should be conducted utilizing a concrete image of soccer play and should ensure that players understand the key muscles involved and their roles in specific movements. Overall, improvements in the understanding of the muscle classification were observed in this study. Comparing this result at the team level, the middle- and bottom-level teams had less knowledge of muscle classification as well as in 2013¹². This finding implies that education may contribute to effective training and team competition. Therefore, to improve the effect of trunk muscle training, an understanding of the role of the inner muscle unit is requisite for the top teams, and knowledge about the anatomy of the trunk muscle has to be informed, especially for middle- and bottom-level players. To realize this, the manager, coach, and trainer should have a sufficient understanding of the anatomical and functional roles of trunk muscles.

This study suggested that trunk muscle training had become popular in 2013, and the knowledge of trunk muscles improved in 2020. However, whether an improvement in the understanding and consciousness of players can contribute to team competition results or injury prevention is still unknown. Therefore, future studies are needed to investigate the relationship between our results and performance levels and injury rates. Moreover, in these future studies, not only soccer but also baseball or track and field should be considered to clarify each sports' characteristics to provide optimal and effective trunk muscle training.

Conflicts of interest

There are no conflicts of interest to declare.

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