The Relationship Among Physical Function, Cognition Function and Emotion of Young Elite Fencing Athletes

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ABSTRACT: There is no definite conclusion about the relationship among physical function, cognition and emotion so far. Thus, the aim of this study is to investigate the relationship between physical function and cognitive and emotional state of the youth fencing athletes by evaluating their body function and cognition and emotion. 40 elite fencing athletes are recruited. All athletes have to be tested their body composition information, physical function, simple reaction time, attention and emotion. The results suggest that physical function has correlation with cognition including their simple reaction time and attention. In addition, the simple reaction time has negative correlation with shoulder mobility and in-line lunge, attention has negative correlation with trunk stability. And trunk stability has correlation with trait anxiety but has no correlation with other affective trait.

1. INTRODUCTION

No matter in match or daily training, for athlete, physical health and mental health play important roles in their career. For physical health, the Functional Movement Screen (FMS) is developed as an evaluation tool for testing the movement patterns of athletes. The FMS is designed from the perspective of the basic movement and used to examine the basic body functions which are reflection of physical health. The flexibility, stability, harmony and symmetry of our body are the reflections of an ability of the cerebellum controlling our trunk. We focus on whether the athletes who have excellent physical function have outstanding cognitive function such as reaction and attention performed by cerebellum in irrelevant sports fields. And Tung Wai Auyeung has showed that poor physical function and muscle strength coexisted with cognitive impairment, independently of muscle mass (Auyeung et al. 2015).

The pressure for success is one of the key factors affecting the performance of players show in sport and usually increases their anxiety. According to Spielberger (Horikawa et al. 2012), there are two kinds of anxieties: state anxiety and trait anxiety. State anxiety reflects a transitory emotional state or a condition that is characterized by subjective, consciously perceived feelings of tension and apprehension, and heightened autonomic nervous system activity. It may fluctuate and can vary in intensity. In contrast, trait anxiety refers to a general tendency to respond with anxiety to perceived threats in the environment, and is a relatively stable characteristic of an individual. An individual with higher trait anxiety feels more threats in many situations than someone with low trait anxiety. In addition, anticipated failure or threats to self-esteem can be more devastating than threats to physiological condition.

Hence, this study aimed at exploring the importance preliminarily of the functional movement training means for cognition and emotion and laying a foundation for the young elite fencing athletes gaining superior performance.

2 METHODS

2.1. Subject
Forty elite fencing athletes were recruited. All the athletes had specific athletic skills or long-term exercise history. Volunteers were excluded if they had diseases that may affect their body function. All the subjects had no pre-test abnormal emotional impact and had been required to have adequate rest and normal life behavior.

2.2. Tests

2.2.1. Functional Movement Screen (FMS)
This study mainly tested their basic movement performance. The functional movement screen is a standardized, field-expedient test battery intended to
assess movement quality and has been used clinically in pre participation screening and in sports injury research. Each participant performed the series of seven functional movement screens (Duncan et al. 2013) including deep squat, hurdle step, in-line lunge, shoulder mobility, active straight raise, trunk stability-push up and rotary stability. And we would score the seven FMS tests by watching the motion of subjects performed. The standard for evaluation is divided into four levels: 3 points represents the subject can perform one FMS test accurately. 2 points represents the subjects can perform one FMS test by rule but the subject has compensated movement in the process of performance. 1 point represents the subjects cannot perform the test and once the subjects felt pain in the process of the performance, the subject would get 0 point.

2.2.2. Cognition test
We tested two main cognition parameters-simple reaction time and attention by PsyKey psychological system. When tested simple reaction time, the stimulus presented on the computer and responses made by subjects were a fixed one. This study tested visual simple reaction time. Visual stimulation was a green circle, the subjects needed to press green key as their response. This test contained 30 times, each time intervals for 2 seconds. When tested attention, there was a 4*4 table on the computer. These 16 numbers appeared in 16 divisions randomly. Subjects needed to pick up numbers from 1 to 16 in sequence. Subjects need to repeat this test three times and the scores which subjects gain from three tests would be averaged.

2.2.3. Emotion test
We tested the depression of the subjects by using Beck Depression Inventory (BDI). The score of BDI is divided into four levels. 0 to 4 points indicates the subjects were not depressed, 5 to 7 points indicates the subjects had mild depressive symptoms, 8 to 15 points indicates the subjects had moderate depressive symptoms and over 16 points indicates the subjects had severe depressive symptoms.

We tested the self-esteem of the subjects by using Rosenberg self-esteem scale (SES). The subject with lower 15 scores for Rosenberg scale indicates low self-esteem and the scores which is between 15 and 25 is in normal range.

To evaluate two different types of anxieties, we used the State-Trait Anxiety Inventory (STAI). Each form has 20 items using four-point Likert-scales, with total scale scores ranging from 20 to 80 (Ursache 2014).

2.3. Statistics
All data were presented as means ± SD, and analyzed by SPSS20.0. Spearman correlation analysis was done among physical function indicators, cognitive indicators and emotion indicators.

3 RESULTS
3.1. Functional movement screen parameters of all the subjects.
Table 1 showed functional movement screen parameters of all the subjects. An individual with higher scores indicates the subjects can perform the motion in an easy manner and the subjects did not feel any pain in the work-out process.

<table>
<thead>
<tr>
<th>Deep squat</th>
<th>Hurdle step</th>
<th>In-line lunge</th>
<th>Shoulder mobility</th>
<th>Active straight raise</th>
<th>Trunk stability push-up</th>
<th>Rotary stability</th>
<th>FMS Total points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 1.86±0.70 1.95±0.21 2.07±0.62 2.54±0.70 2.05±0.71 1.66±0.83 1.80±0.51 14±2.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.2. Cognitive parameters of all the subjects.
Table 2 showed cognition parameters of all the subjects. An individual with shorter test time indicates the subjects have more sensitive response and more concentrated attention.

<table>
<thead>
<tr>
<th>simple reaction time (s)</th>
<th>attention (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 0.28±0.02 8.33±1.46</td>
<td></td>
</tr>
</tbody>
</table>

3.3. Emotion parameters of all the subjects.
Table 3 showed emotion parameters of all the subjects. The result shows the BDI scores of fencing athletes gain is among 0 to 4, 5 to 7 and 8 to 15. It indicates the depression level of most fencing athletes lay below moderate depression. The scores of SES is in normal range for most fencing athletes. And an individual with higher trait anxiety score tends to have higher state anxiety score.
Table 3. Emotion parameters of all the subjects.

<table>
<thead>
<tr>
<th></th>
<th>BDI</th>
<th>SES</th>
<th>T-AI</th>
<th>S-AI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>5.94±3.40</td>
<td>18.06±4.86</td>
<td>46.5±9.90</td>
<td>41.69±6.13</td>
</tr>
</tbody>
</table>

3.4. The correlation between functional movement and cognition parameters of all the athletes.

Table 4 showed the correlation between functional movement and cognition parameters of all the athletes. The simple reaction time has negative correlation with shoulder mobility and In-line lunge, attention has negative correlation with trunk stability. However, the simple reaction time had no correlation with other items of FMS and attention just had correlation with trunk stability.

Table 4. The correlation between functional movement and cognition parameters of all the athletes.

<table>
<thead>
<tr>
<th>Deep squat</th>
<th>Hurdle step</th>
<th>In-line lunge</th>
<th>Shoulder mobility</th>
<th>Active straight raise</th>
<th>Trunk stability push-up</th>
<th>Rotary stability</th>
<th>FMS Total points</th>
</tr>
</thead>
<tbody>
<tr>
<td>The simple reaction time (S)</td>
<td>-.007</td>
<td>.075</td>
<td>-.372*</td>
<td>-.322*</td>
<td>-.069</td>
<td>-.073</td>
<td>.217</td>
</tr>
<tr>
<td>attention (ms)</td>
<td>-.261</td>
<td>-.169</td>
<td>-.122</td>
<td>-.134</td>
<td>-.106</td>
<td>-.333*</td>
<td>.027</td>
</tr>
</tbody>
</table>

* At the 0.05 level (bilateral) significant correlation.

Table 5. The correlation between functional movement and emotion parameters of all the subjects.

<table>
<thead>
<tr>
<th>Deep squat</th>
<th>Hurdle step</th>
<th>In-line lunge</th>
<th>Shoulder mobility</th>
<th>Active straight raise</th>
<th>Trunk stability push-up</th>
<th>Rotary stability</th>
<th>FMS Total points</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDI</td>
<td>-.191</td>
<td>-.125</td>
<td>-.216</td>
<td>.069</td>
<td>-.240</td>
<td>-.221</td>
<td>-.023</td>
</tr>
<tr>
<td>SES</td>
<td>.034</td>
<td>.070</td>
<td>.310</td>
<td>.017</td>
<td>.040</td>
<td>.258</td>
<td>-.073</td>
</tr>
<tr>
<td>T-AI</td>
<td>-.105</td>
<td>-.095</td>
<td>.222</td>
<td>.044</td>
<td>-.086</td>
<td>-.364*</td>
<td>.105</td>
</tr>
<tr>
<td>S-AI</td>
<td>.169</td>
<td>.075</td>
<td>.012</td>
<td>-.028</td>
<td>.155</td>
<td>-.041</td>
<td>.121</td>
</tr>
</tbody>
</table>

* At the 0.05 level (bilateral) significant correlation.

3.5. The correlation between functional movement and emotion parameters of all the subjects.

Table 5 showed the correlation between functional movement and emotion parameters of all the subjects. The trait anxiety has negative correlation with trunk stability and it indicates the subjects who had a more stable trunk had less trait anxiety.

4. DISCUSSION

The Functional Movement Screen is a pre-participation screening tool which evaluates the Fundamental Movement Patterns that underpin performance of all movement. The fundamental movement patterns can reflect the physical function. Physical function is also controlled by the cerebellum. The cerebellum is not only important for motor but also for those cognitive functions (Niederer et al. 2011). This study tests the young fencing athletes who are on the stage that neuromuscular control system develops rapidly. We scored the seven FMS tests by observing the motion of subjects performed. The good grade that the subjects get from FMS reflects their postures and movements of body are well coordinated. And the score represents the ability of cerebellum controlling the body. So the scores are a mirror of the function of cerebellum which is also a symbolic significance of cognition function.

Cognition is the most important psychological condition that people complete any tasks, including language information, intelligence skills, cognitive strategies and so on (Ursache 2014). This study chooses two cognition parameters that may be associated with functional movement, simple reaction time and attention. Results of this study suggest that functional movement is related to cognition function. Getchell et al. suggest that cerebella dysfunction may account for differences in cognition (Getchell et al. 2007). The result shows there is a correlation between the simple reaction time and shoulder mobility and In-line lunge. The two items of FMS is related to physical coordination, and physical coordination is the basis of sensitive reaction in the process of movement. And attention test shows attention has negative correlation with trunk stability. The result of attention test shows that the subject who costs less time is more focused. So
The subject who has more stable trunk costs less time and is more dedicated.

The result about emotion we only find trait anxiety has correlation with trunk stability. An individual with higher trait anxiety score tends to have higher state anxiety score. Both high and low levels of state anxiety can interfere with physical function performance, it is considered that the relationship between state anxiety and performance would show an inverted-U relationship. And the literature still lacks consistent results on the relationship between trait anxiety and performance. Furthermore, according to our results, the physical function may have correlation with some emotion parameters which need to be explored further.

5. CONCLUSIONS

The results suggest that physical function have an effect on cognition including their simple reaction time and attention. In addition the simple reaction time has negative correlation with shoulder mobility and in-line lunge, attention has negative correlation with trunk stability. The trunk stability has correlation with trait anxiety but has no correlation with other affective trait.

6. ACKNOWLEDGEMENTS

We gratefully acknowledge the financial support by NSF of China (Grant No. 30900709), Innovation Platform of Beijing Municipality (Grant No. PXM2015_014206_000053, PXM2015_014206_000072, PXM2015_014206_000051). The authors declare no conflict of interest.

REFERENCES