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Research Article

Correlation between scapular dyskinesia and core deficities in a group of competitive swimmers: an observational study

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Scapular Dyskinesia, Core, Competitive Swimmers, Core Inefficiency, Scapular Pattern, Shoulder, Swimming

Abstract

Background
The core and the shoulder are the focal points of the sporting gesture in swimming and their close connection allows the swimmer to express all his performance skills. For this reason, when one of these two components in dysfunctional, it can also compromise the other. Over the years, both the core and the shoulder have only been studied separately, so understanding their possible correlation is essential in order to improve not only the evaluation but also the treatment of these athletes.
Objectives
The aim of this study is to evaluate and analyze the presence of the correlation between scapular dyskinesia and core inefficiency in a group of swimmers.
Methods
The athletes were evaluated through the use of test batteries developed through the analysis of scientific literature and through validated evaluation scales. The tests used concerned: the analysis of the scapular pattern, specific tests for scapular dyskinesia, differential evaluation tests with shoulder restrictions and impingement and core evaluation tests.
Results
The athletes evaluated had a mean age of 16.93 at the time of data collection, with a range from 16 to 18 years. Ten athletes showed a type I scapular pattern; in fifteen they showed the presence of scapular dyskinesia while for the evaluation of the core in the majority they showed an inefficiency with chronometric times that are positioned below the average. No athlete showed positive differential tests for shoulder restraints and impingement.
Conclusions
Data analysis showed that, in the group examined, there is indeed the presence of scapular dyskinesia and core inefficiency. The limit of this study concerns a possible generalization of the parameters sought, for this reason it would be useful in future research to investigate this correlation also in different swimming realities in order to be able to overcome this limitation and increase knowledge to improve both the functional evaluation and the subsequent treatment.

INTRODUCTION

The core represents the central nucleus from which the necessary stability develops to be able to obtain a correct swim and significantly affects speed, effectiveness and efficiency in terms of reducing energy consumption. It allows to guarantee the three fundamental aspects of swimming such as hydrodynamics, correct body position and roll which make the friction forces of the water less effective in slowing down the motion of the body and guarantee a correct cutting line of the water with the stroke, increasing push capabilities. In addition to this, the stability provided by the core also comes into play in the correct scapular movement during the execution of the sporting gesture, therefore its weakness affects as a predisposing factor in scapular dyskinesia. Normal scapular motion is essential for an efficient and effective swim. When this movement is altered from the kinematic point of view, we are faced with the clinical picture defined as scapular dyskinesia. Scapular dyskinesia is the result of several clinical conditions such as (1): impaired activation of the scapula stabilizer muscles, damage to the nerve compartment that innervates the scapula, and shortening of the pectoralis minor length. It manifests itself in the swimmer as an asynchronism of muscle activation forces between the serratus anterior and its antagonist, the scapular retractor, the rhomboid. Furthermore, its manifestation can be accompanied by a postural attitude which presents itself with an increase in dorsal kyphosis and an anteposition of the head which lengthens and renders the scapula retractors ineffective, thus causing an anterior tilt and protraction. (7) In consideration of all these factors

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and their impact on the swimmer, the purpose of this observational study is to analyze in practice the real correlation between these two components and how they occur in a group of swimmers at a competitive level.

MATERIALS AND METHODS

The observational study examined a group of 15 athletes, with an average age of 6.93 ± 0.80, made up of athletes of both sexes who perform at least 6 weekly workouts lasting 2/3 hours. (Tab. 1) Each athlete was individually examined through an evaluation protocol consisting of test batteries with the aim of examining the two parameters sought: the presence of scapular dyskinesia and the functional effectiveness of the core. Each participant (if of age) or a parent/guardian was required to sign an informed consent form for participation in the observational study. Furthermore, the presence or absence of pain or previous pathologies in the shoulder was noted.

(3,1) Scapular dyskinesia evaluation: Scapular pattern observation, Pathology-specific test for dyskinesia. (4) Differential evaluation with shoulder range of motion restriction and impingement: Scapular axillary hair test at the end of flexion, Clavicular movement, Scapular posterior tilt during the last phase of flexion, Cervicothoracic joint movement during the last phase of flexion. (5,6) Core evaluation: Prone bridge test, Lateral side bridge test, Trunk flexor test, Trunk extensor test.

RESULTS

The data collected showed that almost all of the athletes examined presented an altered scapular movement characterized by a type I scapular pattern when observing the scapular (Tab. 4). In the scapular dyskinesia test battery, 100% of the participants showed signs of dysrhythmia and/or winging, mostly manifesting as a marked abnormality (Tab. 5). As regards the differential evaluation battery, no participant showed positivity to all 4 tests. Only 4 out of 15 participants showed positivity on the first test, but the terms of inclusion to be able to declare the presence of impingement syndrome or shoulder movement restrictions were at least 3 out of 4 tests with a positive result. (Tab. 6) In the evaluation of the core the participants showed a mostly below average efficiency, in some cases the times were average. In all tests, participants lost proper alignment causing time recording to stop due to test failure. (Tab. 6) The results were also analyzed using graphs for a more analytical view. (Fig. 3, 4, 5 and 6)

DISCUSSION

The correlation between scapular dyskinesia and core inefficiency is an understudied topic in the literature. In most of the joints examined, the two parameters were studied individually in swimmers, thus highlighting the need to investigate a possible union of the two parameters. The results obtained, regarding the presence of scapular dyskinesia, summarized in tab. 4 show how in the totality of the sample an abnormality in the movement was highlighted and specifically how this abnormality is marked in almost more than half of the athletes. Furthermore, in some athletes, the simultaneous presence of both parameters of the abnormality sought (winging and dysrhythmia) has been disclosed. On scapular observation, the pattern with the greatest manifestation was the type I pattern, thus suggesting that this type of pattern may define a greater predisposition to the development of scapular dyskinesia. Furthermore, the presence of dyskinesia in swimmers may be linked to the activity itself, in fact the sporting gesture of swimming, with its great demand for high-intensity and cyclically repeated movements, may lead to easier fatigue of the serratus anterior and subscapularis, important in scapular stabilization may lead to easier fatigue of the serratus anterior e subscapularis, important in scapular stabilization also to avoid chronic pain (7,8,9). In fact, the athletes examined did not show positivity in the differential evaluation tests with shoulder restrictions, as reported in tab. 5, thus confirming a closer link of dyskinesia to swimming activity. As regards the functional evaluation of the core analyzed in tab. 6, most of the sample was tested on functional parameters that are below average, outlining a picture of core weakness. In summary, these results indicate the possible coexistence of scapular dyskinesia and core inefficiency in the sample examined. There are some limitations in this study, in fact the sample examined was composed of athletes belonging to the same competitive team and more precisely to the same training group. This factor could reduce a possible generalization. Despite this, the athletes during the competitive season were not followed by a single coach but attended various swimming pools, thus following structurally different training sessions and with a variety that can be attributed to a larger sample.

CONCLUSIONS

The work highlighted, through the analysis of the collected data, the presence of scapular dyskinesia in correlation to a core inefficiency in a group of young swimmers. The knowledge of the coexistence of these two clinical pictures can be important at a clinical level, in order to base a treatment that takes into account both components and at a sporting level for the figures that revolve around the athlete, in order to better understand the problems that can afflict athletes to be able to intervene more effectively and improve performance. It would be useful to deepen this correlation at the level of scientific research in the future to enrich a functional evaluation and a targeted treatment.

	MALE	FEMALE	TOTAL
	Mean ± DS	Mean ± DS	Mean ± DS
Age, y	21.66 ± 0.93	16.67 ± 0.52	16.93 ± 0.80
Weight, Kg	69.26±4.12	52.21±5.09	64.4 ± 7.01
Height, h	1.76±0.05	1.59±0.05	1.69 ± 0.10
BMI, Kg/m2	22.37 ± 1.22	20.61 ± 1.25	21.66 ± 1.48

List of abbreviations: *y, years; Kg, kilograms; h, height; BMI, Body Mass Index.*
Table 1: *Characteristics of the sample*

Athlete	Scapular pattern
1	IV
2	I
3	I
4	I
5	II
6	I
7	III
8	I
9	III
10	I
11	I
12	I
13	I
14	I
15	II

Table 4: *Scapular observation results*

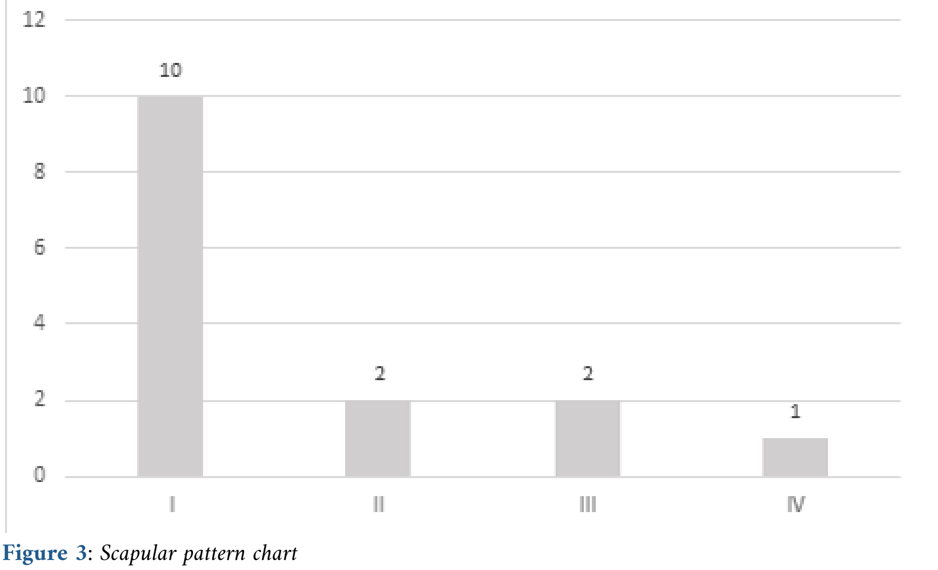

Figure 3: *Scapular pattern chart*

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Athlete	Flexion Test	Abduction Test	Weight used
1	SD	OW	1.4
2	D_OW	D_OW	1.4
3	D_OW	D_OW	1.4
4	D_OW	OW	1.4
5	OW	D_OW	1.4
6	D_SW	D_OW	2.3
7	OW	D_OW	2.3
8	D_OW	D_OW	1.4
9	D_OW	OW	1.4
10	D_OW	D_OW	1.4
11	D_OW	D_OW	2.3
12	D_SW	SD	2.3
13	D_OW	D_OW	2.3
14	D_OW	OD	1.4
15	D_OW	D_OW	2.3

List of abbreviations: *SD, Subtle Dysrhythmia; D_OW, Dysrhythmia and Obvious Winging; OW, Obvious Winging; D_SW Dysrhythmia and Subtle Winging; OD Obvious Dysrhythmia.*

Table 5: *Pathology-specific dyskinesia test results*

Athlete	Age	Gender	Test 1	Test 2	Test 3	Test 4
1	16	F	P	N	N	N
2	17	F	P	N	N	N
3	17	F	N	P	N	N
4	17	F	N	N	N	N
5	16	M	N	N	N	N
6	16	M	N	N	N	N
7	17	M	N	N	N	N
8	16	F	N	N	N	N
9	18	M	N	N	N	N
10	17	F	N	N	N	N
11	18	M	P	N	N	N
12	18	M	N	N	N	N
13	17	M	N	N	N	N
14	18	M	N	N	N	N
15	16	M	P	N	N	N

List of abbreviations: *M, Male; F, Female; P, Positive; N, Negative.*

Table 6: *Differential test results for shoulder restraints*

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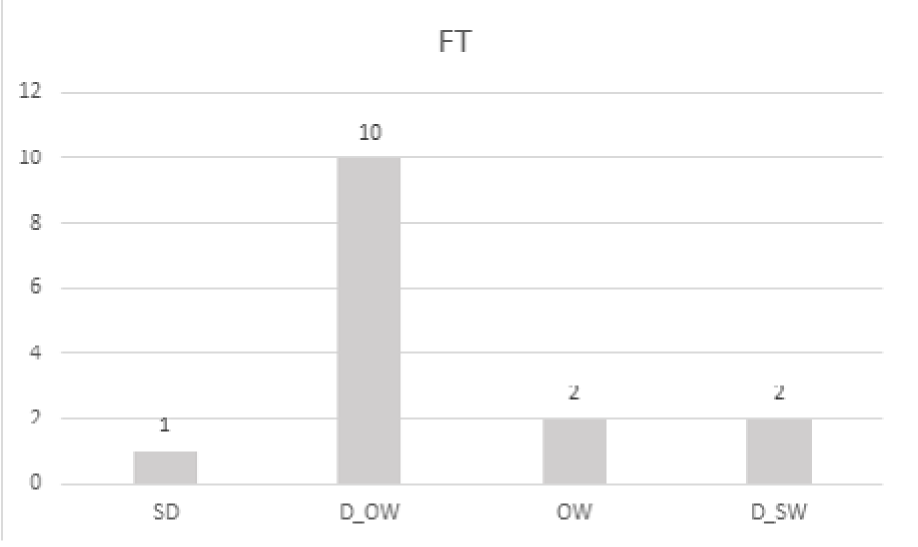
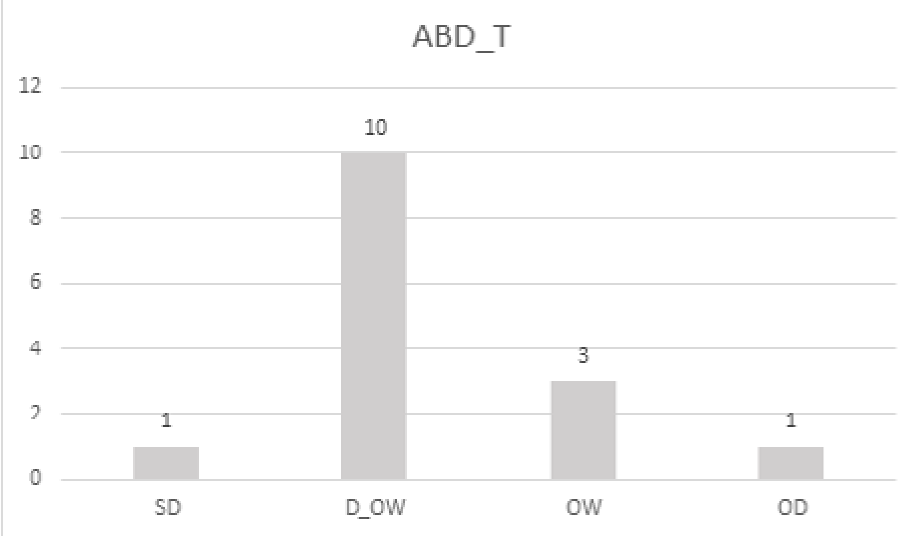


List of abbreviations: FT, Flexion Test; SD, Subtle dysrhythmia; D_MW, Dysrhythmia and obvious winging; MW, Obvious winging; D_SW, Dysrhythmia and subtle winging.



***List of abbreviations**: ABD_T, Abduction Test; SD, Subtle Dysrhythmia; D_OW, Dysrhythmia and obvious winging; OW, Obvious winging; OD, Obvious dysrhythmia.*

Figure 4: *Pathology-specific dyskinesia test charts*

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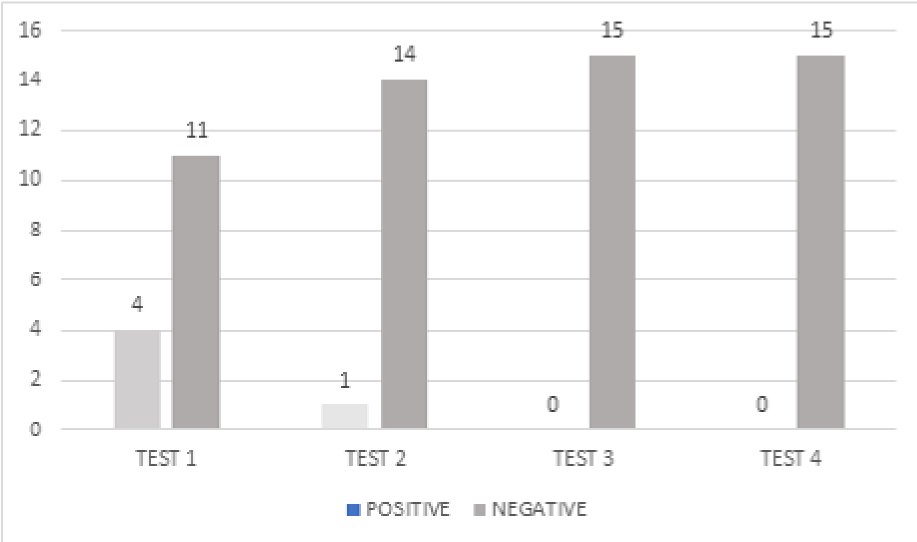

Figure 5: *Differential test chart for shoulder restraints*

Table 7: Core efficiency test results

PBT				
Athlete	Time	Failure	Loss of alignment	
1	33 seconds	No	Yes	Below Avarage
2	40 seconds	No	Yes	Below Avarage
3	33 seconds	No	Yes	Below Avarage
4	1 minute 13 seconds	No	No	Avarage
5	39 seconds	No	Yes	Below Avarage
6	40 seconds	No	Yes	Below Avarage
7	25 seconds	No	Yes	Poor
8	1 minute 02 seconds	No	No	Avarage
9	37 seconds	No	Yes	Below Avarage
10	1 minute e 01 seconds	No	No	Avarage
11	1 minute e 15 seconds	No	No	Avarage
12	1 minute	No	No	Avarage
13	47 seconds	No	Yes	Below Avarage
14	39 seconds	No	Yes	Below Avarage
15	48 seconds	No	Yes	Below Avarage

List of abbreviations: PBT, Prone Bridge Test.

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	LBT_R				LBT_L			
Athlete	Time	Failure	Loss of alignment		Time	Failure	Loss of alignment	
1	20 seconds	No	Yes	Below Avarage	30 seconds	No	Yes	Below Avarage
2	20 seconds	No	Yes	Below Avarage	25 seconds	No	Yes	Below Avarage
3	28 seconds	No	Yes	Below Avarage	16 seconds	No	Yes	Below Avarage
4	36 seconds	No	Yes	Below Avarage	40 seconds	No	Yes	Below Avarage
5	24 seconds	No	Yes	Below Avarage	41 seconds	No	Yes	Below Avarage
6	42 seconds	No	Yes	Below Avarage	26 seconds	No	Yes	Below Avarage
7	25 seconds	No	Yes	Below Avarage	32 seconds	No	Yes	Below Avarage
8	47 seconds	No	Yes	Below Avarage	58 seconds	No	Yes	Below Avarage
9	30 seconds	No	Yes	Below Avarage	40 seconds	No	Yes	Below Avarage
10	36 seconds	No	Yes	Below Avarage	45 seconds	No	Yes	Below Avarage
11	28 seconds	No	Yes	Below Avarage	40 seconds	No	Yes	Below Avarage
12	48 seconds	No	Yes	Below Avarage	1 minute 08 seconds	No	No	Avarage
13	50 seconds	No	Yes	Below Avarage	49 seconds	No	Yes	Below Avarage
14	1 minute	No	Yes	Avarage	42 seconds	No	Yes	Below Avarage
15	50 seconds	No	Yes	Below Avarage	27 seconds	No	Yes	Below Avarage

List of abbreviations: *LBT_R, Lateral Bridge Test Right; LBT_L, Lateral Bridge Test Left.*

TFT			
Athlete	Time	Failure (bench touch)	
1	40 seconds	No	Below Avarage
2	1 minute e 15 seconds	No	Avarage
3	32 seconds	No	Below Avarage
4	56 seconds	No	Below Avarage
5	1 minute e 08 seconds	No	Avarage
6	36 seconds	Yes	Below Avarage
7	1 minute e 20 seconds	No	Avarage
8	1 minute e 09 seconds	No	Avarage
9	1 minute e 06 seconds	No	Avarage
10	54 seconds	No	Below Avarage
11	1 minute e 20 seconds	No	Avarage
12	1 minute e 30 seconds	No	Avarage
13	1 minute e 29 seconds	No	Avarage
14	1 minute e 26 seconds	No	Avarage
15	1 minute e 18 seconds	No	Avarage

List of abbreviations: *TFT, Trunk Flexor Test*

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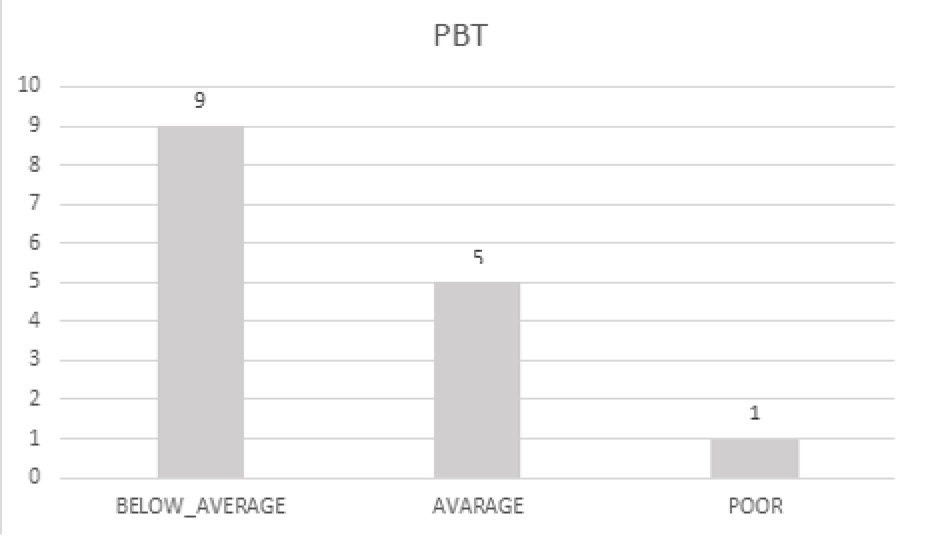
TET				
Athlete	Time	Failure	Loss of alignment	
1	36 seconds	No	Yes	Below Avarage
2	11 seconds	No	Yes	Below Avarage
3	44 seconds	No	Yes	Below Avarage
4	32 seconds	No	Yes	Below Avarage
5	24 seconds	No	Yes	Below Avarage
6	30 seconds	No	Yes	Below Avarage
7	31 seconds	No	Yes	Below Avarage
8	48 seconds	No	Yes	Below Avarage
9	1 minute	No	Yes	Avarage
10	42 seconds	No	Yes	Below Avarage
11	20 seconds	No	Yes	Below Avarage
12	33 seconds	No	Yes	Below Avarage
13	50 seconds	No	Yes	Below Avarage
14	56 seconds	No	Yes	Below Avarage
15	54 seconds	No	Yes	Below Avarage

List of abbreviations: *TET Trunk Extensor Test*

Table 7: Core efficiency test results

Figure 6: *Core efficiency test charts*



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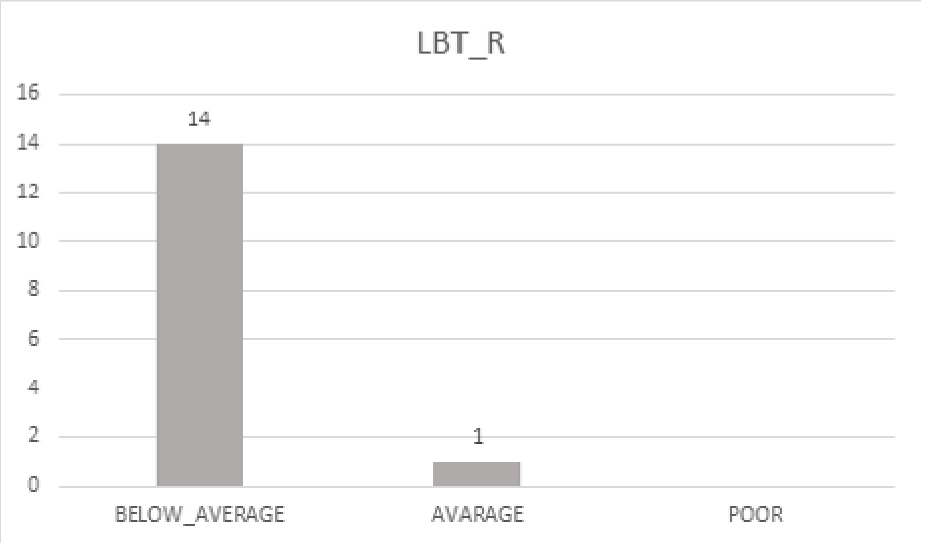

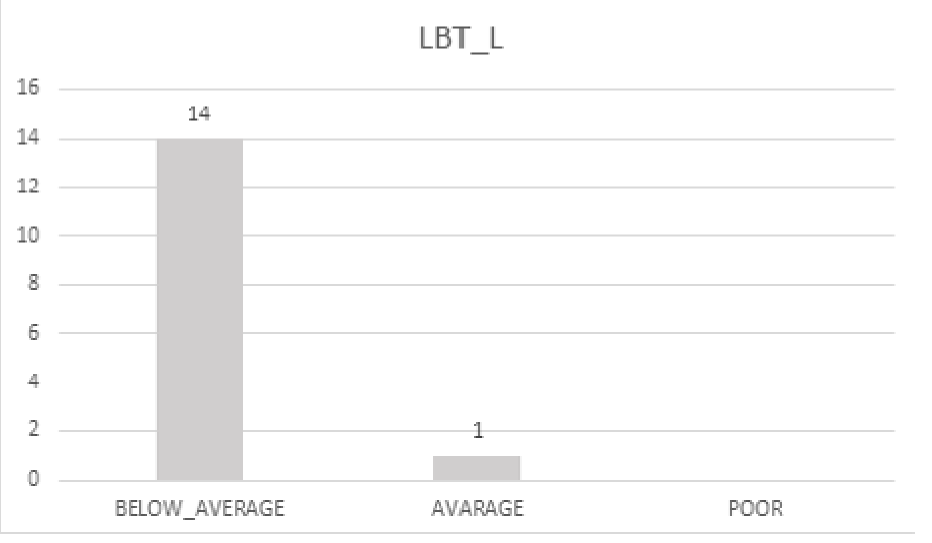

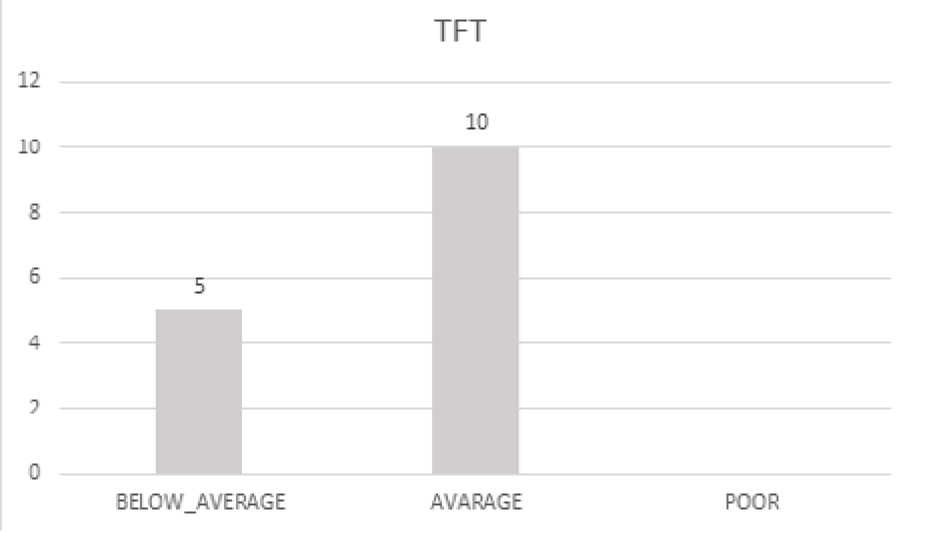

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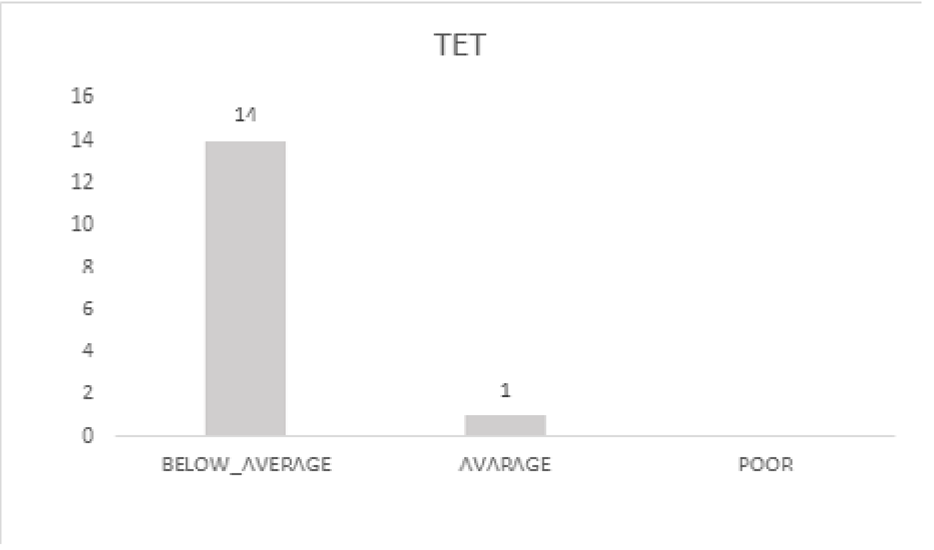

List of abbreviations: *PBT, Prone Bridge Test; LBT_R, Lateral Bridge Test Right; LBT_L, Lateral Bridge Test Left; TFT, Trunk Flexor Test; List of abbreviations: TET Trunk Extensor Test.*

Figure 6: *Core efficiency test charts*

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