

Postural weakness test using activforce device for regional muscle force in young volleyball athletes

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ABSTRACT

Postural weakness measurements are evaluated with hand dynamometer postural muscle testing to assess regional force range of motion. The aim of the study is to determine the strength and range of motion of young volleyball players according to peak and average force and regional muscle activation tests of 24 upper and lower body muscle groups. Subjects mean age 16 year participated in this study. Methodology was conducted activforce isometric muscle activation on examiner stability and proper measurement techniques. One and last (after 6 month) measured general force characteristics to determine peak and average force. Body peak force characteristics resulted large effect size, however, EF, EP, WE, WABD, KE, and AE not significant effect size. Body average force characteristics resulted large effect size, however, EF, WE, KE, AE not significant effect size with outcomes correlated on upper and lower body regional muscle force relationship. In this results can provide full body range of motion force production on testing condition to sport specific tasks, force measurements, postural weakness detection.

Keywords: Performance analysis, Activforce device, Upper and lower region, Postural weakness.

Cite this article as:

Kesler, A., & Kahraman, Y. (2025). Postural weakness test using activforce device for regional muscle force in young volleyball athletes. *Scientific Journal of Sport and Performance*, 4(4), 570-577. <https://doi.org/10.55860/SES7112>



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Submitted for publication May 31, 2025.

Accepted for publication August 02, 2025.

Published August 23, 2025.

Scientific Journal of Sport and Performance. ISSN 2794-0586.

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doi: <https://doi.org/10.55860/SES7112>

INTRODUCTION

Human posture is described anatomical static alignment on ground location to proper plumbline in various position of joints and body segment (Kahraman, 2020). This postural position is essential to analyse muscle regional force (Kahraman, 2021). Postural regional force classifications activate one or two joint range of motion to shorten (i.e., concentric contraction) through muscle strength strong and simultaneously in anterior medial, posterior lateral represented by the length-strain curve (Conory et al., 2005). As defined by O'Connell and Gardner (1972) and Kendall et al (1952), passive ability and stabilities of a muscle indicated of full range motion of any joint such as shortness of a muscle length of multi joint, is not sufficient to permit normal elongation. Additionally, regional muscle force of multi or more joints produce simultaneously mechanical range of motion by sufficiency lengthening to achieve full range of motion produce shorten muscle in greatest strength test position (Conory et al., 2005; Andrews et al., 1996). For example, gravities of postural location in anatomical muscle position offered best test position may be resulted strain of the muscle force (Kendall et al., 2005). Muscle weakness restricts mechanical joint range of motion, frequently regional muscle did not complete the normal range of motion to actual weak should be so graded (Conory et al., 2005). However, this postural alignment is important to recognize potential force improvement, relieving strain on muscle force throughout muscle belly protected an adequate normal position resulting from joint instability (Andrews et al., 1996).

Postural location is alignment on mechanical joint range of motion to different muscle strong (Kendall et al., 2005). In that location properly measures joint upper and lower body segment (Andrews et al., 1996). Muscular body force testing used for determining length of muscle produce peak and average force in range of motion to instability (Kahraman, 2024). The capability of postural muscle weakness to isometric muscle function provides stability desired muscle force testing (Kahraman & Kesler, 2025). The activity postural muscle is promoted with strength testing (Conroy et al., 2005). Many postural conditions has been characterized by muscle weakness of detected mechanical force modelling patterns i.e., range of motion (Kendall et al., 2005). In this reason, muscle force characteristics provide on return of optimal strength in individual, therefore postural imbalance muscle properties associated with adequate regional peak and average force (Kahraman, 2024; Kahraman & Kesler, 2025). Muscle force devices such as activforce dynamometers measure the regional body force increase to exert muscle force decrease detection (Karagiannopoulos et al., 2022). Device is encumbered for muscle of mechanical range motion positioning segment, controlling movement function direction (Karagiannopoulos et al., 2022). Last year ago in literature revealed some reliability for upper regional force demonstrated good intratester reliability using activforce dynamometer (Karagiannopoulos et al., 2022; Kahraman & Kesler, 2025). In muscle force production also measured maximal shoulder, elbow, wrist, hip, knee and ankle range of motion on muscle regional forces. The dynamometers obtained to testing of adequate strength to hold stability against the effort to the tested individual as well as maximum force limited by upper and lower regional body muscles (Andrews et al., 1996).

Activforce hand dynamometer to muscle contraction time isometric force activation is normative to estimated normalized peak and average force as well as a valid and reliable method, however, limited knowledge statement is available regarding length-strain curve (Andrews et al., 1996; Karagiannopoulos et al., 2022). Accordingly, available studies are inadequate to sport modalities on isometric regional force of postural weakness and strong activation. Karagiannopoulos et al (2022) reported that upper body shoulder on mechanics provided potential range of motion in isometric activation of individuals. Isometric activation again determines priority muscle weakness, muscle strong, length-strain curve in peak or average force totally (Kahraman, 2024; Kahraman & Kesler, 2025). In this as Karagiannopoulos et al (2022) investigation of muscle length-strain curve have been promoted individual as mechanical range of motion in specifically upper

body region. However, isometric force of individuals only was performed on reliability measurement in shoulder flexion and extension. To resistance strong continuum of mechanical force contrast external hand dynamometer in isometric action was used to range of motion and muscle strain of movement speed on static one or multi joint mechanical force. Therefore, the study to aimed investigate postural weakness by mechanical force and range of motion of regional muscle groups in young volleyball athletes.

MATERIAL AND METHODS

Subjects

Total 13 young volleyball players in professional league, age (16.01 ± 0.72 yr), height (1.70 ± 0.42 m) and body mass (58.73 ± 4.51 kg) participated in this study. Young volleyball players were provided postural weakness isometric force protocol. The experimental isometric force measurement processes evaluated in the sport laboratory. Inclusion criteria stated to health performance was formed to generally body health is optimal and no prevent training. Total time to all body force was 20 min only for one subject. Subjects assigned appropriately in population creating were obtained detect calculation effect size $d = 1.14$ min value change to minimum one values, α error probability = .5 and power ($1-\beta$) error probability = .95 transferred by G*Power sample analysis. This study stated that quality score was formed to first study implement.

Test procedure

Postural weakness grades result to strain formation force offered by gravity on anatomical body axis. A break postural weakness test was conducted on muscle strength activforce isometric muscle activation exerted by an individual performance in isometric contraction used determining good postural alignment (Conory et al., 2005). The optimal test position was performed completion of mechanical one joint muscles and two or more joint muscles to can be assessed isometric peak and average force is at midrange of overall length-strain curve principle. Test using, postural position enabled the examiner to detect postural alignment and other muscle contraction immediately to hold test position. Subjects were included in test to isometric peak and average force based on time-dependent protocol of mechanical range of motion. Total time was to maximal isometric muscle force 20 min in one subject. To muscle isometric activation evaluated to use activforce 2 hand dynamometer. Addition, isometric dynamometer measured one joint postural alignment muscle force similar in ICC = 0.85-0.99 (Karagiannopoulos et al., 2022). All of body joint muscle force analysed on 24 mechanical range of motion regions in near joint proximal. Testing process formed mechanical range of motion: Shoulder flexion (SF), shoulder extension (SE), shoulder abduction (SABD), shoulder adduction (SADD), shoulder lateral rotation (SLR), shoulder medial rotation (SMR), elbow flexion (EF), elbow extension (EE), elbow supination (ES), elbow pronation (EP), wrist flexion (WF), wrist extension (WE), wrist abduction (WABD), wrist adduction (WADD), hip flexion (HF), hip extension (HE), hip abduction (HABD), hip adduction (HADD), knee flexion (KF), knee extension (KE), ankle plantar flexion (APF), ankle dorsal flexion (ADF), ankle inversion (AI), ankle eversion (AE) (Andrews et al., 1996).

Statistical analysis

Priority postural weakness was tested on mechanical force and range of motion measurement on the young volleyball athletes. To peak and average isometric force determine were executed min, max and mean descriptive analysis. One measurement and last measurement (after 6 month) differences determined with one way ANOVA f test to significant time-dependent measurement. The measure effect size was Cohen'd: small – 0.20, moderate – 0.50 and large - >0.80 large in significant level was p -values (<.05) (Cohen, 1988). To regional force detection from one and last measurements was analysed on the correlation relationship (p < .05).

RESULTS

To body range of motion peak force concluded on Table 1.

Table 1. Body range of motion peak force.

ROM	Peak force Min		Peak force Max		Peak force Mean		Peak force F-test	p-Value	ES
SF	54.52 ^a	89.49 ^b	138.76 ^a	163.24 ^b	95.15 ^a	129.13 ^b	13.312	.003	1.47
SE	70.31 ^a	108.85 ^b	134.64 ^a	221.59 ^b	93.38 ^a	144.44 ^b	28.194	.000	1.82
SADB	59.52 ^a	94.52 ^b	125.23 ^a	174.07 ^b	96.74 ^a	133.95 ^b	30.917	.000	1.80
SADD	58.25 ^a	111.93 ^b	131.60 ^a	173.50 ^b	83.46 ^a	136.14 ^b	62.186	.000	2.61
SLR	51.09 ^a	94.07 ^b	161.71 ^a	220.40 ^b	92.58 ^a	148.38 ^b	23.836	.000	1.56
SMR	60.60 ^a	86.46 ^b	127.78 ^a	163.04 ^b	78.41 ^a	121.09 ^b	35.498	.000	2.07
EF	81.00 ^a	97.25 ^b	224.74 ^a	228.14 ^b	132.69 ^a	139.38 ^b	0.355	.562	trivial
EE	51.97 ^a	120.55 ^b	144.45 ^a	217.86 ^b	102.56 ^a	162.86 ^b	26.805	.000	1.93
ES	58.25 ^a	83.47 ^b	142.19 ^a	179.24 ^b	84.21 ^a	137.53 ^b	28.201	.000	1.92
EP	62.27 ^a	82.94 ^b	142.78 ^a	163.57 ^b	105.30 ^a	125.50 ^b	4.600	.053	trivial
WF	54.91 ^a	69.04 ^b	116.99 ^a	128.73 ^b	85.28 ^a	110.89 ^b	17.365	.001	1.40
WE	59.82 ^a	53.55 ^b	116.99 ^a	121.93 ^b	85.45 ^a	85.07 ^b	0.001	.980	trivial
WABD	42.56 ^a	70.46 ^b	188.38 ^a	200.32 ^b	88.08 ^a	121.63 ^b	4.227	.062	trivial
WADD	46.28 ^a	78.39 ^b	100.42 ^a	133.18 ^b	67.21 ^a	99.95 ^b	21.281	.001	1.91
HF	66.39 ^a	168.45 ^b	206.92 ^a	328.78 ^b	139.86 ^a	209.21 ^b	16.091	.002	1.62
HE	76.19 ^a	160.13 ^b	167.39 ^a	290.89 ^b	124.75 ^a	239.23 ^b	52.711	.000	3.03
HABD	60.80 ^a	109.53 ^b	166.32 ^a	254.98 ^b	117.30 ^a	169.44 ^b	21.171	.001	1.53
HADD	71.78 ^a	104.01 ^b	134.74 ^a	255.35 ^b	100.67 ^a	182.41 ^b	28.740	.000	2.22
KF	97.77 ^a	133.72 ^b	170.04 ^a	272.67 ^b	130.57 ^a	194.90 ^b	17.059	.001	1.69
KE	85.51 ^a	113.19 ^b	267.52 ^a	301.55 ^b	165.08 ^a	177.44 ^b	0.712	.415	trivial
APF	46.48 ^a	81.57 ^b	110.81 ^a	192.86 ^b	86.73 ^a	123.15 ^b	17.671	.001	1.67
ADF	35.40 ^a	77.06 ^b	115.32 ^a	162.63 ^b	78.29 ^a	123.41 ^b	16.186	.002	1.41
AI	53.93 ^a	77.46 ^b	118.66 ^a	133.45 ^b	79.88 ^a	106.06 ^b	16.509	.002	1.46
AE	73.25 ^a	60.65 ^b	100.22 ^a	159.48 ^b	85.25 ^a	100.08 ^b	4.768	.050	trivial

Note. ^a: one measurement. ^b: last measurement.

The peak force on postural mechanical range of motion were concluded on upper body regional force no important results in EF ($p = .562$), EP ($p = .053$), WE ($p = .980$), WABD ($p = .062$), and on lower body regional force no important results in KE ($p = .415$), AE ($p = .050$) $p > .05$.

Table 2. Body range of motion average force.

ROM	Average force Min		Average force Max		Average force Mean		Average force F-test	p-Value	ES
SF	41.18 ^a	74.56 ^b	100.22 ^a	130.24 ^b	71.44 ^a	104.87 ^b	32.921	.000	2.03
SE	56.29 ^a	83.86 ^b	108.36 ^a	144.36 ^b	78.69 ^a	110.97 ^b	34.146	.000	1.87
SADB	51.58 ^a	73.62 ^b	123.36 ^a	147.10 ^b	83.78 ^a	109.71 ^b	12.792	.004	1.25
SADD	40.40 ^a	93.37 ^b	103.06 ^a	131.31 ^b	69.33 ^a	109.49 ^b	63.229	.000	2.58
SLR	39.71 ^a	71.59 ^b	129.05 ^a	182.15 ^b	75.85 ^a	117.16 ^b	12.962	.004	1.36
SMR	50.01 ^a	77.26 ^b	105.81 ^a	117.38 ^b	66.08 ^a	97.43 ^b	40.269	.000	2.20
EF	63.05 ^a	80.10 ^b	176.02 ^a	176.08 ^b	101.71 ^a	113.37 ^b	1.252	.285	trivial
EE	34.91 ^a	101.15 ^b	128.17 ^a	189.45 ^b	84.37 ^a	131.41 ^b	18.089	.001	1.89
ES	42.07 ^a	77.33 ^b	99.43 ^a	155.03 ^b	66.93 ^a	116.38 ^b	29.795	.000	2.37
EP	52.26 ^a	77.22 ^b	120.03 ^a	141.37 ^b	84.52 ^a	106.90 ^b	8.552	.013	1.12
WF	46.87 ^a	61.68 ^b	100.71 ^a	120.16 ^b	71.01 ^a	95.20 ^b	17.693	.001	1.43
WE	44.91 ^a	38.44 ^b	94.33 ^a	101.73 ^b	69.28 ^a	70.67 ^b	0.030	.865	trivial
WABD	37.65 ^a	63.02 ^b	84.04 ^a	98.09 ^b	56.30 ^a	80.28 ^b	24.296	.000	0.85

WADD	34.42 ^a	58.29 ^b	144.55 ^a	160.31 ^b	70.49 ^a	98.68 ^b	5.247	.041	1.69
HF	58.93 ^a	145.47 ^b	192.89 ^a	224.93 ^b	116.92 ^a	169.77 ^b	19.220	.001	1.63
HE	48.93 ^a	122.32 ^b	149.84 ^a	222.40 ^b	99.39 ^a	182.75 ^b	30.626	.000	2.38
HABD	38.34 ^a	88.92 ^b	150.33 ^a	191.23 ^b	95.06 ^a	131.87 ^b	20.379	.001	1.28
HADD	53.64 ^a	87.11 ^b	113.36 ^a	211.58 ^b	84.66 ^a	143.31 ^b	24.320	.000	2.01
KF	76.78 ^a	102.50 ^b	147.29 ^a	211.94 ^b	108.20 ^a	157.54 ^b	12.354	.004	1.54
KE	80.02 ^a	99.76 ^b	215.94 ^a	188.91 ^b	136.70 ^a	135.98 ^b	0.012	.914	trivial
APF	29.02 ^a	74.92 ^b	96.79 ^a	169.78 ^b	71.97 ^a	107.29 ^b	19.429	.001	1.91
ADF	16.96 ^a	67.18 ^b	79.04 ^a	138.32 ^b	60.32 ^a	103.87 ^b	22.359	.000	1.48
AI	35.89 ^a	62.15 ^b	95.12 ^a	117.28 ^b	65.97 ^a	83.67 ^b	8.962	.011	1.07
AE	60.31 ^a	51.18 ^b	80.80 ^a	117.89 ^b	70.63 ^a	80.63 ^b	4.603	.053	trivial

Note. ^a: one measurement. ^b: last measurement.

The peak force on postural mechanical range of motion were concluded on upper body regional force no important results in EF ($p = .285$), WE ($p = .865$) and on lower body regional force no important results in KE ($p = .914$), AE ($p = .053$) $p > .05$.

Table 3. Upper body mechanic.

Shoulder peak ^a	SE	SABD	SADD	SLR	SMR
SF	$r=0.692 - p=.009$	$r=0.714 - p=.006$	$r=0.737 - p=.004$	$r=0.895 - p=.000$	$r=0.691 - p=.009$
Shoulder peak ^b	SF	SE	SABD	SADD	SMR
SLR	$r=0.278 - p=.358$	$r=0.695 - p=.008$	$r=0.605 - p=.028$	$r=0.717 - p=.006$	$r=0.464 - p=.110$
Shoulder average ^a	SE	SABD	SADD	SLR	SMR
SF	$r=0.704 - p=.007$	$r=0.666 - p=.013$	$r=0.770 - p=.002$	$r=0.873 - p=.000$	$r=0.717 - p=.006$
Shoulder average ^b	SF	SE	SABD	SADD	SMR
SADD	$r=0.386 - p=.192$	$r=0.689 - p=.009$	$r=0.273 - p=.367$	$r=0.032 - p=.918$	$r=0.429 - p=.413$
Elbow peak ^a	EE	ES	EP		
EF	$r=0.678 - p=.011$	$r=0.566 - p=.044$	$r=0.711 - p=.006$		
Elbow peak ^b	EF	EE	EP		
ES	$r=0.633 - p=.020$	$r=0.702 - p=.008$	$r=0.693 - p=.009$		
Elbow average ^a	EF	ES	EP		
EE	$r=0.565 - p=.044$	$r=0.560 - p=.047$	$r=0.595 - p=.032$		
Elbow average ^b	EF	EE	EP		
ES	$r=0.540 - p=.057$	$r=0.502 - p=.080$	$r=0.645 - p=.017$		
Wrist peak ^a	WF	WE	WADD		
WABD	$r=0.078 - p=.801$	$r=0.036 - p=.906$	$r=0.742 - p=.004$		
Wrist peak ^b	WF	WE	WADD		
WABD	$r=0.644 - p=.017$	$r=0.650 - p=.016$	$r=0.658 - p=.015$		
Wrist average ^a	WF	WE	WADD		
WABD	$r=0.168 - p=.582$	$r=-0.342 - p=.253$	$r=0.721 - p=.005$		
Wrist average ^b	WF	WE	WADD		
WABD	$r=0.314 - p=.296$	$r=0.666 - p=.013$	$r=0.559 - p=.047$		

Note. ^a: one measurement. ^b: last measurement.

The shoulder peak forces were correlated on SF and SE ($p < .01$), SF and SABD ($p < .01$), SF and SADD ($p < .01$), SF and SLR ($p < .01$), SF and SMR ($p < .01$). Peak forces were correlated on SLR and SE ($p < .01$), SLR and SABD ($p < .05$), SLR and SADD ($p < .01$). Additionally, shoulder average forces were correlated on SF and SE ($p < .01$), SF and SABD ($p < .05$), SF and SADD ($p < .01$), SF and SLR ($p < .01$), SF and SMR ($p < .01$). Average forces were correlated on SADD and SE ($p < .01$). The elbow peak forces were correlated on EF and EE ($p < .05$), EF and ES ($p < .05$), EF and EP ($p < .01$). Peak forces were correlated on ES and EF ($p < .01$), ES and EE ($p < .01$), ES and EP ($p < .01$). Additionally, elbow average forces were correlated on EE and EF ($p < .05$), EE and ES ($p < .05$), EE and EP ($p < .05$). Average forces were correlated on ES

and EP ($p < .05$). The wrist peak forces were correlated on WABD and WADD ($p < .01$). Peak forces were correlated on WABD and WF ($p < .05$), WABD and WE ($p < .05$), WABD and WADD ($p < .05$). Additionally, wrist average forces were correlated on WABD and WADD ($p < .01$). Average forces were correlated on WABD and WE ($p < .05$), WABD and WADD ($p < .05$).

Table 6. Lower body mechanic

Hip peak ^a	HE	HABD	HADD
HF	$r=0.708 - p=.007$	$r=0.639 - p=.019$	$r=0.137 - p=.655$
Hip peak ^b	HF	HE	HABD
HADD	$r=0.578 - p=.038$	$r=0.728 - p=.005$	$r=0.700 - p=.008$
Hip average ^a	HE	HABD	HADD
HF	$r=0.742 - p=.004$	$r=0.573 - p=.041$	$r=0.120 - p=.695$
Hip average ^b	HF	HE	HABD
HADD	$r=0.391 - p=.186$	$r=0.540 - p=.057$	$r=0.731 - p=.005$
Knee peak ^a	KE		
KF	$r=0.662 - p=.014$		
Knee peak ^b	KE		
KF	$r=0.316 - p=.293$		
Knee average ^a	KE		
KF	$r=0.727 - p=.005$		
Knee average ^b	KE		
KF	$r=0.450 - p=.123$		
Ankle peak ^a	ADF	AI	AE
APF	$r=0.673 - p=.012$	$r=0.660 - p=.014$	$r=-0.350 - p=.241$
Ankle peak ^b	ADF	AI	AE
APF	$r=0.292 - p=.332$	$r=0.356 - p=.233$	$r=0.040 - p=.896$
Ankle average ^a	APF	ADF	AE
AI	$r=0.562 - p=.046$	$r=0.633 - p=.020$	$r=0.145 - p=.636$
Ankle average ^b	APF	ADF	AE
AI	$r=0.471 - p=.104$	$r=0.360 - p=.227$	$r=0.346 - p=.247$

Note. ^a: one measurement. ^b: last measurement.

The hip peak forces correlated on HE and HF, HADD and HE, HADD and HABD, averages forces correlated on HF and HE ($p < .05$). The knee peak forces were correlated on KF and KE ($p < .05$). Additionally, knee average forces were correlated on KF and KE ($p < .05$). The ankle peak forces were correlated on APF and ADF ($p < .05$), APF and AI ($p < .05$). Additionally, ankle average forces were correlated on AI and APF ($p < .05$), AI and ADF ($p < .05$).

DISCUSSION

The peak force on high performance have been tested by regional body areas. Peak and average force to upper and lower segments were correlated to postural weakness measurements on this study. In this outcome that reported on mechanical force of range of motion of regional body motions. To lower body regional force provided on hip, knee and ankle and upper body regional such as shoulder, elbow and wrist by gravities of postural alignment in location of ground were in young volleyball athletes. In a outcomes of this study indicated that use of activforce measurements has been produced large effect size to upper and lower regional muscle force and range of motion performance. These results were similar that reported by Karagiannopoulos (2022) peak force of regional postural weakness and length-strain curve utilizing a portable postural alignment. The activforce device measurements tested on untrained individual young population, therefore, outcomes of peak and average force were provided unsimilar outcomes (Kahraman &

Kesler, 2025). The similar study was reported on muscle force activation investigated on volleyball players, to regional muscle force production using activforce device measurements (Kahraman, 2024). The outcomes of these findings noted the development of a reliable testing procedure for measuring isometric muscle force among a volleyball athletes who is likely to reach ceiling effect with manual postural muscle testing. The use of activforce measurement evaluates rate data that can be used to document changes that cannot otherwise be captured with ordinal data obtained with other techniques. The data from this investigation can be compared to other studies published in peak and average force (Karagiannopoulos et al., 2022; Kahraman, 2024; Kahraman & Kesler, 2025). This study investigating a sample of volleyball players measuring upper and lower regional force compared to other study was high large effect in mechanical range of motion to postural muscle testing. These conclusion are high desirable reported in this study and potentially illustrate how volleyball players and tester peak or average can have a positive impact on the reliability of activforce measurements. The various regional activities noted that very good reliability indicators and extremely strong effect size. Peak and average force test condition reported on low risk ratio of the coefficient variance on peak force; CV (0.21-0.37) – effect size ($d = 2.67-4.59$), average force; CV (0.22-0.35) – effect size ($d = 2.79-4.39$) (Kahraman & Kesler, 2025). The shoulder mechanical range of motion to length-strain curve generates more muscle force than elbow and wrist flexion resulting of in upper body regional force values, thus study resulted that shoulder ranges to peak force obtainment intra rater reliability 0.85-0.99 ICC in individuals affording a similar postural testing position (Karagiannopoulos et al., 2022). The other study reported isometric muscle activation tests; 24 body region from upper and lower compartment. For this isometric muscle action test detected on peak force outcomes (SEM: 37.90; CV: 1.79) and average force outcomes (SEM: 33.62; CV: 1.84). These results and the findings from this study demonstrate how the use of a postural stabilization device or dynamometer may limit the effects of peak and average force on postural strength testing. An additional benefit of the Activforce is that it is designed to be practical for use in the clinical setting and physical therapist office. This study is not without limitations. This study demonstrates the use of a portable stabilization device and the Activforce isometric muscle activation measurement to measure upper and lower body regional strength performance in an active and young volleyball population, demonstrating high efficacy at 6-month assessment. Future research on this topic should include other major upper and lower muscle groups not measured in the study and assess mean values using this method. Research into other non-athletic and injured populations should also be considered.

CONCLUSION

The use of the activforce device resulted in a high relationship between muscle strength and mechanical force formations depending on the range of motion, and in the examinations to be carried out, exercise methods can be exhibited through the potentials that can be produced by combining upper and lower compartment muscles as a result of the study. In the study, the differences in strength are individual, and force capacity and production studies must be performed according to more muscle groups and postural placements in ranges of motion.

AUTHOR CONTRIBUTIONS

Author AK and YK executed study research, methodological analysis, statistical analysis, result findings, conclusion of terminology for support in this study.

SUPPORTING AGENCIES

No funding agencies were reported by the authors.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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