

\*

)" - "

(

(Sony)

.( % 90 % 75 % 50 (:

:

:

:

(

)

:

:

.( )

:

(1993)

( )

\*

.2011/10/12

2011/6/8

/

- 170

6 (2) 180

.( ) :2 ...

70 %100

45 - 35

6 (6)

( )

.( ) :3

80 %100

(Adams , 1992)

20 - 15

6 (10)

.( 3.3)

(1997 ) Harra

:

: -1

:( ) -2

(Lander, 1990)

: -3

(1997)

)

( )

(

( )

)

(

.(1997 )

.( ) :1

, 1996)

180

%100

.(1997 )

: •

) ( )

.(

-1

-2

(Randall & William, 2002)

-3

)

) (

) (%10

(%10

)

(

( 1 x 0.76) 2

(OR6-5-2000, AMTI, Watertown, MA)

(EGM)

500

4

21-19

. 1.79

74

):

).(

:

(Lander, 1990)

6

:

) (( )

)

.(

)  
 .((%90 %80 %70 )  
 ( 4 ) :  
 (O'Brien) .(3 2 1 ) :  
 .(6 5 4 ) :  
 )  
 .(  
 ) " - " :  
 . ( %90  
 •  
 •  
 :  
 ) (EMG)  
 ( )  
 (1) 4  
 (1995)

(1)

%90	%75	%50	%100						
235	200	130	260	105+	146	187	29		1
180	150	100	200	105+	115	184	23		2
144	120	80	160	62	62	162	26		3
180	150	100	200	105	102	168	18		4
144	120	80	160	77	72	167	19		5
70	60	40	80		82	178	25		6
70	60	40	80		78	178	25		7
70	60	40	80		75	183	25		8
70	60	40	80		70	170	28		9
70	60	40	80		90	176	28		10

(1)

( / 25)  
( 95)

(4.45)  
(1)  
(1)  
(2)

%50

%90

%75

50 (Sony)

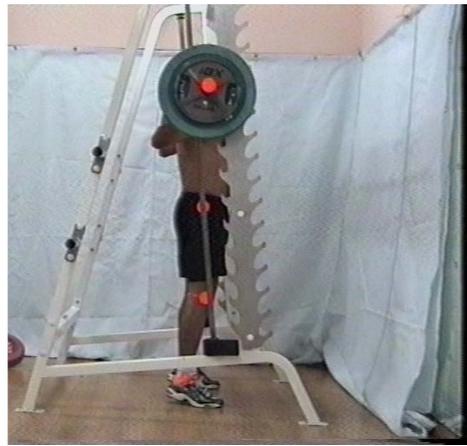
(Stick Figure)

AutoCAD )

(2000

)

.(



(1)

-1

-2

-3

.(1999)

-4



(2)

(AutoCAD 2000)

(3)

%100

-1

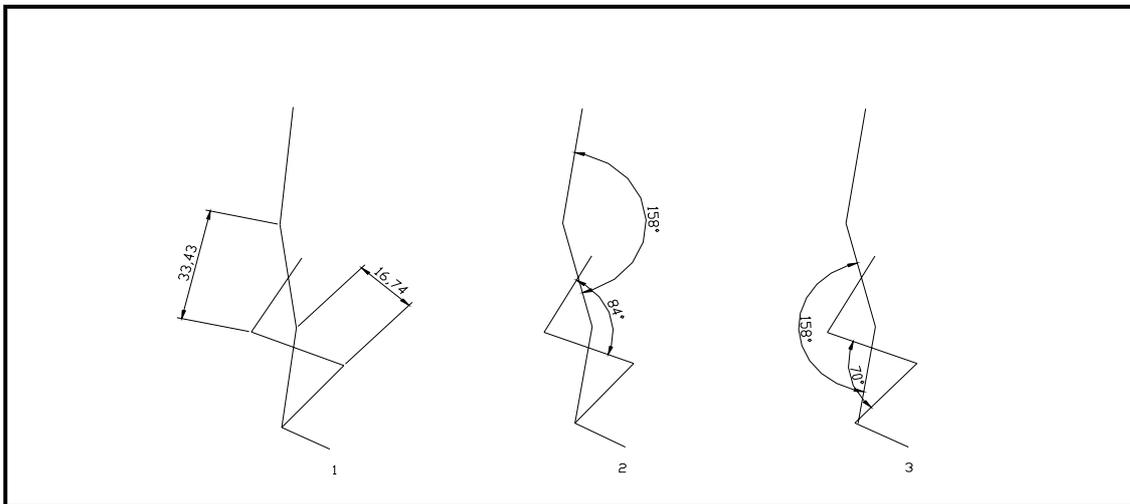
-2

% 90 % 75 % 50 :

.	x	=	•	.	-3	
.	x	=	•	.	-4	
.	( )	x	=	•	-5	
.	( )	x	=	•	-6	
-----	=		•	.	-7	
			•	.	-8	
			•	.	-9	
			•	.	-10	
			•	.	-11	
			•	.	-12	
			•	.	-	
x	) } =		•	-3	-2	-1
x	) + (			(115°, 105°, 95)		
x	) + (			:		
.	(2000)	{		( )		
				0.05 ≥ α		
				:		

(AutoCAD 2000)

(3)



(2)

$(\alpha \leq 0.05)$

	0.18	-1.44	0.16	0.59	%50			1
			0.17	0.64	%75			
	0.06	-2.42	0.17	0.59	%50			
			0.22	0.73	%90			
	0.11	-1.85	0.17	0.64	%75			
			0.22	0.73	%90			
	0.05	-0.61	0.17	0.58	%50			
			0.14	0.59	%75			
	0.04	-2.62	0.18	0.58	%50			
			0.17	0.78	%90			
	0.04	-2.59	0.15	0.59	%75			
			0.17	0.78	%90			
	0.02	2.96	0.01	0.98	%50			2
			0.00	0.93	%75			
	0.02	2.86	0.00	0.98	%50			
			0.14	0.85	%90			
	0.01	1.90	0.00	0.93	%75			
			0.14	0.85	%90			
	0.02	0.12	0.01	0.95	%50			
			0.11	0.90	%75			
	10.0	5.85	0.00	0.95	%50			
			0.01	0.85	%90			
	0.03	2.80	0.12	0.90	%75			
			0.01	0.85	%90			
	0.10	3.24	0.01	0.47	%50			3
			0.01	0.43	%75			
	0.66	0.46	0.01	0.47	%50			
			0.18	0.44	%90			
	0.84	-0.21	0.01	0.43	%75			
			0.18	0.44	%90			
	0.12	1.71	0.01	0.44	%50			
			0.01	0.42	%75			
	0.10	6.62	0.00	0.44	%50			
			0.00	0.37	%90			
	0.09	5.01	0.00	0.42	%75			
			0.00	0.37	%90			
	0.03	2.69	0.63	1.69	%50			4
			0.55	1.45	%75			
	0.01	3.41	0.69	1.69	%50			
			0.49	1.07	%90			
	0.04	2.50	0.57	1.45	%75			
			0.49	1.07	%90			
	0.05	2.32	0.56	1.72	%50			

			0.46	1.55	%75			
	0.00	5.60	0.57	1.72	%50			
			0.29	1.00	%90			
	0.00	5.70	0.47	1.55	%75			
			0.29	1.00	%90			
	0.02	2.89	0.98	3.47	%50			
			0.87	3.03	%75			
	0.01	3.37	1.04	3.47	%50			
			0.90	2.50	%90			
	0.05	2.08	0.91	3.03	%75			
			0.90	2.50	%90			
	0.03	1.90	1.00	3.70	%50			5
			0.71	3.35	%75			
	10.0	6.87	0.99	3.70	%50			
			0.52	2.40	%90			
	10.0	7.43	0.68	3.35	%75			
			0.52	2.40	%90			
	0.86	0.18	6.72	326.30	%50			
			11.73	325.60	%75			
	0.32	1.08	5.41	326.30	%50			
			112.85	282.47	%90			
	0.34	1.03	12.28	324.60	%75			
			112.85	282.47	%90			
	0.20	-2.96	12.14	138.30	%50			6
			14.17	145.13	%75			
	0.50	-0.71	13.09	138.30	%50			
			18.83	139.63	%90			
	0.58	0.59	13.11	145.13	%75			
			18.83	139.63	%90			
	0.86	0.18	6.59	340.40	%50			
			6.80	340.00	%75			
	0.06	2.22	5.58	340.40	%50			
			7.35	333.38	%90			
	0.08	2.57	7.03	340.40	%75			
			7.35	333.38	%90			
	0.24	-1.26	11.92	152.90	%50			7
			17.30	159.50	%75			
	0.17	-1.55	12.35	152.90	%50			
			13.42	157.50	%90			
	0.90	0.13	19.34	159.50	%75			
			13.42	157.50	%90			
	0.19	-1.44	13.36	133.80	%50			
			42.22	154.00	%75			
	0.25	-1.27	13.65	133.80	%50			8
			72.53	165.75	%90			
	0.48	-0.75	34.73	154.00	%75			
			72.53	165.75	%90			

	0.75	-0.33	10.14	323.80	%50			
			5.73	324.80	%75			
	0.85	0.20	10.86	323.80	%50			
			9.12	321.63	%90			
	0.30	1.12	5.31	324.80	%75			
			9.12	321.63	%90			
	0.10	-3.74	15.01	147.10	%50			
			15.30	159.30	%75			
	0.12	-1.78	16.03	147.10	%50			
			18.00	152.75	%90			
	0.22	1.36	17.17	159.30	%75			
			18.00	152.75	%90			
	0.24	-1.25	28.38	323.40	%50			
			8.50	334.90	%75			
	0.33	-1.05	31.94	323.40	%50			
			8.77	332.00	%90			
	0.23	1.32	7.75	334.90	%75			
			8.77	332.00	%90			
	0.01	1.42	198.45	712.37	%50			
			153.80	663.95	%75			
	10.0	4.35	201.01	712.37	%50			
			76.06	490.56	%90			
	10.0	4.24	155.43	663.95	%75			
			76.06	490.56	%90			
	0.03	2.02	185.99	671.80	%50			
			168.79	619.88	%75			
	10.0	4.45	203.41	671.80	%50			
			149.30	555.65	%90			
	0.01	3.25	170.49	619.88	%75			
			149.30	555.65	%90			
	10.0	3.88	162.13	727.14	%50			
			133.24	613.37	%75			
	0.01	3.60	159.16	727.14	%50			
			199.22	582.56	%90			
	0.04	0.89	140.06	613.37	%75			
			199.22	582.56	%90			
	0.46	-0.77	0.14	0.87	%50			
			0.01	0.90	%75			
	0.35	-1.00	0.14	0.87	%50			
			0.12	0.92	%90			
	0.35	-1.00	0.01	0.90	%75			
			0.12	0.92	%90			
	0.83	-0.22	0.01	0.91	%50			
			0.01	0.91	%75			
	1.00	0.00	0.01	0.91	%50			
			0.01	0.90	%90			
	0.53	0.66	0.01	0.91	%75			
			0.01	0.90	%90			

	0.01	1.42	198.45	712.37	%50			
			153.80	663.95	%75			
	10.0	4.35	201.01	712.37	%50			
			76.06	490.56	%90			
	10.0	4.24	155.43	663.95	%75			
			76.06	490.56	%90			
	10.0	-5.45	627.64	1314.54	%50			
			1074.63	2158.20	%75			
	0.02	-1.79	489.10	1314.54	%50			
			1137.42	1834.58	%90			
	0.05	0.57	943.86	2158.20	%75			
			1137.42	1834.58	%90			
	10.0	-5.45	627.64	1314.54	%50			13
			1074.63	2158.20	%75			
	10.0	-6.61	489.10	1314.54	%50			
			900.63	2187.63	%90			
	0.01	-1.49	943.86	2158.20	%75			
			900.63	2187.63	%90			
	10.0	-5.14	336.30	615.29	%50			
			529.37	985.21	%75			
	0.03	-2.81	231.55	615.29	%50			
			791.85	1190.53	%90			
	0.02	-1.37	416.25	985.21	%75			
			791.85	1190.53	%90			
	10.0	-5.37	340.40	615.08	%50			14
			532.93	991.30	%75			
	10.0	-5.78	239.06	615.08	%50			
			454.35	1002.16	%90			
	0.01	-1.47	397.18	991.30	%75			
			454.35	1002.16	%90			
	10.0	6.01	669.17	-1514.74	%50			
			1033.99	-2211.41	%75			
	0.05	0.95	533.51	-1514.74	%50			
			1615.30	-1914.41	%90			
	0.05	-0.31	800.25	-2211.41	%75			
			1615.30	-1914.41	%90			
	10.0	6.33	664.05	-1516.55	%50			
			1018.16	-2227.70	%75		95	15
	10.0	6.10	523.19	-1516.55	%50			
			997.42	-2457.41	%90			
	10.0	4.93	788.55	-2227.70	%75			
			997.42	-2457.41	%90			
	10.0	5.87	680.60	-1493.03	%50			
			1064.90	-2211.87	%75			
	10.0	6.09	551.01	-1493.03	%50			
			1012.24	-2407.00	%90		105	16
	10.0	5.64	858.55	-2211.87	%75			
			1012.24	-2407.00	%90			

	10.0	7.07	689.33	-1478.44	%50			
			1016.91	-2225.92	%75			
	10.0	6.53	558.48	-1478.44	%50			
			1008.27	-2424.65	%90			
	10.0	4.15	788.83	-2225.92	%75			
			1008.27	-2424.65	%90			
	10.0	6.48	699.58	-1501.74	%50			
			877.23	-2069.05	%75			
	10.0	6.12	550.44	-1501.74	%50			
			1004.40	-2395.42	%90			
	10.0	5.93	839.11	-2069.05	%75			
			1004.40	-2395.42	%90			
	10.0	8.18	684.46	-1474.69	%50		115	17
			831.55	-2123.20	%75			
	10.0	6.44	552.95	-1474.69	%50			
			1008.83	-2420.34	%90			
	0.01	4.09	786.47	-2123.20	%75			
			1008.83	-2420.34	%90			

:(1999 ) - (2)

: ( ) -

(1987)

( x = )  
 .(1982 )  
 :( ) -

:( ) -

) :

( ( )

(1)

:( ) x = (1982) ) - :( ) (

(1995)

( )

( ( ) )

:( ) -

( ) ( )

( x = ) ( x = )

(1982) (1982) ( ) ( )

:( ) - :( ) -

( )

(Rotenberg 1993 ) (Lander, 1990 (4)

(2) 95

(1)

:( )

-

%50

%75

(5)

(2)

(1993 )

:( )

-

:

x =

(4)

(2)

(1999 ) ( )

(95 )

(105 )

-

%50

%75

:(115 )

:

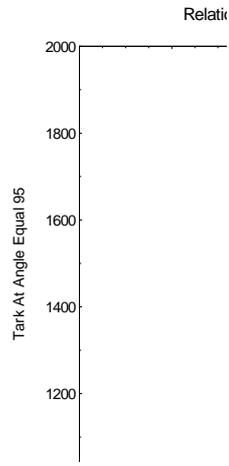
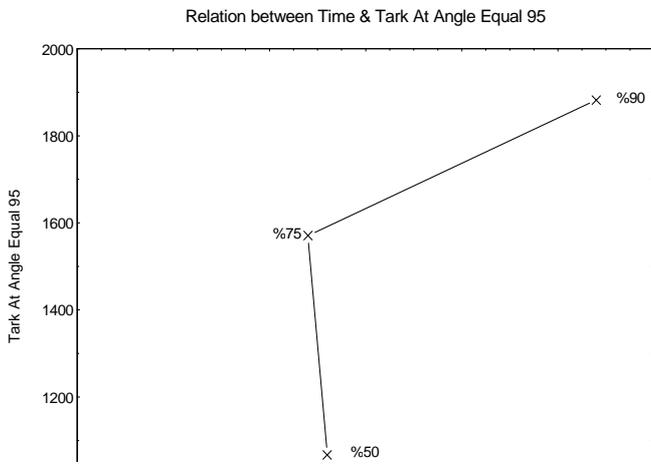
x =

(1993)

(2)

95

(4)



(2)

(5)

-4

-5

:

-1

-6

-2

-7

-3

2000

1990

.2

1994

1982

.1

1994

1997

1999

1993

.2

Adams K., O, Shea K. & Clintein M. 1992. The effect of six weeks of squat, plyometric and squat- plyometric training on power production. journal of applied sport science research.

1997

1985

Escamilla, R., Fleisig, G., Zheng, N., Barrentine, S., Wilk, K., & Andrews, J. 1998. Biomechanics of the knee during closed kinetic chain and open kinetic chain exercises. Medicine and Science in Sports and Exercise, 30, 556-569.

99 1999

1982

Kevin G. Abelbeck. 2002. Biomechanical Model and Evaluation of a Linear Motion Squat Type Exercise. Journal of Strength and Conditioning Research. 16(4), 516-524.

1997

1985

Kreighbaum, E., and K.m Barthels. 1996. biomechanical, A qualitative approach for study of human movement, 2nd ed, Minneapolis, MN Burgess

1980

1995

- Sports Medicine, 22, 768-773.
- Wilk, K., Escamilla, R., Fleisig, G., Barrentine, S., Andrews, J., & Boyd, M. 1996. A comparison of tibiofemoral joint forces and electromyographic activity during open and closed kinetic chain exercises. *The American Journal of Sports Medicine*, 24, 518-527.
- Wretenberg, P., Feng, Y., Lindberg, F., & Arborelius, U. 1993. Joint moments of force and quadriceps muscle activity during squatting exercise. *Scandinavian Journal of Medicine and Science in Sports*, 3, 244-250.
- William p.ebben & Randall L. Jensen. 2002. Electromyographic and Kinetic Analysis of Traditional, Chain, and Elastic Band Squats. *Journal of Strength and Conditioning Research*. 16 (4), 547-550.
- Lutz, G., Palmitier, R., An, K., & Chao, E. 1991. Closed kinetic chain exercises for athletes after reconstruction of the anterior cruciate ligament, *Medicine and Science in Sports and Exercise*, 24, S69.
- Lander, B. 1990. Training effect of difference loads at low back mechanical- pressure and mechanical power output in human muscle, *Scandinavia journal of sport science*.
- Nisell, R., & Ekholm, J. 1986. Joint load during the parallel squat in power lifting and force analysis of in vivo bilateral quadriceps tendon rupture. *Scandinavian Journal of Sports Science*, 8, 63-70.
- Panariello, R., Backus, S., & Parker, J. 1994. The effect of the squat exercise on anterior-posterior knee translation in professional football players. *The American Journal of*

## **The Effect of Differences Intensity on some Biomechanical Variables During Two Style of Squat Performance**

*Khaled. M. Atiyat and Mohammad. L. Al-Quran \**

### **ABSTRACT**

This study aimed at determining the effects of differences intensity on some Biomechanical variables through two style squat performance. The description experimental method had been applied in ten persons as a samples. Five athletes (male) from the national team for weights lifting represented different weight groups and five athletes (male) practicing free squat for body fitness and keeping a good health. The study was registered by a video camera (Sony) gives 25 pictures per second, in which every player made three trials of the weights: 50 %, 75 %, 90 % from the higher weight was lifted for the free squat exercise and three trials on Smith Machine. The results of the samples were analyzed by the slow motion with a (Sony) video, which gives 50 picture per second, after that the drawing inserted to the (AutoCAD 2000) computer program, which gave the ability to take many operations related with dimensions, angles and so on. In the statistical treatment, the researchers showed differences with a statistical reference during the squat exercise in different intensity in the researcher recommended to using smith machine in practicing squat exercise, because the high value for this machine to make us get practicing in a good, right technical picture that work to protect us of any hits or injures.

**Keywords:** The Differences Intensity, Biomechanical Variables, Squat Performance.

\* Department of Physical Education, Faculty of Education, University of Jordan. Received on 8/6/2011 and Accepted for Publication on 12/10/2011.