Abstract

In recent decades advancements in technology, medicine, and human health have been explosive. These key categories have crossed paths to bring forth the development of an electric muscle-stimulating machine called E-Fit EF1280. Much like a scene from a futuristic movie, participants are prepared in a full body suit with surface electrodes connected to 14 key muscle groups. Using only 2-pound weights and very basic movements, E-Fit will contract and relax the muscles at any designated intensity, time, and order. E-Fit relies on water as a conductor of the electrical current being sent from the machine to the suit. Previous research provides sufficient evidence to make the claim that the suit does provide muscle enhancing results as well as to increase functional health of previously damaged joints. The studies conducted in this research wished to focus on the applied question: How does E-Fit's 20 minute workout compare to standard weight training? The research was propelled by the claim that a 20 minute E-Fit workout could constructively stimulate just as many muscle fibers as a 90 minute workout with weights. This study was conducted by collecting 30 healthy participants to undergo a bi-weekly 6-week exercise regimen. The volunteers were randomly split into the "experimental" (E-Fit method) and "control" (conventional method). Measurements including body fat %, body mass index, muscle mass index, strength, and endurance values were recorded at the beginning of the study, before session 7, and after the last session (14). Results showed that the E-Fit group showed more beneficial outcomes than the conventional group in every test except for BMI.

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Table 1.1 Participant Selection Analyses

	Male (E-Fit)	Female (E-Fit)	Male (Conventional)	Female (Conventional
Very Fit	3	1	2	2
Fit	2	2	2	2
Sedentary	3	4	4	3

Table 1.1 Training Routine Weeks 1-6

Exercise	Reps	Sets
Shoulder Press	35	1
Chest Press	35	1
Front Biceps Curl	25	1
Overhead Triceps Extension	25	1
T-Curl (Biceps)	25	1
Triceps Kickbacks	25	1
Squats	35	1
Lunges	25	1
Crunches	20 Sec	1
Russian Twists	20 Sec	1
Lying Flutter Kicks	20 Sec	1
Lying Scissor Kicks	20 Sec	1
Leg Raises	20 Sec	1

Table 1.3 Pre-Exercise Data Collection

Participant	BMI	MMI	BF%	1RM Bench	1RM Squat	1RM Sh.Press	Endu. Push Up	Endu. Sit Up
1 Male (Efit)	18.0	42.1	9.6	140	200	135	60	82
2 Male (Efit)	18.0	39.2	10.3	195	210	140	73	103
3 Male (Efit)	16.5	30.5	15.2	115	195	135	58	75
4 Male (Efit)	17.0	29.4	16.0	255	185	185	62	67
5 Male (Efit)	24.0	48.2	12.0	310	365	200	55	92
6 Male (Efit)	21.5	30.0	11.6	155	190	145	58	76
7 Male (Efit)	20.2	39.2	14.5	165	295	145	75	97
8 Male (Efit)	19.4	38.1	19.0	155	285	125	46	58
9 Female (Efit)	24.5	26.5	22.1	85	165	80	42	76
10 Female (Efit)	21.3	27.2	24.0	90	155	90	31	67
11 Female (Efit)	15.5	28.9	23.1	85	175	70	28	58
12 Female (Efit)	17.0	27.2	22.6	70	145	45	18	64
13 Female (Efit)	27.0	30.0	25.1	55	135	66	21	57
14 Female (Efit)	21.4	21.2	29.0	55	130	55	34	46
15 Female (Efit)	24.5	28.1	32.0	85	175	75	25	35
16 Male (Conv.)	27.2	41.0	13.9	145	225	155	34	67
17 Male (Conv.)	21.0	38,6	17.6	175	265	155	53	53
18 Male (Conv.)	20.2	39.0	12.1	105	145	140	49	36
19 Male (Conv.)	17.2	32.9	18.1	135	145	130	59	74
20 Male (Conv.)	19.5	44.0	14.0	225	315	185	74	21
21 Male (Conv.)	21.0	48.2	15.1	295	285	185	110	65
22 Male (Conv.)	24.0	34.1	8.5	145	185	135	93	85
23 Male (Conv.)	23.1	41.0	7.2	275	315	125	54	36
24 Female (Conv.)	22.8	26.0	17.5	110	135	100	57	73
25 Female (Conv.)	22.1	27.3	20.0	55	165	55	63	42
26 Female (Conv.)	25.1	24.1	21.0	90	170	105	48	53
27 Female (Conv.)	24.0	33.1	26.1	65	105	65	75	42
28 Female (Conv.)	18.0	32.0	19.0	75	125	65	24	47
29 Female (Conv.)	21.3	26.1	25.0	60	105	50	53	27
30 Female (Conv.)	21.9	26.0	24.4	80	115	55	64	35

Table 1.4 Intra-Exercise Data Collection

Participant	BMI	MMI	BF%	1RM Bench	1RM Squat	1RM Sh.Press	Endu. Push Up	Endu. Sit Up
1 Male (Efit)	17.0	42.8	9.4	165	245	155	85	84
2 Male (Efit)	17.3	39.6	10.0	205	255	145	101	107
3 Male (Efit)	17.0	30.5	15.1	135	205	140	67	92
4 Male (Efit)	21.0	34.8	15.8	280	205	215	75	85
5 Male (Efit)	22.5	47.5	11.0	315	385	215	70	103
6 Male (Efit)	22.0	30.2	11.1	165	205	145	64	102
7 Male (Efit)	20.8	38.2	15.2	160	300	145	72	100
8 Male (Efit)	19.4	38.9	18.8	175	305	135	54	55
9 Female (Efit)	23.9	27.5	24.0	90	160	85	44	82
10 Female (Efit)	21.5	28.0	24.0	100	160	105	42	74
11 Female (Efit)	16.1	30.8	24.5	105	195	85	34	65
12 Female (Efit)	17.8	28.2	22.4	85	155	60	25	72
13 Female (Efit)	27.8	30.2	25.5	65	145	72	35	64
14 Female (Efit)	21.0	21.0	27.2	60	140	65	36	52
15 Female (Efit)	24.5	28.2	31.5	95	190	85	32	40
16 Male (Conv.)	25.0	38.8	12.2	155	230	165	28	55
17 Male (Conv.)	20.0	38.5	16.2	190	285	160	55	54
18 Male (Conv.)	20.3	39.1	12.4	110	145	150	53	42
19 Male (Conv.)	18.0	33.1	18.5	150	145	140	63	78
20 Male (Conv.)	19.7	44.1	13.8	245	325	190	78	24
21 Male (Conv.)	21.2	50.1	14.9	305	290	190	112	72
22 Male (Conv.)	24.1	34.5	9.5	155	205	140	100	92
23 Male (Conv.)	22.8	39.0	8.4	240	300	130	62	44
24 Female (Conv.)	22.6	25.0	17.2	115	135	100	60	70
25 Female (Conv.)	22.1	27.3	20.0	60	170	55	72	51
26 Female (Conv.)	26.1	23.2	19.8	85	175	100	52	61
27 Female (Conv.)	24.8	33.5	27.0	70	115	75	81	50
28 Female (Conv.)	19.1	32.4	20.1	85	135	75	27	47
29 Female (Conv.)	21.3	28.1	24.6	60	110	70	72	45
30 Female (Conv.)	21.6	28.0	25.2	85	120	65	69	41

Table 1.5 Post-Exercise Data Collection

Participant	BMI	MMI	BF%	1RM Bench	1RM Squat	1RM Sh.Press	Endu. Push Up	Endu. Sit Up
1 Male (Efit)	19.1	43.0	9.4	155	215	140	85	90
2 Male (Efit)	18.4	40.2	10.0	225	240	155	92	110
3 Male (Efit)	18.1	34.4	14.0	145	205	145	70	84
4 Male (Efit)	17.0	30.5	15.2	275	210	200	71	80
5 Male (Efit)	24.2	49.3	12.1	325	370	205	68	100
6 Male (Efit)	22.2	35.0	11.9	165	200	165	65	81
7 Male (Efit)	20.1	39.0	15.0	170	285	150	82	100
8 Male (Efit)	19.8	39.1	18.0	170	295	130	76	64
9 Female (Efit)	22.0	26.5	20.5	90	170	85	48	82
10 Female (Efit)	21.0	28.0	23.7	100	205	92	38	77
11 Female (Efit)	16.2	30.2	22.2	90	190	65	34	64
12 Female (Efit)	17.2	28.0	21.5	75	165	55	24	72
13 Female (Efit)	27.7	31.2	24.7	65	145	75	29	64
14 Female (Efit)	22.0	24.0	30.0	60	155	70	42	52
15 Female (Efit)	24.0	27.8	33.0	85	175	70	27	40
16 Male (Conv.)	26.5	40.6	13.5	150	230	155	41	70
17 Male (Conv.)	21.1	38.9	17.6	180	265	155	55	48
18 Male (Conv.)	20.8	39.4	12.0	110	190	145	52	39
19 Male (Conv.)	18.0	32.5	17.9	145	150	140	66	79
20 Male (Conv.)	20.0	44.8	13.9	240	335	195	81	24
21 Male (Conv.)	21.7	47.8	14.1	305	305	180	112	70
22 Male (Conv.)	23.3	35.5	9.2	155	205	140	100	91
23 Male (Conv.)	24.0	40.1	8.4	280	301	135	72	44
24 Female (Conv.)	24.8	25.2	19.2	110.	120	105	48	63
25 Female (Conv.)	22.7	26.5	21.9	60	170	60	72	48
26 Female (Conv.)	26.1	25.0	21.9	90	175	125	52	50
27 Female (Conv.)	23.1	34.0	25.8	75	115	75	77	50
28 Female (Conv.)	19.1	33.6	20.1	80	135	75	32	50
29 Female (Conv.)	22.1	28.0	26.1	60	115	50	53	32
30 Female (Conv.)	21.9	26.0	24.5	80	120	55	62	37

Introduction

Considered one of the most powerful platforms of preventative medicine and health development, the fitness industry has become inflated with diverse forms and methods of exercise. Progression in physiological understanding has allowed researchers to advance efforts in discovering the most efficient exercise system. The state of the art E-Fit EF-1280 (E-Fit) machine aims to achieve just that. Its advanced mechanism of training utilizes electrical muscle stimulation (EMS) to train key muscle groups. Daniel Nyiri, member of the E-Fit development team, states that a 90-minute conventional workout yields approximately 21,000 muscle contractions while a 20-minute E-Fit workout achieves more than 32,000 fibrous contractions…delivering "the most efficient workout in the country" (Nyiri, 2012).

The machine producers have implemented a training protocol that includes wearing a tight fitting and highly conductive spandex under suit in addition to an over suit fitted with electrodes strategically placed to the human musculoskeletal system. The electrodes require warm alkaline water as a conductor in order to activate the muscle. The machines utilize electrical currents on a frequency ranging from 5 Hz to 120 Hz to effectively contract the muscles of indicated use. It is said that the machine is effective due to the rapid contraction and relaxation of each muscle, which actually enhances aerobic metabolism (Kovacs, 2012).

Initially geared towards astronauts, the E-Fit technology is the first tool to utilize maximum muscle output without touching a weight. The technology utilizes five phases during a standard training session. The first is the comprehensive warm-up that engages myofascial release, activating and relaxing the muscles in a way such that they are

primed for exercise. This two minute warm-up includes rapid movement to a transition of slow and controlled movements. The second phase is the strength program. During this phase the muscles are contracted for a longer time and then released for a very short rest in between repetitions. This fires surface muscle tissue, activating type II fibers. The third phase is the endurance program. The muscles are contracted for an extended time during the phase and are given little to no rest time. This ensures that the deep tissues (type I fibers) are being activated. The fourth phase is the abdominal program in which core is the primary focus. The final phase is a cool down period. The patron will simply lie on a mat in a relaxed state while a low frequency of power stimulates the muscles. This helps drive lactic acid out of the muscles as well as remove water from the skin, which treats cellulite.

Image obtained from the E-Fit America Website.

The E-Fit machine above shows the individual dials that control the intensity and activation each muscle can experience.

Training Protocol

The training regimen for this machine differs depending on professional expertise, client goals, and preference. Nyiri, owner of E-Fit US distribution rights, has constructed a systemic training plan that requires each individual to undergo a 20-minute session two times per week. He claims that the workout is so intense on the muscles as well as demanding on the central nervous system that it is not necessary to train any more than twice per week (Nyiri, 2012). In fact, he considers it to be dangerous if completed any more than that (Kovacs, 2012).

Study Background

Research exists utilizing EMS for athletic performance, pain management, and physiological benefits but this study aims to target the actual comparison between conventional weight training and EMS training routines. An integrated approach was generated to systematically compare the benefits of the two unique methods of training. This was completed by selection of some of the most informative fitness measurements: including body mass index (BMI), body fat percentage (BF%), muscle mass index (MMI), strength using 1 repetition maximum (1RM), and endurance tests. The study's scope focused equally on both conventional training and E-Fit training by utilizing the

exact same workout program and diet approach with each participant. The study did not include an overwhelming focus on one style of training over the other.

History of Electrical Muscle Stimulation

The civilizations of Ancient Egypt and Rome were the first to discover EMS benefits through the use of electrical fish for pain management. Since then, many electrotherapy pioneers have contributed significant efforts to the process. One of the most notable includes Guillaume Duchenne de Boulogne. This 19th century researcher was the first to stimulate surface muscles using water as a conductor. He placed dampened electrodes and used a battery to implement controlled voltage to the muscle (Kovacs, 2012). Before the E-Fit machine was mass-produced, professional athletes were able to utilize EMS devices solely for their fitness development. The company E-Fit accomplished the launch of EMS to the fitness industry in the early 2000s. In recent decades, electrical stimulation was actually modified to target neurotransmitters. The most common neuromuscular applications include the transcutaneous electrical nerve stimulation (TENS) and percutaneous electrical nerve stimulation (PENS). Through studies of these treatments, electrical stimulation has been proven to actually rid mild to moderate joint, muscle, and/or ligament pain while EMS has yielded results that show improvements and prevention of muscle dysfunction and sarcopenia (Heidland, 2012).

Abbreviations

Sh.Press (Shoulder Press)

Endu. (Endurance)

EMS (Electical Muscle Stimulation)

E- Fit (Electo Fitness)

BMI (Body Mass Index)

BF% (Body Fat Percentage)

MMI (Muscle Mass Index)

1RM (1 Repetition Maximum)

TENS (Transcutaneous Electrical Nerve Stimulation)

PENS (Percutaneous Electrical Nerve Stimulation)

P-Width (Pulse Width)

BCAA (Branch Chain Amino Acids)

Methods

Sample Selection

The study included use of 16 males and 14 females training at an exact frequency of twice per week. Each of the subjects experienced average* childhood health and range between the ages of 21 and 38. The male subject average age was 24 while the female subject average age was 25. None of the subjects had any current physical limiting injuries or notable hormonal imbalances. In sight, none of the subjects were experiencing any result-altering conditions at the time of volunteer selection. Five males and three females were considered “very fit”, meaning they trained at least five times per week. Four males and four females were considered “fit”, meaning they trained three to five per week. And seven males and seven females were considered “sedentary”, meaning they participated in one or less days of physical activity.

Refer to Table 1.1 for sample categories.

Experimental Procedure

The subjects were split in half in accordance to gender and then again at random into two categories: E-Fit training and conventional training.

See Table 1.2 for training routine. Note: the regimen for both conventional training and E-Fit training were identical.

Each of the “E-Fit Training” subjects participated in a 20 minute supervised E-Fit workout on a bi-weekly routine for six weeks. While each of the “Conventional Training” subjects participated in a 20 minute supervised conventional workout on a bi-weekly routine.

The workout, repetitions, weight, and E-Fit variables were maintained until the professional trainer felt that the participant could healthily progress to the next weight and/or P-Width – depending on classification of subject’s workout method.

Data recordings of three sets of data included body mass index (BMI), body fat percentage (BF%), muscle mass index (MMI), strength using 1 repetition maximum (1RM) for bench press, squat, and shoulder press, endurance using push-up challenge and sit-up challenge. These proper measurements were to be taken at the beginning of session 1, session 7, and two days after session 12.

See Table 1.3 for body measurements and data collection for “Pre-Training Measurements”.
See Table 1.4 for body measurements and data collection for “Intra-Training Measurements”.
See Table 1.5 for body measurements and data collection for “Post-Training Measurements”.

Diet and Supplementation

Each participant was subject to following a structured calorie restricted program. This was created by determining each participant's BMI, BF%, and body measurements. In conjunction with gender, age, height, and weight; all seven measurements were used to create a customized caloric requirement in order to maintain body weight while still promoting full muscle recovery, organ function, and fat loss*.

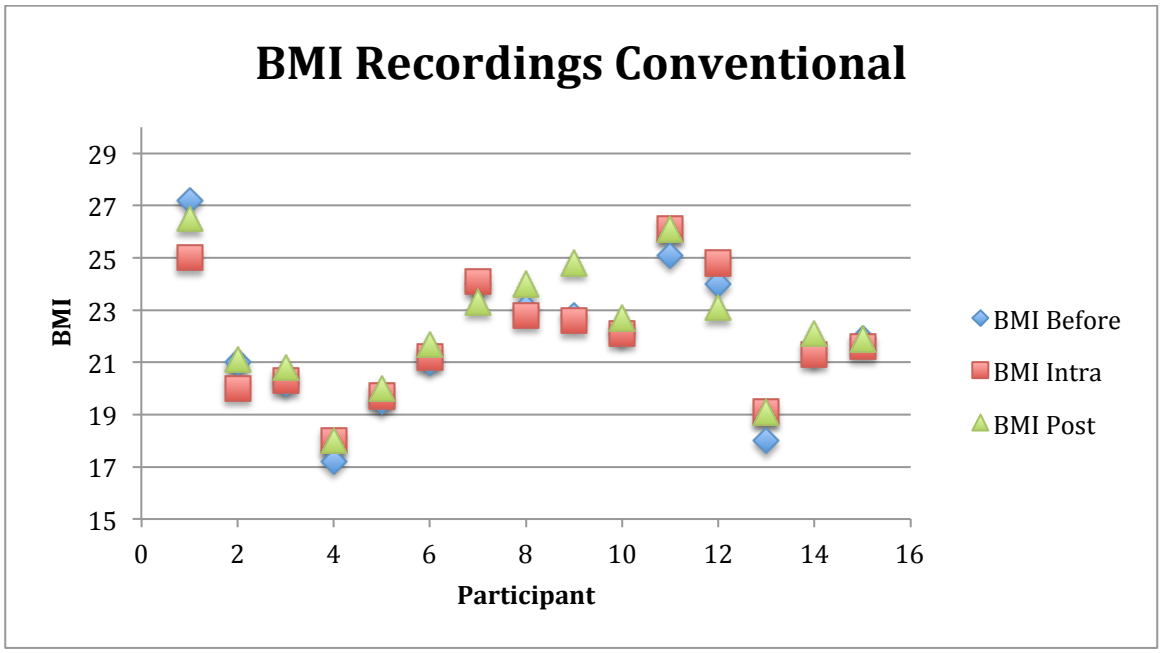
Supplement recommendations included multivitamins, BCAA and protein powders essential in the recovery of broken muscle tissue.

Results

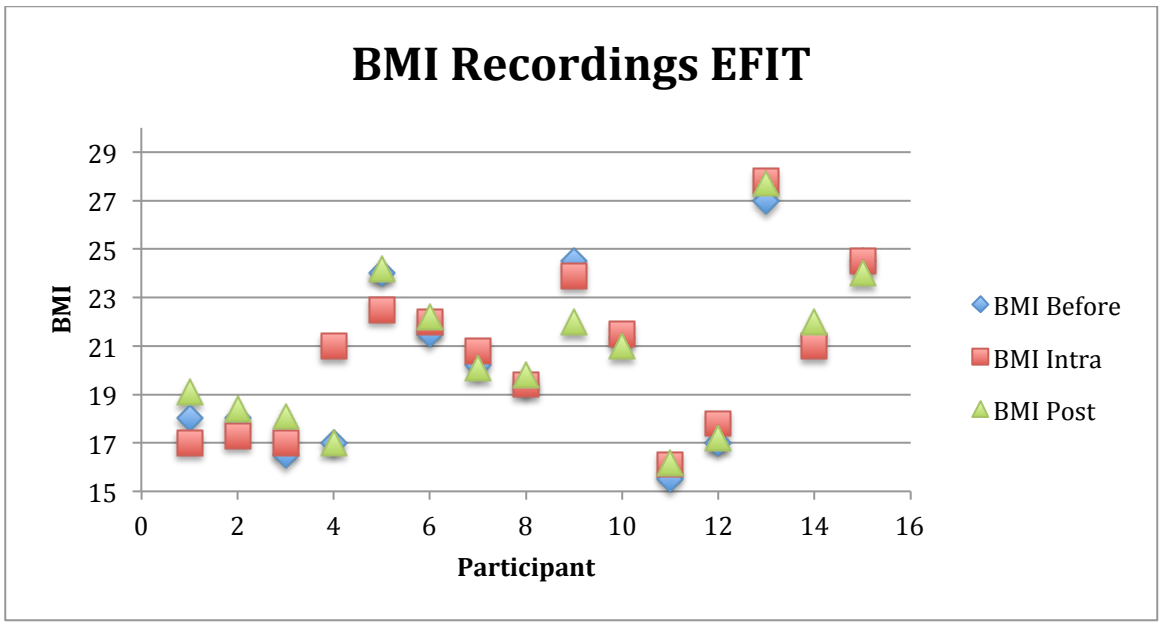
The results obtained were analyzed in a comparison manner of before and after recordings through each study. This helped identify the degree of change on an individual scale so the results could be most easily translated.

Comparative Data

Graph 1.1 BMI Results of the Conventional Method of Training



Graph 1.2 BMI Results of E-Fit Method of Training



Body mass index (BMI) is essentially an individual ratio of their weight to their height.

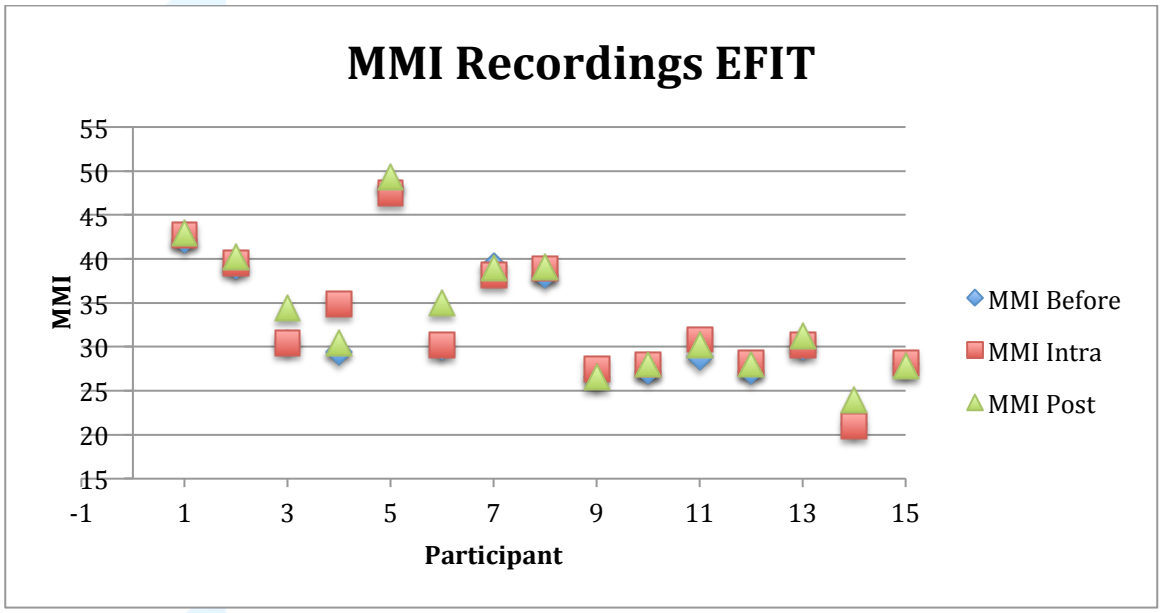
BMI: 18.5-24.9 = Normal

BMI: 25-29.9 = Overweight

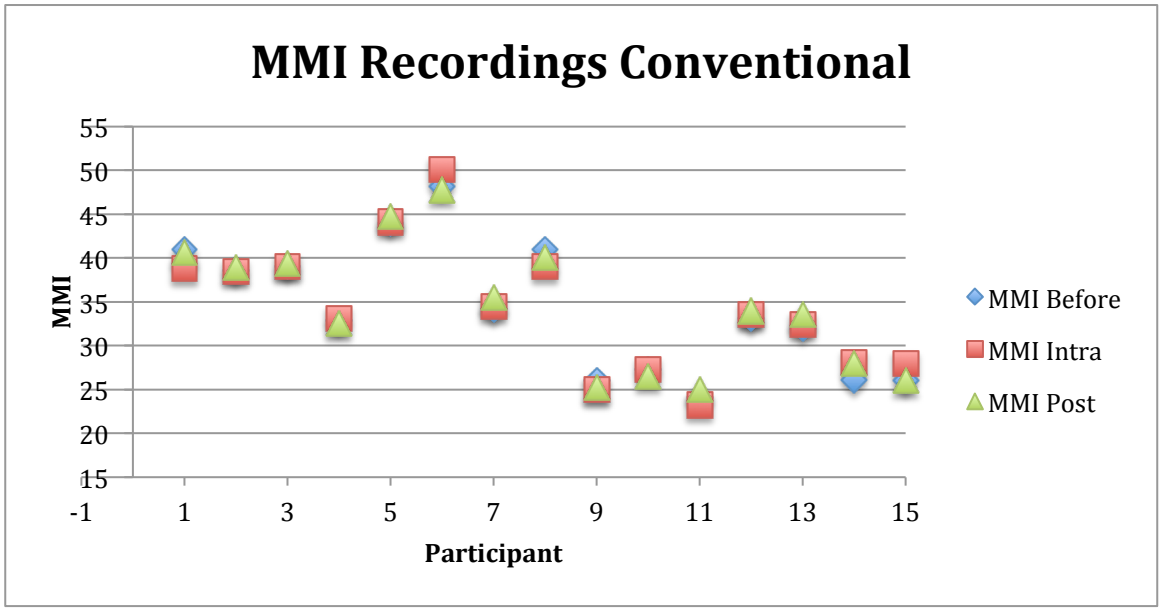
BMI: 30+ = Obese

Graph 1.1 and 1.2 provide very valuable data in regards to the role of conventional training and E-Fit towards BMI. The E-fit group began with an average BMI of 20.39 and after six weeks finished with an average of 20.60, for a change of +0.21. The conventional group began with an average BMI of 21.90 and final recordings provided an average of 22.35, yielding a difference of +0.45.

Graph 2.1 MMI Results of E-Fit Method of Training

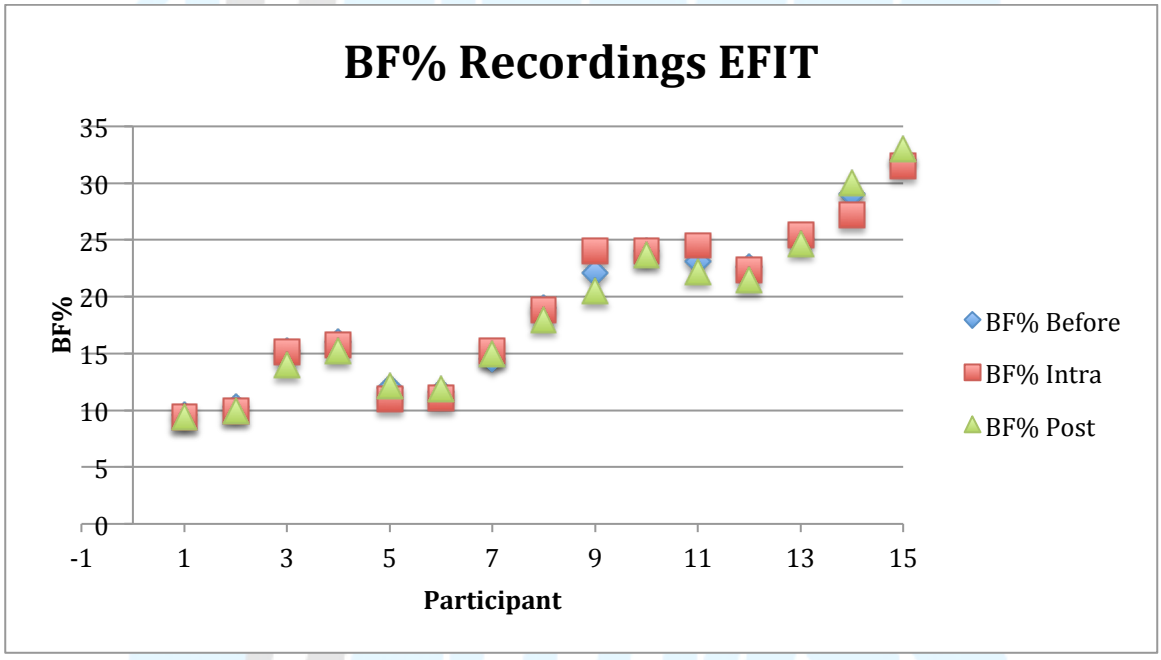


Graph 2.2 MMI Recordings of the Conventional Method of Training

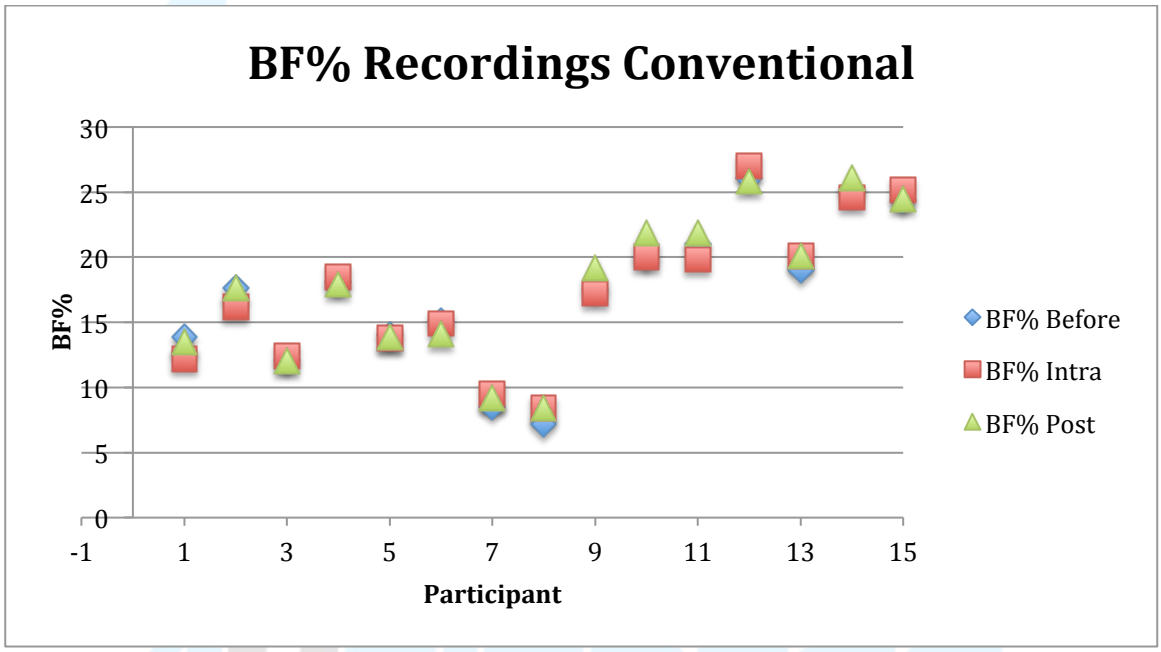


Muscle mass index gives an alternative perspective to the results associated with fitness. The data recorded proved much more interesting results than BMI. The initial recordings for the E-Fit group averaged at 32.39 and after six weeks proved to be 33.75 for a change of +1.36. The conventional group began with an average of 34.23 and after six weeks was 34.53, a change of +0.30. Both results yielded a positive increase in muscle mass index proving that both forms of exercise will (on average) increase an individual's muscle mass index. In regards to increasing MMI, it is absolutely favorable towards the E-Fit method to be more efficient than the conventional method at only two times per week.

Graph 3.1 Body Fat Percentage Results of E-Fit Method of Training

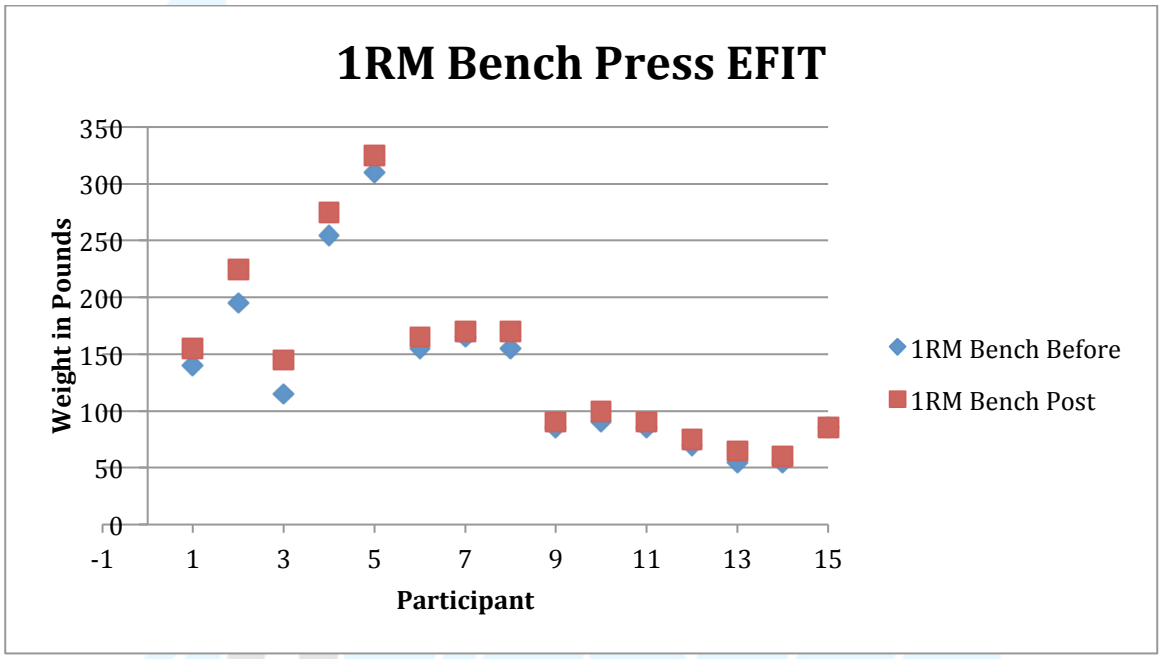


Graph 3.2 Body Fat Percentage of the Conventional Method of Training

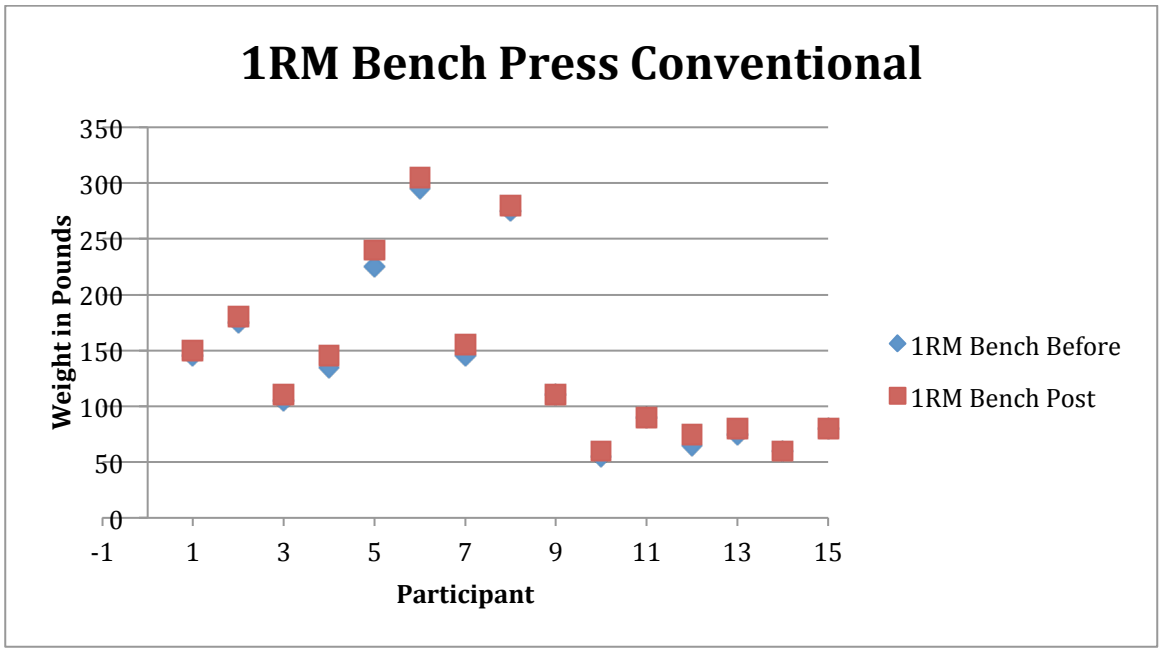


Body fat percentage is one of the most well-known in the fitness industry. This is due to the fact that it takes body composition into account. The E-fit group began the study with an average BF% of 19.07% and the final recording was 18.75% (-0.32%). The conventional group began the study with an average BF% of 17.3% and the final recording was 17.74% (+0.44%).

Graph 4.1 1 Repetition Maximum Bench Press of E-Fit Group

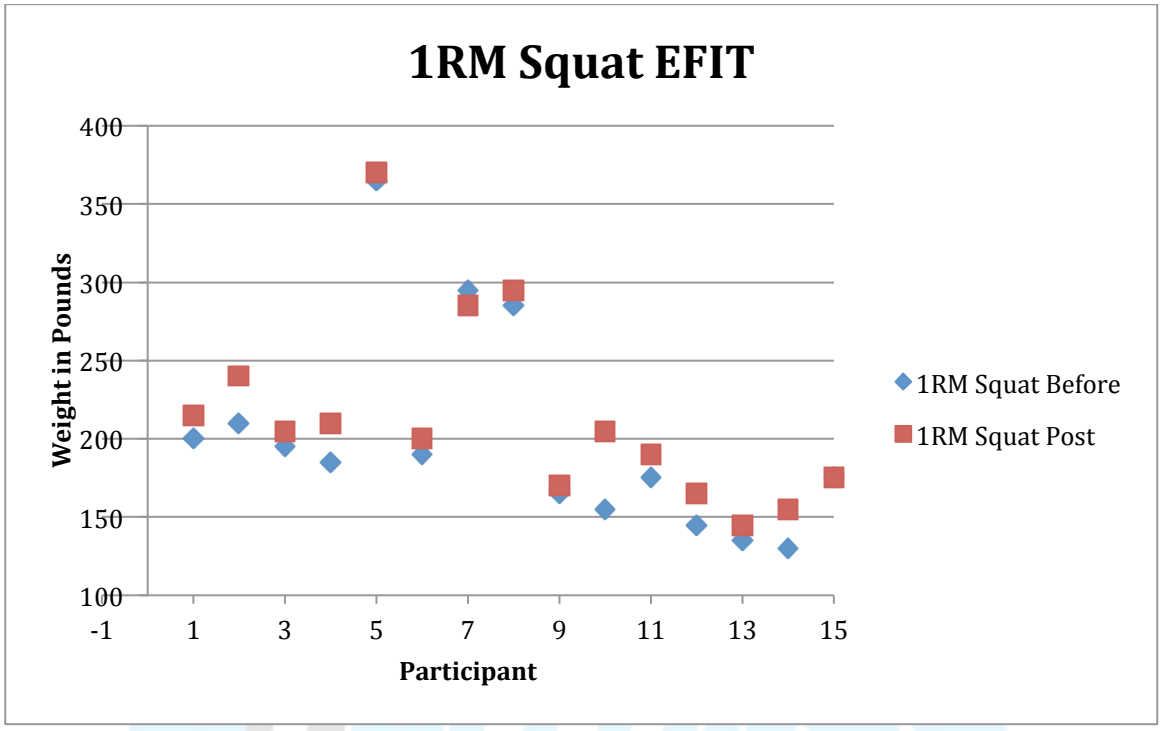


Graph 4.2 1 Repetition Maximum Bench Press of Conventional Group

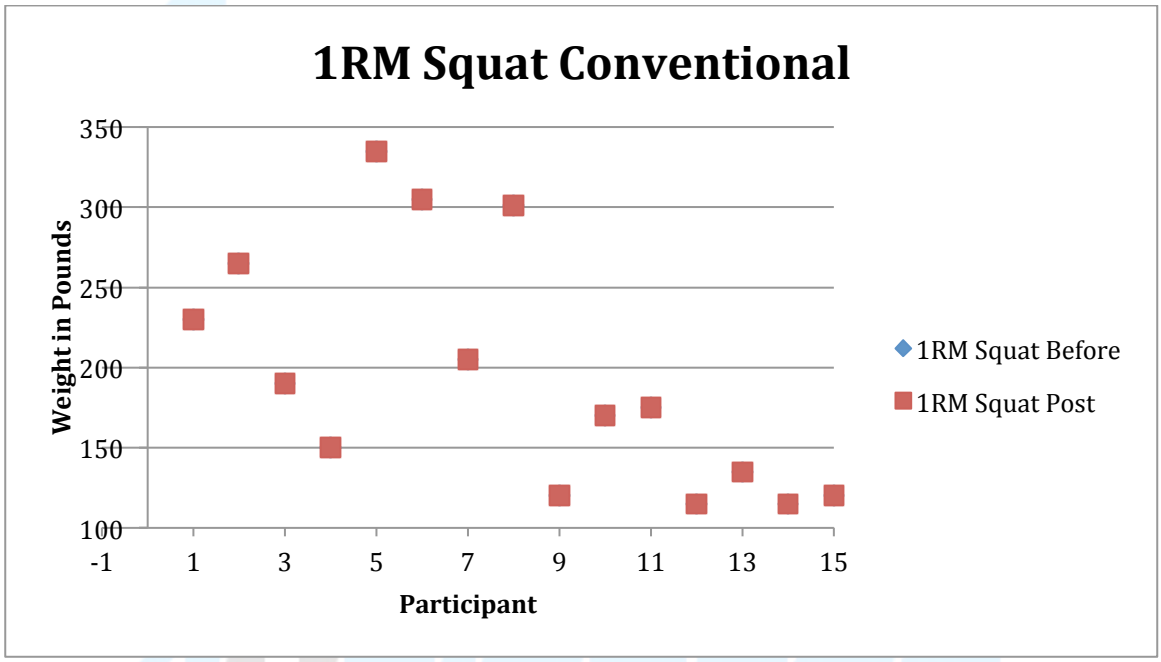


Bench press data was initially recorded by allowing the participants to warm up to a state of full muscle activation during 1-repetition maximum sets. The E-Fit group averaged a beginning weight of 134.33 lbs. and final recordings were averaged at 146.33 lbs., which is a total increase of 12 lbs. over six weeks. The conventional group began with an average bench press maximum of 135.67 lbs. and finished the study with an average bench press maximum of 141.33 lbs. The increase was 5.66 lbs.

Graph 5.1 1 Repetition Maximum Squat of E-Fit Group

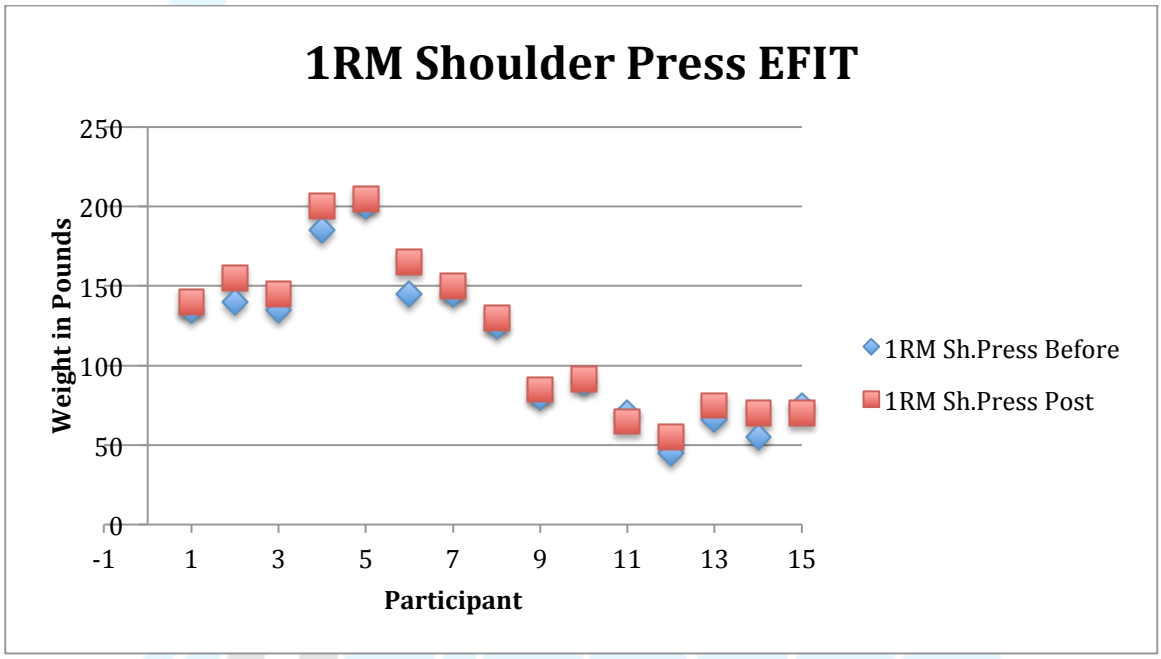


Graph 5.2 1 Repetition Maximum Squat of Conventional Group

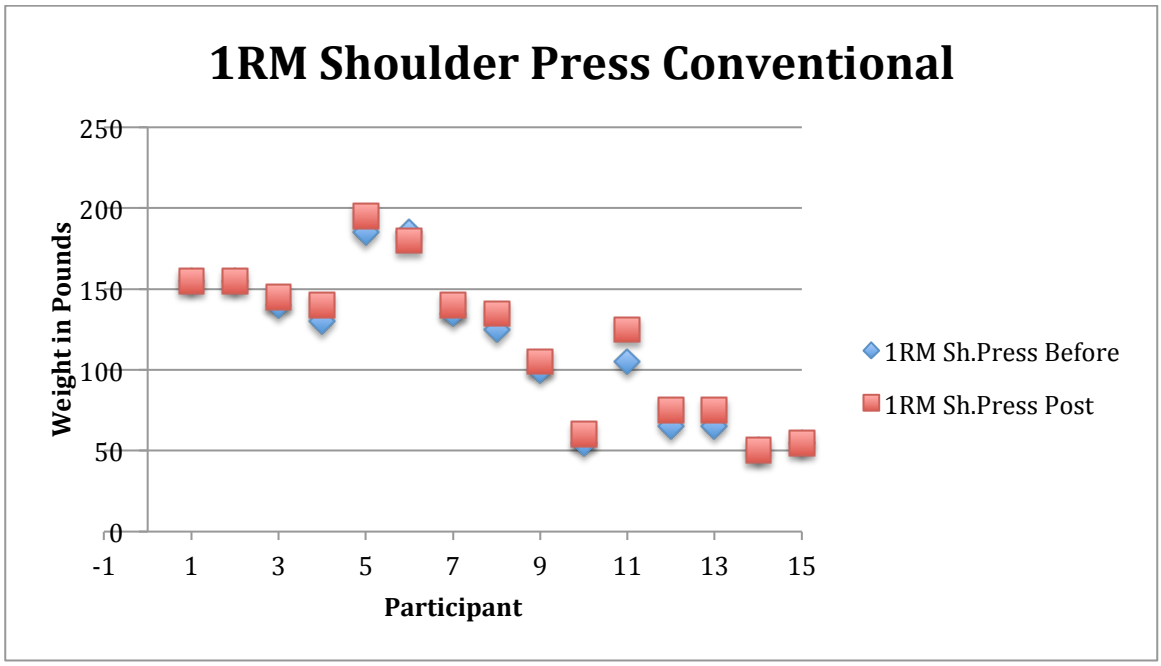


The barbell squat was performed by first ensuring proper warm-up of every participant. Auxiliary and compound stretches were required to ensure safety and maximal muscle output. The E-fit group began with an average of 200.33 lbs. and the final recordings averaged at 215 lbs., proving an average increase in max squat capability of approximately 15 lbs. The conventional group began the study with an average 1RM squat of 186.67 lbs. and finished with an average of 195.4 lbs. The increase was 8.73 lbs.

Graph 6.1 1 Repetition Maximum Shoulder Press of E-Fit Group

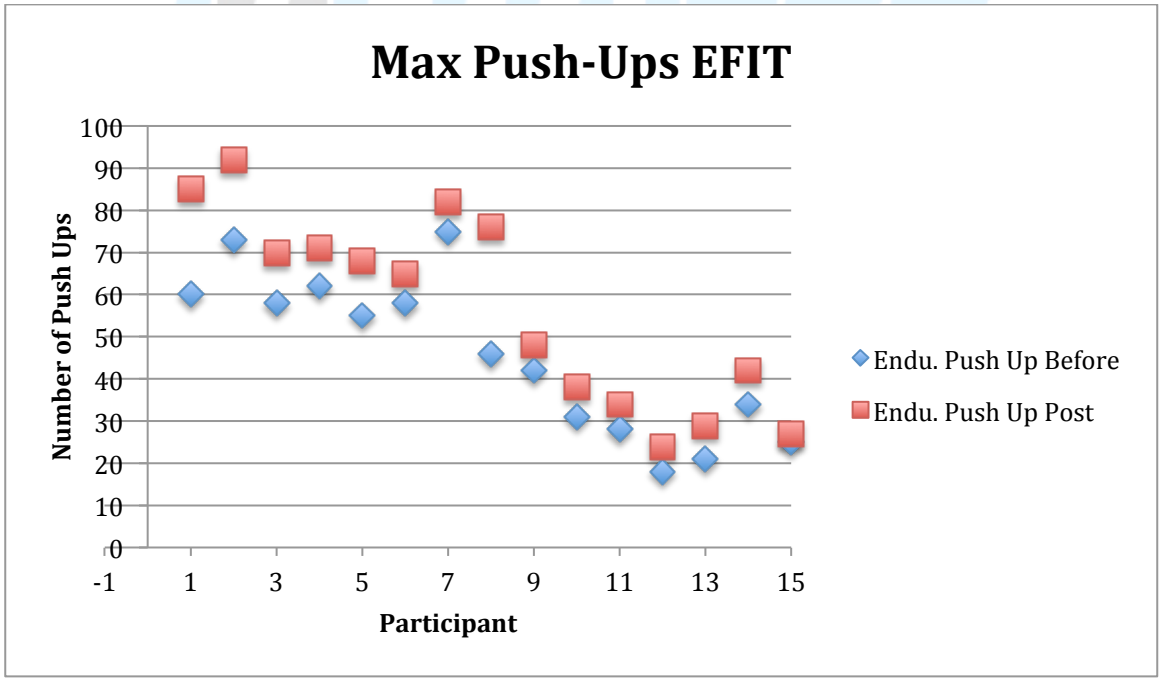


Graph 6.2 1 Repetition Maximum Shoulder Press of Conventional Group

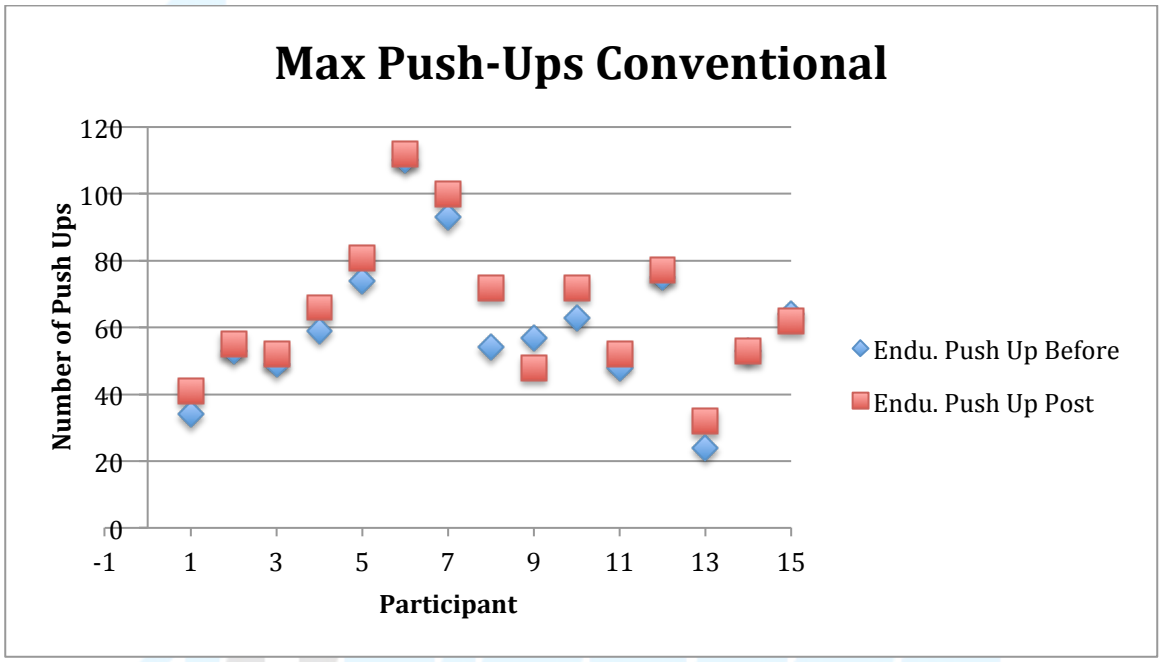


The barbell shoulder press was performed by first ensuring proper warm-up of every participant. Auxiliary and compound stretches were required to ensure safety and maximal muscle output. The E-fit group began with an average of 112.73 lbs. The final recordings averaged at 120.13 lbs., proving an average increase in maximum shoulder press capability of 7.4 lbs. The conventional group began the study with an average 1RM shoulder press of 113.67 lbs. and after the study the group averaged 119.33 lbs. The increase in the 1RM shoulder press was 5.67 lbs.

Graph 7.1 Maximum Push-Ups of E-Fit Group

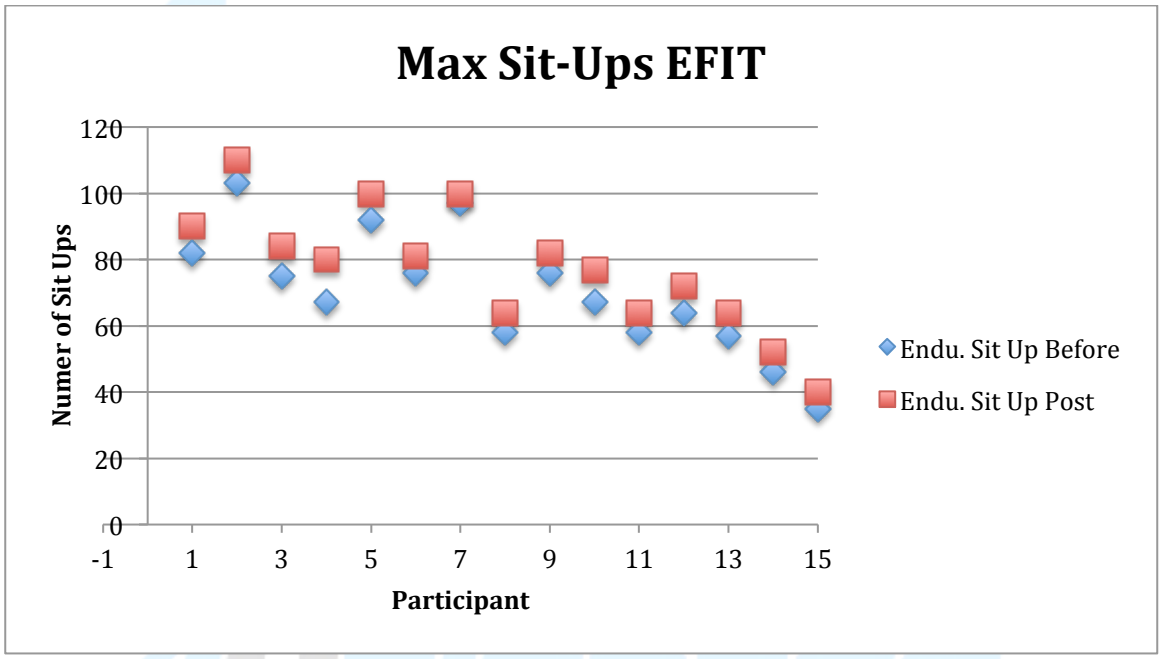


Graph 7.2 Maximum Push-Ups of Conventional Group

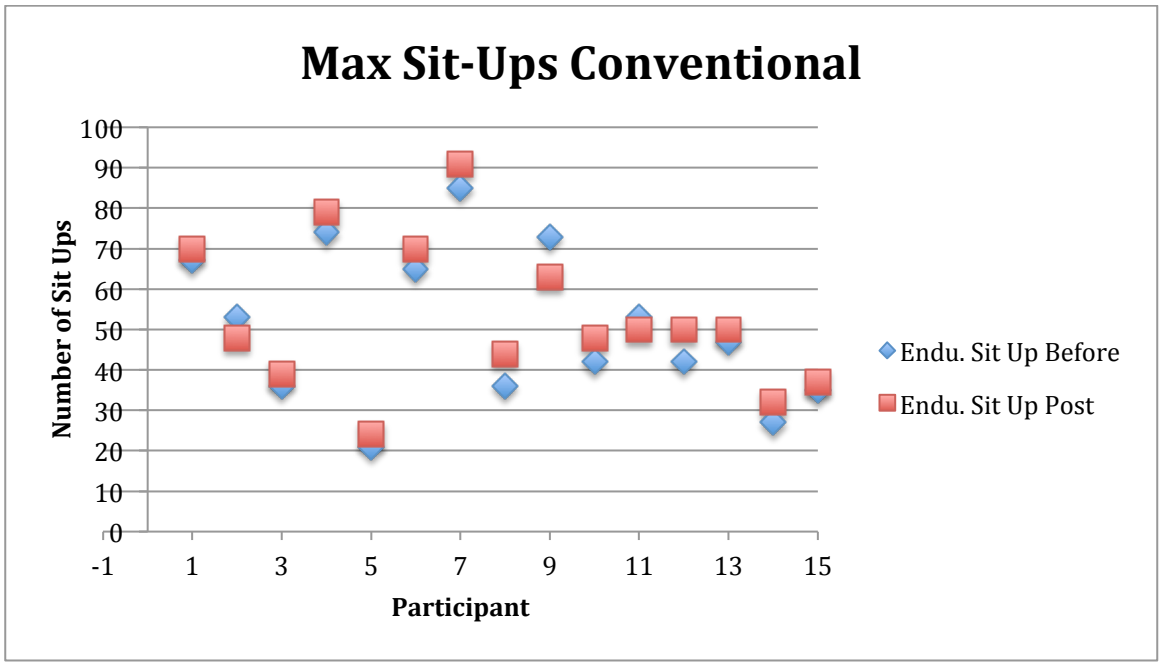


The push-ups were performed by calculating the maximum amount that could be completed without resting. The E-fit group recorded an average of 45.73 before the study and ended with an average of 56.73, and an increase of 11 push-ups. The conventional group recorded an average of 60.67 before the study and ended at 65.00, and an increase of 4.33 push-ups.

Graph 8.1 Maximum Sit-Ups of E-Fit Group



Graph 8.2 Maximum Sit-Ups of Conventional Group



The sit-ups were performed by calculating the maximum amount that could be completed without resting. The E-fit group recorded an average of 70.20 before the study and ended with an average of 77.33, an increase of 7.13 sit-ups. The conventional group recorded an average of 50.40 before the study and ended with an average of 53.00, an increase of 2.6 sit-ups.

Individual Subject Analytic Tables

Table 2.1 BMI E-Fit

Participant	BMI Before	BMI Intra	BMI Post
1 Male (Efit)	18	17	19.1
2 Male (Efit)	18	17.3	18.4
3 Male (Efit)	16.5	17	18.1
4 Male (Efit)	17	21	17
5 Male (Efit)	24	22.5	24.2
6 Male (Efit)	21.5	22	22.2
7 Male (Efit)	20.2	20.8	20.1
8 Male (Efit)	19.4	19.4	19.8
9 Female (Efit)	24.5	23.9	22
10 Female (Efit)	21.3	21.5	21
11 Female (Efit)	15.5	16.1	16.2
12 Female (Efit)	17	17.8	17.2
13 Female (Efit)	27	27.8	27.7
14 Female (Efit)	21.4	21	22
15 Female (Efit)	24.5	24.5	24
Average	20.38666667		20.6

Table 2.2 BMI Conventional

Participant	BMI Before	BMI Intra	BMI Post
16 Male (Conv.)	27.2	25	26.5
17 Male (Conv.)	21	20	21.1
18 Male (Conv.)	20.2	20.3	20.8
19 Male (Conv.)	17.2	18	18
20 Male (Conv.)	19.5	19.7	20
21 Male (Conv.)	21	21.2	21.7
22 Male (Conv.)	24	24.1	23.3
23 Male (Conv.)	23.1	22.8	24
24 Female (Conv.)	22.8	22.6	24.8
25 Female (Conv.)	22.1	22.1	22.7
26 Female (Conv.)	25.1	26.1	26.1
27 Female (Conv.)	24	24.8	23.1
28 Female (Conv.)	18	19.1	19.1
29 Female (Conv.)	21.3	21.3	22.1
30 Female (Conv.)	21.9	21.6	21.9
Average	21.89333333		22.34666667

Table 3.1 MMI E-Fit

Participant	MMI Before	MMI Intra	MMI Post
1 Male (Efit)	42.1	42.8	43
2 Male (Efit)	39.2	39.6	40.2
3 Male (Efit)	30.5	30.5	34.4
4 Male (Efit)	29.4	34.8	30.5
5 Male (Efit)	48.2	47.5	49.3
6 Male (Efit)	30	30.2	35
7 Male (Efit)	39.2	38.2	39
8 Male (Efit)	38.1	38.9	39.1
9 Female (Efit)	26.5	27.5	26.5
10 Female (Efit)	27.2	28	28
11 Female (Efit)	28.9	30.8	30.2
12 Female (Efit)	27.2	28.2	28
13 Female (Efit)	30	30.2	31.2
14 Female (Efit)	21.2	21	24
15 Female (Efit)	28.1	28.2	27.8
Average	32.38666667		33.74666667

Table 3.2 MMI Conventional

Participant	MMI Before	MMI Intra	MMI Post
16 Male (Conv.)	41	38.8	40.6
17 Male (Conv.)	38.6	38.5	38.9
18 Male (Conv.)	39	39.1	39.4
19 Male (Conv.)	32.9	33.1	32.5
20 Male (Conv.)	44	44.1	44.8
21 Male (Conv.)	48.2	50.1	47.8
22 Male (Conv.)	34.1	34.5	35.5
23 Male (Conv.)	41	39	40.1
24 Female (Conv.)	26	25	25.2
25 Female (Conv.)	27.3	27.3	26.5
26 Female (Conv.)	24.1	23.2	25
27 Female (Conv.)	33.1	33.5	34
28 Female (Conv.)	32	32.4	33.6
29 Female (Conv.)	26.1	28.1	28
30 Female (Conv.)	26	28	26
Average	34.22666667		34.52666667

Table 4.1 Body Fat % E-Fit

Participant	BF% Before	BF% Intra	BF% Post
1 Male (Efit)	9.6	9.4	9.4
2 Male (Efit)	10.3	10	10
3 Male (Efit)	15.2	15.1	14
4 Male (Efit)	16	15.8	15.2
5 Male (Efit)	12	11	12.1
6 Male (Efit)	11.6	11.1	11.9
7 Male (Efit)	14.5	15.2	15
8 Male (Efit)	19	18.8	18
9 Female (Efit)	22.1	24	20.5
10 Female (Efit)	24	24	23.7
11 Female (Efit)	23.1	24.5	22.2
12 Female (Efit)	22.6	22.4	21.5
13 Female (Efit)	25.1	25.5	24.7
14 Female (Efit)	29	27.2	30
15 Female (Efit)	32	31.5	33
Average	19.07333333		18.74666667

Table 4.2 Body Fat % Conventional

Participant	BF% Before	BF% Intra	BF% Post
16 Male (Conv.)	13.9	12.2	13.5
17 Male (Conv.)	17.6	16.2	17.6
18 Male (Conv.)	12.1	12.4	12
19 Male (Conv.)	18.1	18.5	17.9
20 Male (Conv.)	14	13.8	13.9
21 Male (Conv.)	15.1	14.9	14.1
22 Male (Conv.)	8.5	9.5	9.2
23 Male (Conv.)	7.2	8.4	8.4
24 Female (Conv.)	17.5	17.2	19.2
25 Female (Conv.)	20	20	21.9
26 Female (Conv.)	21	19.8	21.9
27 Female (Conv.)	26.1	27	25.8
28 Female (Conv.)	19	20.1	20.1
29 Female (Conv.)	25	24.6	26.1
30 Female (Conv.)	24.4	25.2	24.5
Average	17.3		17.74

Table 5.1 1RM Bench Press E-Fit

Participant	1RM Bench Before	1RM Bench Post
1 Male (Efit)	140	155
2 Male (Efit)	195	225
3 Male (Efit)	115	145
4 Male (Efit)	255	275
5 Male (Efit)	310	325
6 Male (Efit)	155	165
7 Male (Efit)	165	170
8 Male (Efit)	155	170
9 Female (Efit)	85	90
10 Female (Efit)	90	100
11 Female (Efit)	85	90
12 Female (Efit)	70	75
13 Female (Efit)	55	65
14 Female (Efit)	55	60
15 Female (Efit)	85	85
Average	134.3333333	146.3333333

Table 5.2 1RM Bench Press Conventional

Participant	1RM Bench Before	1RM Bench Post
16 Male (Conv.)	145	150
17 Male (Conv.)	175	180
18 Male (Conv.)	105	110
19 Male (Conv.)	135	145
20 Male (Conv.)	225	240
21 Male (Conv.)	295	305
22 Male (Conv.)	145	155
23 Male (Conv.)	275	280
24 Female (Conv.)	110	110
25 Female (Conv.)	55	60
26 Female (Conv.)	90	90
27 Female (Conv.)	65	75
28 Female (Conv.)	75	80
29 Female (Conv.)	60	60
30 Female (Conv.)	80	80
Average	135.6666667	141.3333333

Table 6.1 1RM Squat E-Fit

Participant	**1RM** Squat Before	**1RM** Squat Post
1 Male (Efit)	200	215
2 Male (Efit)	210	240
3 Male (Efit)	195	205
4 Male (Efit)	185	210
5 Male (Efit)	365	370
6 Male (Efit)	190	200
7 Male (Efit)	295	285
8 Male (Efit)	285	295
9 Female (Efit)	165	170
10 Female (Efit)	155	205
11 Female (Efit)	175	190
12 Female (Efit)	145	165
13 Female (Efit)	135	145
14 Female (Efit)	130	155
15 Female (Efit)	175	175
Average	200.3333333	215

Table 6.2 1RM Squat Conventional

Participant	**1RM** Squat Before	**1RM** Squat Post
16 Male (Conv.)	225	230
17 Male (Conv.)	265	265
18 Male (Conv.)	145	190
19 Male (Conv.)	145	150
20 Male (Conv.)	315	335
21 Male (Conv.)	285	305
22 Male (Conv.)	185	205
23 Male (Conv.)	315	301
24 Female (Conv.)	135	120
25 Female (Conv.)	165	170
26 Female (Conv.)	170	175
27 Female (Conv.)	105	115
28 Female (Conv.)	125	135
29 Female (Conv.)	105	115
30 Female (Conv.)	115	120
Average	186.6666667	195.4

Table 7.1 1RM Shoulder Press E-Fit

Participant	**1RM** Sh.Press Before	**1RM** Sh.Press Post
1 Male (Efit)	135	140
2 Male (Efit)	140	155
3 Male (Efit)	135	145
4 Male (Efit)	185	200
5 Male (Efit)	200	205
6 Male (Efit)	145	165
7 Male (Efit)	145	150
8 Male (Efit)	125	130
9 Female (Efit)	80	85
10 Female (Efit)	90	92
11 Female (Efit)	70	65
12 Female (Efit)	45	55
13 Female (Efit)	66	75
14 Female (Efit)	55	70
15 Female (Efit)	75	70
Average	112.7333333	120.1333333

Table 7.2 1RM Shoulder Press Conventional

Participant	**1RM** Sh.Press Before	**1RM** Sh.Press Post
1 Male (Efit)	155	155
2 Male (Efit)	155	155
3 Male (Efit)	140	145
4 Male (Efit)	130	140
5 Male (Efit)	185	195
6 Male (Efit)	185	180
7 Male (Efit)	135	140
8 Male (Efit)	125	135
9 Female (Efit)	100	105
10 Female (Efit)	55	60
11 Female (Efit)	105	125
12 Female (Efit)	65	75
13 Female (Efit)	65	75
14 Female (Efit)	50	50
15 Female (Efit)	55	55
Average	113.6666667	119.3333333

Table 8.1 Endurance Push-Up E-Fit

Participant	Endu. Push Up Before	Endu. Push Up Post
1 Male (Efit)	60	85
2 Male (Efit)	73	92
3 Male (Efit)	58	70
4 Male (Efit)	62	71
5 Male (Efit)	55	68
6 Male (Efit)	58	65
7 Male (Efit)	75	82
8 Male (Efit)	46	76
9 Female (Efit)	42	48
10 Female (Efit)	31	38
11 Female (Efit)	28	34
12 Female (Efit)	18	24
13 Female (Efit)	21	29
14 Female (Efit)	34	42
15 Female (Efit)	25	27
Average	45.73333333	56.73333333

Table 8.2 Endurance Push-Up Conventional

Participant	Endu. Push Up Before	Endu. Push Up Post
16 Male (Conv.)	34	41
17 Male (Conv.)	53	55
18 Male (Conv.)	49	52
19 Male (Conv.)	59	66
20 Male (Conv.)	74	81
21 Male (Conv.)	110	112
22 Male (Conv.)	93	100
23 Male (Conv.)	54	72
24 Female (Conv.)	57	48
25 Female (Conv.)	63	72
26 Female (Conv.)	48	52
27 Female (Conv.)	75	77
28 Female (Conv.)	24	32
29 Female (Conv.)	53	53
30 Female (Conv.)	64	62
Average	60.66666667	65

Table 9.1 Endurance Sit-Up E-Fit

Participant	Endu. Sit Up Before	Endu. Sit Up Post
1 Male (Efit)	82	90
2 Male (Efit)	103	110
3 Male (Efit)	75	84
4 Male (Efit)	67	80
5 Male (Efit)	92	100
6 Male (Efit)	76	81
7 Male (Efit)	97	100
8 Male (Efit)	58	64
9 Female (Efit)	76	82
10 Female (Efit)	67	77
11 Female (Efit)	58	64
12 Female (Efit)	64	72
13 Female (Efit)	57	64
14 Female (Efit)	46	52
15 Female (Efit)	35	40
Average	70.2	77.33333333

Table 9.2 Endurance Sit-Up Conventional

Participant	Endu. Sit Up Before	Endu. Sit Up Post
16 Male (Conv.)	67	70
17 Male (Conv.)	53	48
18 Male (Conv.)	36	39
19 Male (Conv.)	74	79
20 Male (Conv.)	21	24
21 Male (Conv.)	65	70
22 Male (Conv.)	85	91
23 Male (Conv.)	36	44
24 Female (Conv.)	73	63
25 Female (Conv.)	42	48
26 Female (Conv.)	53	50
27 Female (Conv.)	42	50
28 Female (Conv.)	47	50
29 Female (Conv.)	27	32
30 Female (Conv.)	35	37
Average	50.4	53

Discussion

The data recorded during the study is original and was subject to human and experimental error that will be further discussed. The importance of testing a series of data was significant to the study. It was vital to identify and record changes in body composition, mass, and muscular productiveness.

The workout provided to the E-Fit group and the conventional group was identical on paper but differed in a host of ways. When training conventionally, it takes approximately 25 minutes to fully activate the muscles. On the contrary, with E-Fit it takes just seconds to experience over 300 muscle contractions in over 18 muscles. The E-Fit group's results showed a greater benefit in every area of data except for BMI.

Body Composition

BMI

The overall change in body mass index was minor, not significant and failed to reject the null hypothesis. BMI is a great variable for determining obesity but it does have a degree of error. Weight and height are the only considerations of BMI, while key values such as muscular density, composition, and muscle mass index were not factored into the end variable (Hiza, 2011). An example of a false diagnosis of obesity would be a 5'10" male weighing 200 pounds at 10% body fat with a BMI of "overweight". For the possibility of skewed entry data, it was necessary to take other factors into consideration such as muscle mass index and body fat percentage.

MMI

Muscle mass index is a great indicator of genuine muscle development. Since the muscle fibers studied do not replicate but rather expand and grow, it can be claimed that E-fit at two times per week is more efficient and productive at expanding muscle fibers than the conventional method. This is based on the data that proves the increase of 1.36 MMI in the E-fit group compared with the increase of 0.30 MMI in the conventional group during the study. The significant increase in muscle mass index in the E-Fit group gives rise to new questions of hope for athletes and fitness enthusiasts looking for a new method of training to progress them further.

Body Fat

The data compiled in this category was the most interesting. The E-Fit group of participants saw a decrease in body fat percentage while the conventional method group saw an increase in body fat. This can be attributed to the idea that training conventionally with weights just two times per week does not stimulate the muscles enough to create metabolic increases. The opposite can be said for E-Fit. The average body fat of the E-Fit participants fell a significant amount in just six weeks time (12 workouts). Even more interesting, mid-point recordings showed that participants lost half of their overall change, providing a clean trend of decrease in body fat projections for the E-Fit group. It is necessary for children to exercise at least 60 minutes daily to ensure health and body development (Stong, 2005). As children age, the body's central nervous system expects exercise but in some individuals this is not possible due to health issues, anatomical underdevelopment, or even just timing. E-Fit could resolve this issue, requiring 40 minutes per week to see a decline in body fat percentage.

Muscular and Cardiovascular Development

1RM Bench Press

The bench press is a movement that requires activation of numerous muscles used in the motion of pushing. For a 1 repetition maximum, it is important to note that the primary type of muscle used is the type 2b muscle fibers. These fibers are extremely susceptible to fatigue and are often used for brief explosive motions, such as bench-pressing at maximum capacity. There was a greater increase in the 1RM bench press of the E-Fit group compared to the conventional training group, although both served as productive methods of training to increase muscular strength. E-Fit is run on a muscle depth system, meaning the machine must pass through a series of muscle fibers activating all three types.

1RM Barbell Squat

The barbell squat is a similar movement to the bench press in that it requires activation of a combination of muscles. This set of data showed very similar results to those recorded in the bench press. The E-Fit group improved their average squat maximum of approximately 15 lbs. while the conventional group increased by 8.73 lbs. Both are proven to be effective in building raw strength in the lower body/trunk but it is certainly clear which is more efficient. It should be noted that a normal power lifter's training routine is comprised of three days of squats, adding to the list of reasons why the increase in strength was not notably higher in the conventional group. Considering that the E-Fit group did not use a weight even close to maximum capabilities, it is astonishing they

were able to achieve raw strength gains of this caliber. This may attributed to the fact that extreme muscle damage stimulates type 2b fibers to become better conditioned and more active in the right environment. A muscle fiber can exist without any use, but its ability to work at full potential is dependent on the individual's use of that fiber. The E-Fit group participated in the full E-Fit workout that stimulates the muscles to a degree not obtainable with traditional weights – at least at only 2 times per week.

1RM Shoulder Press

The barbell shoulder press was the final compound movement tested during the study. The results were similar to the other strength tests' results. The E-Fit group recorded an average 1RM increase of over 7 lbs. while the conventional group was only 5.67 lbs. This was certainly not expected due to the fact that there is not an electrode connected to the deltoid muscles. When performing the E-Fit workout, participants do not their deltoids engaged by an electrode but rather through a series of indirect contractions. The chest, back, bicep, and tricep electrodes work in sequence to contract and relax all three heads of the deltoid. This indirect relationship allows for safe, yet full, contraction of the shoulder muscles. In the conventional group, the deltoids are trained during the program so it is clear why strength gains were made in this group. But yet again, E-Fit proves to be the more efficient option when training just two times per week.

Endurance Push-Up

The results obtained during the endurance push-up study were rather remarkable. There was a tremendous increase of 11 repetitions in the E-Fit group average and only an average increase of 4.33 repetitions in the conventional group. This is a genuine indicator of type 1 fiber development due to the fact that type 1 fibers are used primarily in

endurance training. During testing the muscles used in the push-up are taken to failure and notation time of fatigue is the goal. In the E-Fit group it is clear there was a significant increase in type 1 fiber resistance to fatigue as well as overall condition. The conventional group did indeed see an increase in type 1 fiber condition but rather insignificant when compared to the E-Fit group. This is possibly due to the fact that the conventional group did not achieve type 1 fiber muscle exertion to the extent of the E-Fit group. Even though the E-Fit group participated in just over 20 minutes of training twice per week, it is clear that the muscle contractions were both deep and intense enough to create noticeable development in type 1 fibers.

Endurance Sit-Up

Much like the results of the endurance push-up challenge, the results recorded during this study were in E-Fit's favor. The E-Fit group recorded an average increase of seven sit-ups from the beginning to the end of the study while the conventional group recorded an increase of just two repetitions. The debate for this can also be related to the endurance push-up challenge. Type 1 fibers are only trained when excessive time of contraction has been implemented on the body. It can be argued that the workout provided to the conventional group was not sufficient enough to stimulate type 1 fibers to new growth.

Conclusion

Conventional weightlifting dates back further than any other form of muscular development. Within the past 10 years (E-Fit's initial introduction to the market), weightlifting and body engineering has become an extremely popular area of focus for both athletes and scientists. With the introduction of a new machine to the market, it is likely not an accepted tool by traditionalists. E-Fit is modern exercise that is geared towards those looking to save time, prevent injury, and maintain a healthy routine. The results in this study proved E-Fit is beneficial in saving time and enhancing muscular development.

The hypothesis, that E-Fit would have insignificant benefits to human metabolism and the muscular system compared with conventional training, as tested thoroughly over the course of the six-week study. But after the data were placed in a comparative scenario, it is necessary to accept the null hypothesis. E-Fit proved itself to show significant benefits to the human body at just two workouts per week while the conventional training method at the same volume proved itself to be ineffective. This stems from the results showing beneficial results in the E-Fit group of the categories: muscle mass index, body fat percentage, 1 repetition maximum bench press, 1 repetition maximum squat, 1 repetition maximum shoulder press, maximum push-ups, and maximum sit-ups. The only category in which the conventional group outperformed the E-Fit group was the body mass index.

It is critical to analyze the human and experimental errors that could have impacted the study. Human error can be attributed to numerous variables but the most vital include improper measurements, improper form of the subject, and even improper

adjustment of weight/power on exercises. The most critical human error could be the subject's diet and sleep habits. The subjects were given nutritional guidelines to follow but if were inconsistent with their nutrition, the primary factor affected would be fitness level and exercise progress. Experimental error includes the error associated with a measured value and the true value. The possibility of experimental error arises in the observed data collection. An example would be the subject engaging in a specific weight for an exercise, assuming they could not do more even if it were possible. This causes inconsistency in the data and the results could be skewed. For future studies, it may be beneficial to compose a longer study with more subjects and more data columns. This would identify if a subject was experiencing abnormal strength or endurance declines on that day.

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