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A comparative study of effect of step aerobic training for six weeks with 6 inches and 8 inches step platform at 126 beats per minute (BPM) on kinetic (ground reaction force) and kinematic (temporal) variables

Dr. Sonia Shalini

Abstract
A study was conducted with the objective to analyze the effect of six weeks step aerobic training on selected kinetic (Ground Reaction Force) and Kinematic (Temporal) of step aerobic training with the Protocol 1-of lower step (6 inches) and lower music tempo [126 beats per minute (BPM)] and adaptation to the same, Protocol 2- higher step (8 inches) and music tempo [126 beats per minute (BPM)], and comparison of the two. The study was delimited to female subjects only (N=32), age ranging from 18 to 22 years, height of step platform set 6 inches and 8 inches, music set at 126 beats per minute. The study delimited to selected kinetic (Ground Reaction Force) variables namely as Peak Force in X-axis on Force Plate 2(PF2X), Peak Force in y-axis on Force Plate 2 (PF2Y), Peak Force in z-axis on Force Plate 2 (PF2Z), Peak Force in X-axis on Force plate 1(PF1X), Peak Force in Y-axis on Force Plate 1(PF1Y), Peak Force in Z-axis on Force Plate 1(PF1Z), Kinematic (Temporal Variables) namely as Time taken to achieve Peak Force in X-axis on Force Plate 2(TPF2X), Time taken to achieve Peak Force in Y-axis on Force Plate 2(TPF2Y), Time taken to achieve Peak Force in Z-axis on Force Plate 2(TPF2Z), Time taken to achieve Peak Force in X-axis on Force plate 1(TPF1X), Time taken to achieve Peak Force i in Y-axis on force plate 1(TPF1Y), Time taken to achieve peak force in Z- axis on force plate 1(TPF1Z). The Data Recording and quantification for pre-test and post-test were administered by Dynamometric Analysis (force plate recordings) for both 6 inch and 8 inch Step Aerobic Training. Collected data were computed with mean, standard deviation and t-test. The Ground Reaction variables namely as PF2X, PF2Y, PF2Z, PF1X, PF1Y, PF1Z, TPF2X, TPF2Y, TPF2Z and TPF1X, TPF1Y, TPF1Z, decreased significantly. Six weeks of step aerobic training were found to be sufficient length of training (training cycle) for bio-mechanical adaptation. All the selected kinetic (ground reaction force) and kinematic(Temporal) variables supported each other as per the existing literature or research and were found suitable for step aerobic training evaluation.

Keywords: Step aerobic training, ground reaction force, temporal variables

Introduction
A number of biomechanical studies have been concluded on step aerobic training with emphasis on biomechanical load, exercise prescription and injury prevention.
A comparative study on ground reaction force (GRF) analysis of step aerobic training "move" – known as "basic step' with walk and run was conducted. The findings showed that GRF of walking at three miles per hour (MPH) was lowest. Step aerobic training was higher than walk but still lower than the GRF of running at seven MPH. The research further documented that different step moves and impact styles contribute to different GRF, which constitute repetitive forces placed on the feet.
The University of California studied the effect of such repetitive load movements on bone mineral density. The result revealed no statistical effect of high impact step aerobic training on bone mineral density. In contrast to the above findings, L. Liang suggested that a combination of high-impact exercise and strength training for best bone results. Researchers have compared GRF of a step aerobic training to locomotor activities, also compared the impact on each foot in a step "move". The conclusion being that GRF of step aerobic training is more than a walk but less than a run and further concluded that the vertical impact of the first step while stepping up on the platform is more compared to the second step while

stepping up. But the first step stepping down recorded the maximum vertical impact among the four counts of a basic step. A number of investigators conducted studies on various ground reaction force of step heights, stepping tempo, weighted vest etc. in search of safe methods to make the step aerobic training more and more challenging.

But further research is needed to know GFR of varying step height with varying music tempo (within the prescribed safety limits) to know the safest way to progress as the fitness level of the participants.

A number of researchers have been working on the effect of impact forces. Researches by Hecko and Finch state that during the step cycle in a step aerobics training, the highest mechanical load is experienced when the first foot in stepping down. Hence the research scholar has considered these variables in the study.

There are different protocol of training and testing of step aerobic but not bio-mechanically validated about the bio-mechanical adaptation. The question to be answered that whether a height of step of 6 inches with music (i.e. 126 beats per minute) vs height of step of 8 inches with music (i.e. 126 beats per minute) for six weeks, 5 days per week with a duration of 30 minutes can lead to bio-mechanical adaptation i.e. Ground Reaction Force (GRF) parameters.

The study by C.H. Turner *et al.*, (2003) observed that the osteogenic potential of physical activity is determined by the magnitude of the external load, the dynamic nature of the load, the rate at which the load is introduced, and the duration of the loading bout [1]. Weight-bearing activities that introduce stress to the skeleton through either ground reaction force (GRF) (e.g., running, jumping) or high-intensity joint reaction forces (e.g., weight lifting) have a greater impact on bone mineral accretion than weight-supported activities produce (e.g., bicycling, swimming), and may be more effective in reducing future risk of osteoporosis [2].

Methodology

32 female subjects were selected for the purpose of the study. 16 female subjects were selected for the protocol 1 - Step Height of 6 inches and music speed of 126BPM. 16 female subjects were selected for the protocol 2 - Step Height of 8 inches and music speed of 126 BPM. The age of the subjects ranged from 18 years to 22 years. Training for 30 min. (which included 5 min. for warm up and cool down), 5 times a week for 6 weeks for each protocol. The nature of the study and the procedure of the testing was explained to all the volunteers in advance before the experimentation was conducted. The following Kinetic (Ground Reaction Force) Variables were selected for the study:- PF2X = Peak Force in X-axis on Force Plate 2 mounted on logs of wood, PF2Y = Peak Force in Y-axis on Force Plate 2 mounted on logs of wood, PF2Z = Peak Force in Z-axis on Force Plate 2 mounted on logs of wood, PF1X = Peak Force in X-axis on Force plate 1 mounted on the floor adjacent to the step platform, PF1Y = Peak Force in Y-axis on Force Plate 1 mounted on the floor adjacent to the step platform, PF1Z = Peak Force in Z-axis on Force Plate 1 mounted on the floor adjacent to the step platform. TPF2X = Time taken to achieve Peak Force in X-axis on Force Plate 2 mounted on logs of wood. TPF2Y = Time taken to achieve Peak Force in Y-axis on Force Plate 2 mounted on logs of wood. TPF2Z = Time taken to achieve Peak Force in Z-axis on Force Plate 2 mounted on logs of wood. TPF1X= Time taken to achieve Peak Force in X-axis on Force plate 1 mounted on the floor adjacent to the step platform. TPF1Y = Time taken to achieve Peak Force i in Y-axis on Force Plate 1 mounted on the floor adjacent to the step platform. TPF1Z = Time taken to achieve Peak Force in Z-axis on Force Plate 1 mounted on the floor adjacent to the step platform.

The study was conducted by adopting test-retest design. According to the design of the study, all the subjects were tested (pre-test) before step aerobic training. Thereafter, step aerobic training was given for a period of six weeks to the selected subjects as per the protocol. After six weeks of training the subjects were retested (post-test). The recording was taken at Human Ergonomics Laboratory, DIPAS, Delhi. Each recording duration was 10 seconds for each subject. Note: The post-test was conducted for subjects who had completed their respective training protocols for a minimum of five days a week for a period of six weeks.

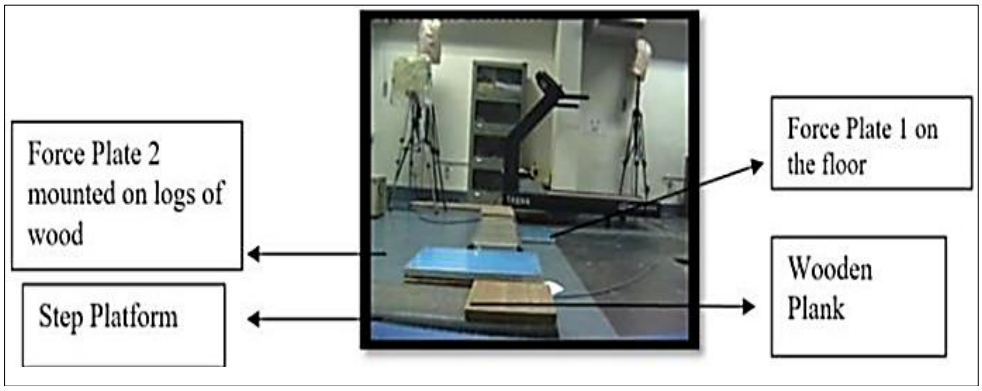

Fig 1: Aerobic training set up

Table 1: List of abbreviations

Abbreviations	Name of variables
PF2X	Peak Force in X-axis on Force Plate 2 mounted on logs of wood.
PF2Y	Peak Force in y-axis on Force Plate 2 mounted on logs of wood.
PF2Z	Peak Force in z-axis on Force Plate 2 mounted on logs of wood.
PF1X	Peak Force in X-axis on Force plate 1 mounted on the floor adjacent to the step platform
PF1Y	Peak Force in Y-axis on Force Plate 1 mounted on the floor adjacent to the step platform
PF1Z	Peak Force in Z-axis on Force Plate 1 mounted on the floor adjacent to the step platform
TPF2X	Time taken to achieve Peak Force in X-axis on Force Plate 2 mounted on logs of wood
TPF2Y	Time taken to achieve Peak Force in Y-axis on Force Plate 2 mounted on logs of wood
TPF2Z	Time taken to achieve Peak Force in Z-axis on Force Plate 2 mounted on logs of wood
TPF1X	Time taken to achieve Peak Force in X-axis on Force plate 1 mounted on the floor adjacent to the step platform.
TPF1Y	Time taken to achieve Peak Force i in Y-axis on Force Plate 1 mounted on the floor adjacent to the step platform.
TPF1Z	Time taken to achieve Peak Force in Z-axis on Force Plate 1 mounted on the floor adjacent to the step platform
Pre-test	Test conducted before starting the experimental treatment
Post-test	Test conducted after six weeks of step aerobic training.

Statistical analysis

The data obtained was analyzed by computing the mean, standard deviation and two tail 't' test by difference method was computed to these paired observations of protocol experiment for the selected kinetic (ground reaction force) variables. The research hypothesis was tested using the following formula:

$$t = \frac{\Sigma d}{\sqrt{\frac{N\Sigma d^2 - (\Sigma d)^2}{N}}}$$

Where,

N = Sample Size

Σd = Sum Total of Difference between Pre-test and Post-test

Σd2 = Sum Total of Square of Difference between Pre-test and Post-test

(Σd)2 = Whole Square of Sum of Difference between Pre-test and Post-test

The level of significance chosen was 0.05 for testing the hypothesis.

Table 2: Effect of step aerobic training on ground reaction force after six weeks with 6 inch step platform at 126 beats per minute (BPM) on kinetic (Ground reaction force) and kinematic (Temporal) variables. Protocol 1

S. No.	Variable	Test	Mean	SD	ΣD	ΣD2	(ΣD)2	t
1.	PF2X	pre-test	48.43	12.44	976.02	46691.42	952615.52	7.50*
		post-test	34.36	18.65				
2.	PF2Y	Pre-test	50.29	18.13	575.00	19049.02	330622.99	6.16*
		Post-test	49.04	13.47				
3.	PF2Z	Pre-test	543.75	64.99	801.90	29390.06	643041.64	8.32*
		Post-test	541.39	75.36				
4.	PF1X	Pre-test	43.71	15.69	895.79	48868.87	802439.45	5.81*
		Post-test	44.98	21.15				
5.	PF1Y	Pre-test	51.50	16.40	786.81	27883.23	619068.84	8.52*
		Post-test	60.97	31.08				
6.	PF1Z	Pre-test	803.97	149.44	2369.15	279421.59	4620.49	4.48*
		Post-test	801.74	139.07				
7.	TPF2X	Pre-test	2.11	0.51	34.62	68.41	1198.54	6.22*
		Post-test	2.55	0.35				
8.	TPF2Y	Pre-test	1.55	1.05	80.76	476.76	6522.18	4.89*
		Post-test	3.63	2.87				
9.	TPF2Z	Pre-test	1.89	0.91	30.74	45.27	944.95	7.75*
		Post-test	2.55	0.90				
10.	TPF1X	Pre-test	5.53	0.78	67.88	176.91	4607.69	11.83*
		Post-test	6.27	1.91				
11.	TPF1Y	Pre-test	8.07	1.57	118.69	4327.43	14086.15	1.90(NS)
		Post-test	5.93	1.39				
12.	TPF1Z	Pre-test	7.02	1.55	51.24	113.20	2625.54	9.18*
		Post-test	5.42	2.00				

Notes: N = 16, Time = ms, significance level =.05*, NS = not significant at level.05

PF2X = Peak Force in X-axis on Force Plate 2 mounted on step platform

PF2Y = Peak Force in y-axis on Force Plate 2 mounted on step platform

PF2Z = Peak Force in z-axis on Force Plate 2 mounted on step platform

PF1X = Peak Force in X-axis on Force plate 1 mounted on the floor adjacent to the step platform.

PF1Y = Peak Force in Y-axis on Force Plate 1 mounted on the floor adjacent to the step platform.

PF1Z = Peak Force in Z-axis on Force Plate 1 mounted on the floor adjacent to the step platform.

TPF2X = Time to Peak Force in X-axis on Force Plate 2 mounted on step platform

TPF2Y = Time to Peak Force in Y-axis on Force Plate 2 mounted on step platform

TPF2Z = Time to Peak Force in Z-axis on Force Plate 2 mounted on step platform

TPF1X= Time to Peak Force in X-axis on Force plate 1 mounted on the floor adjacent to the step platform.

TPF1Y = Time to Peak Force i in Y-axis on Force Plate 1 mounted on the floor adjacent to the step platform.
TPF1Z = Time to Peak Force in Z-axis on Force Plate 1 mounted on the floor adjacent to the step platform.
Pre-test =Test conducted before starting the experimental treatment.
Post-test=Test conducted after six weeks of step aerobic training.

The analysis of data in Table-2 documented the Mean, Standard Deviation and 't' ratio of Kinetic(Ground Reaction Force) variables PF1X, PF1Y, PF1Z, PF2X, PF2Y, PF1Z, TPF1X,TPF1Y, TPF1Z, TPF2X, TPF2Y and TPF2Z recorded at Pre-Test and Post-test of Protocol 2. According to the table the mean and standard Deviation of PF2X (pre-test) was 48.43±12.44 and post-test was 34.36± 18.65, with significant 't' ratio (t= 7.50) at.05 level. Mean and standard deviation of PF2Y pretest was 50.29 ± 18.13 and post-test was 49.04 ± 13.47 with significant 't' ratio (t= 6.16) at.05 level. Mean and standard deviation of PF2Z pre-test was 543.75 ± 75.36 and post-test was 541.39 ± 63.39 with significant 't' ratio (t= 8.32) at.05 level. Mean and standard deviation of PF1X pre-test was 43.71 ± 15.69 and post-test was 44.98 ± 21.15 with significant 't' ratio (t= 5.81) at.05 level. Mean and standard deviation of PF1Y pre-test was 51.50 ± 16.40 and post-test was 60.97 ± 21.08 with significant 't' ratio (t= 8.52) at.05 level. Mean and standard deviation of PF1Z pre-test was 803.97± 149.44 and post-test was 801.74 ± 139.07 with significant 't' ratio (t= 4.48) at.05 level. Mean and standard deviation of TPF2X pre-test was 2.11 ± 0.51 and post-test was 2.55 ± 0.35 with significant 't' ratio (t= 6.22) at.05 level. Mean and standard deviation of TPF2Y pre-test was 1.55± 0.05 and post-test was 3.63 ± 2.87 with significant 't' ratio (t= 4.89) at.05 level. Mean and standard deviation of TPF2Z pre-test was 1.89± 0.91and post-test was 2.55± 0.90 with significant 't' ratio (t= 7.75) at.05 level. Mean and standard deviation of TPF1X pre-test was 5.53± 0.78 post-test was 6.27± 1.91 with significant 't' ratio (t= 11.83) at.05 level. Mean and standard deviation of TPF1Y pre-test was 8.07± 1.57 post-test was 5.93±1.39 with insignificant 't' ratio (t= 1.90) at.05 level. Mean and standard deviation of TPF1Z pre-test was 7.02 ± 1.55 post-test was 5.42 ± 2.00 with significant 't' ratio (t= 9.18) at.05 level.

Table 3: Effect of step aerobic training for six weeks with 8 inch step platform at 126 beats per minute (BPM) on kinetic (ground reaction forces) and kinematic (temporal) variables. Protocol 2.

S. No.	Variable	Test	Mean	SD	ΣD	ΣD2	(ΣD)2	t
1.	PF2X	pre-test	66.66	12.93	1551.63	103701.55	2407552.94	9.20*
		post-test	72.60	14.81				
2.	PF2Y	Pre-test	79.22	13.31	3094.43	469543.28	9575527.76	7.50*
		Post-test	167.27	48.84				
3.	PF2Z	Pre-test	795.55	71.81	2118.67	233354.71	4488750.64	6.94*
		Post-test	792.23	72.16				
4.	PF1X	Pre-test	111.08	24.76	2679.22	330578.07	7178200.19	8.22*
		Post-test	75.21	25.53				
5.	PF1Y	Pre-test	112.78	47.31	3635.10	769301.67	13213928.00	6.09*
		Post-test	96.33	22.17				
6.	PF1Z	Pre-test	1199.34	197.02	5313.11	1619798.23	10164.57	4.18*
		Post-test	1042.78	117.77				
7.	TPF2X	Pre-test	1.33	0.92	55.98	119.94	3133.76	11.93*
		Post-test	2.98	0.88				
8.	TPF2Y	Pre-test	1.25	0.85	55.32	120.23	3060.30	11.15*
		Post-test	2.98	0.70				
9.	TPF2Z	Pre-test	1.15	0.79	49.46	111.50	2446.29	8.35*
		Post-test	2.69	0.87				
10.	TPF1X	Pre-test	5.34	0.34	70.94	196.74	5032.48	11.29*
		Post-test	6.75	1.21				
11.	TPF1Y	Pre-test	5.62	1.42	57.78	171.20	3338.53	7.07*
		Post-test	6.52	1.32				
12.	TPF1Z	Pre-test	5.30	0.70	53.32	114.40	2843.02	10.55*
		Post-test	6.96	1.01				

Notes: N = 16, Time = ms, significance level =.05*, NS = not significant at level.05
PF2X = Peak Force in X-axis on Force Plate 2 mounted on step platform
PF2Y = Peak Force in y-axis on Force Plate 2 mounted on step platform
PF2Z = Peak Force in z-axis on Force Plate 2 mounted on step platform
PF1X = Peak Force in X-axis on Force plate 1 mounted on the floor adjacent to the step platform.
PF1Y = Peak Force in Y-axis on Force Plate 1 mounted on the floor adjacent to the step platform.
PF1Z = Peak Force in Z-axis on Force Plate 1 mounted on the floor adjacent to the step platform.
TPF2X = Time to Peak Force in X-axis on Force Plate 2 mounted on step platform
TPF2Y = Time to Peak Force in Y-axis on Force Plate 2 mounted on step platform
TPF2Z = Time to Peak Force in Z-axis on Force Plate 2 mounted on step platform
TPF1X= Time to Peak Force in X-axis on Force plate 1 mounted on the floor adjacent to the step platform.
TPF1Y = Time to Peak Force in Y-axis on Force Plate 1 mounted on the floor adjacent to the step platform.
TPF1Z = Time to Peak Force in Z-axis on Force Plate 1 mounted on the floor adjacent to the step platform.
Pre-test =Test conducted before starting the experimental treatment.
Post-test=Test conducted after six weeks of step aerobic training.

The analysis of data in Table-3 documented the Mean, Standard Deviation and 't' ratio of Kinetic(Ground Reaction Force) variables PF1X, PF1Y, PF1Z, PF2X, PF2Y, PF2Z, TPF1X,TPF1Y, TPF1Z, TPF2X, TPF2Y and TPF2Z recorded at Pre-Test and Post-test of Protocol 4. According to the table the Mean and standard deviation of PF2X pre-test was 66.66± 12.93 and post-test was 72.60 ± 14.81, with significant 't' ratio (t= 9.20) at.05 level. Mean and standard deviation of PF2Y pre-test was 79.22± 13.31 and post-test was 167.27 ± 48.84 with significant 't' ratio (t= 7.50) at.05 level. Mean and standard deviation of PF2Z pre-test was 795.55± 71.81 post-test was 792.23± 72.16 with significant 't' ratio (t= 6.94) at.05 level. Mean and standard deviation of PF1X pre-test was 111.08 ± 24.76 post-test was 75.21± 25.53 with significant 't' ratio (t= 8.22) at.05 level. Mean and standard deviation of PF1Y pre-test was 112.78 ± 87.31 and post-test was 96.33± 22.17 with significant 't' ratio (t= 6.09) at.05 level. Mean and standard deviation of PF1Z pre-test was 1199.34 ± 197.02 post-test was 1042.78 ± 117.77 with significant 't' ratio (t= 4.18) at.05 level. Mean and standard deviation of TPF2X pre-test was 1.33± 0.92 post-test was 2.98± 0.88 with significant 't' ratio (t= 11.93) at.05 level. Mean and standard deviation of TPF2Y pre-test was 1.25 ± 0.85 and post-test was 2.98± 0.70 with significant 't' ratio (t= 11.15) at.05 level. Mean and standard deviation of TPF2Z pre-test was 1.15 ± 0.79and post-test was 2.69 ± 0.87 with significant 't' ratio (t= 8.35) at.05 level. Mean and standard deviation of TPF1X pre-test was 5.34 ± 5.34 and post-test was 6.75± 1.21 with significant 't' ratio (t= 11.29) at.05 level. Mean and standard deviation of TPF1Y pre-test was 5.62 ± 0.42 post-test was 6.52 ± 1.32 with significant 't' ratio (t= 7.07) at.05 level. Mean and standard deviation of TPF1Z pre-test was 5.62 ± 0.42 post-test was 6.52 ± 1.32 with significant 't' ratio (t= 7.07) at.05 level. Mean and standard deviation of TPF1Z pre-test was 5.30 ± 0.70 post-test was 6.96± 1.01 with significant 't' ratio (t= 10.55) at.05 level.

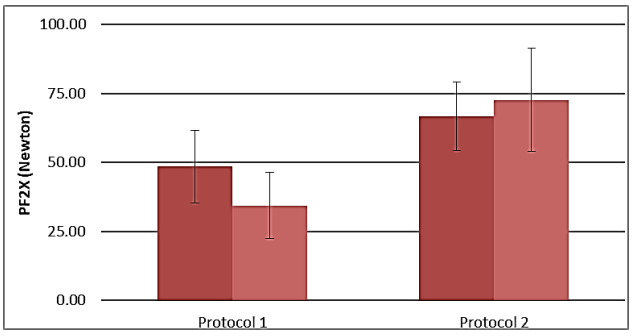

Fig 2: Comparison among two protocols in regard to the variable PF2X

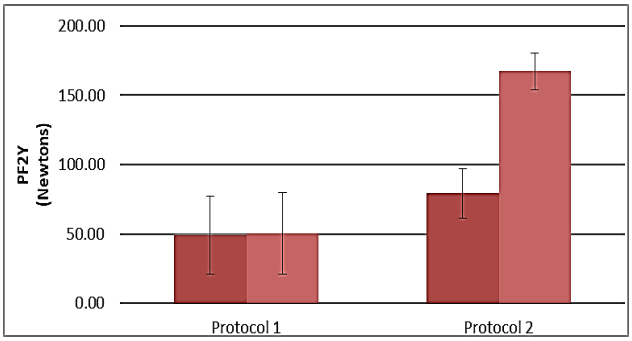

Fig 3: Comparison among two protocols in regard to the variable PF2Y

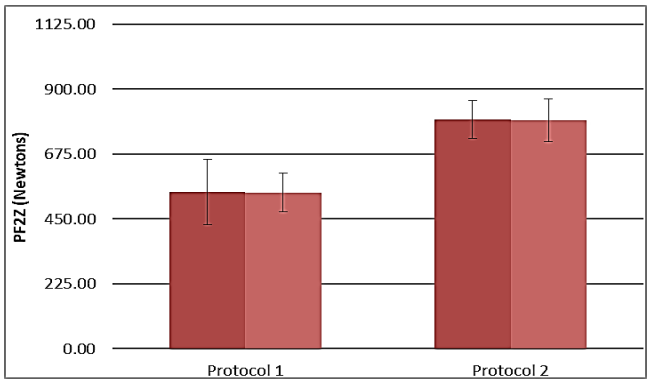

Fig 4: Comparison among four protocols in regard to the variable PF2Z

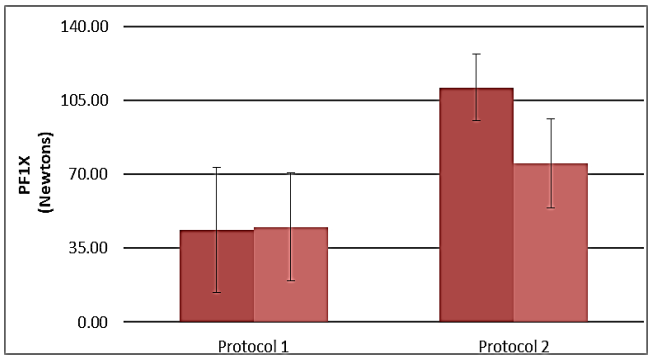

Fig 5: Comparison among two protocols in regard to the variable PF1X

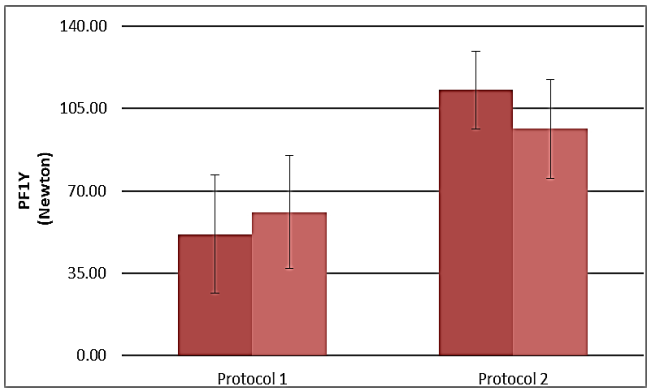

Fig 6: Comparison among four protocols in regard to the variable PF1Y

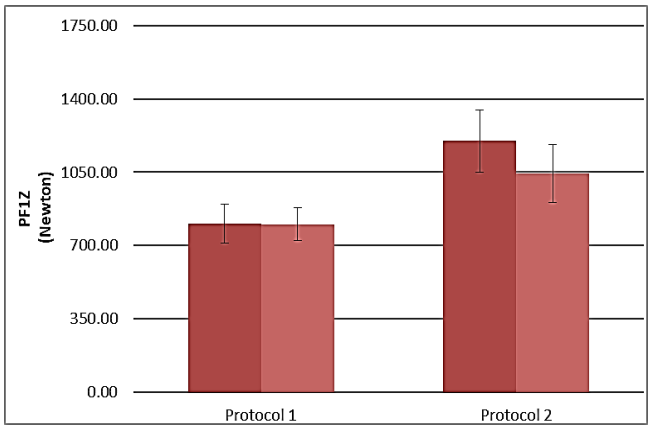

Fig 7: Comparison among four protocols in regard to the variable PF1Z

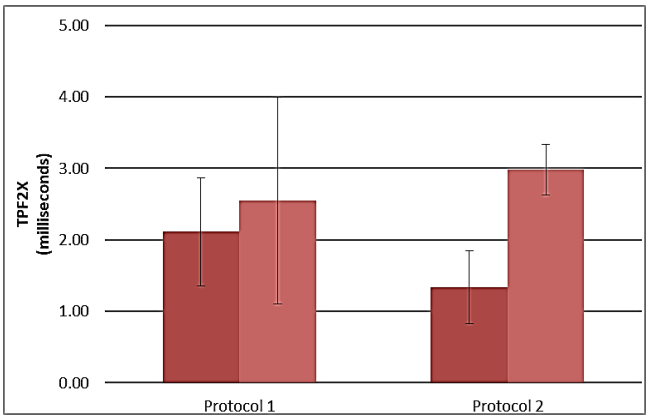

Fig 8: Comparison among two protocols in regard to the variable

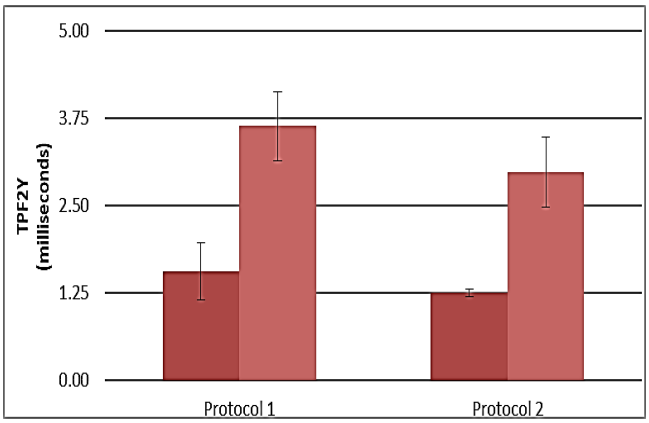

Fig 9: Comparison among four protocols in regard to the variable TPF2Y

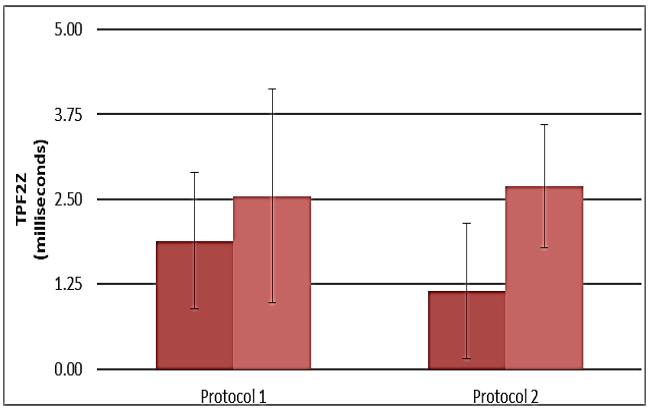

Fig 10: Comparison among two protocols in regard to the variable TPF2Z

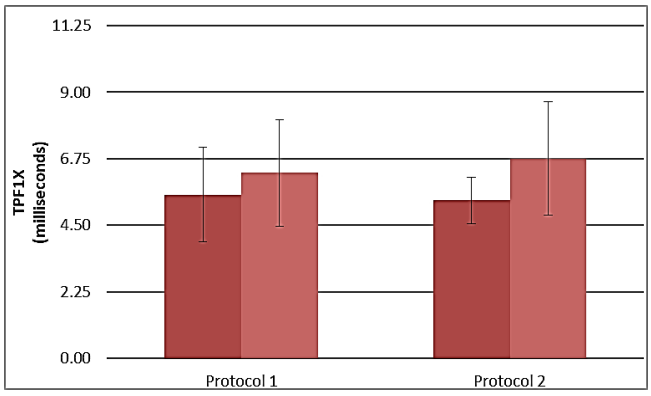

Fig 11: Comparison among two protocols in regard to the variable TPF1X

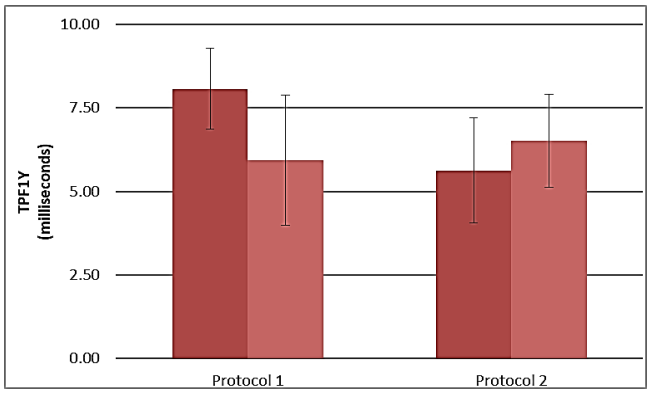

Fig 12: Comparison among two protocols in regard to the variable TPF1Y

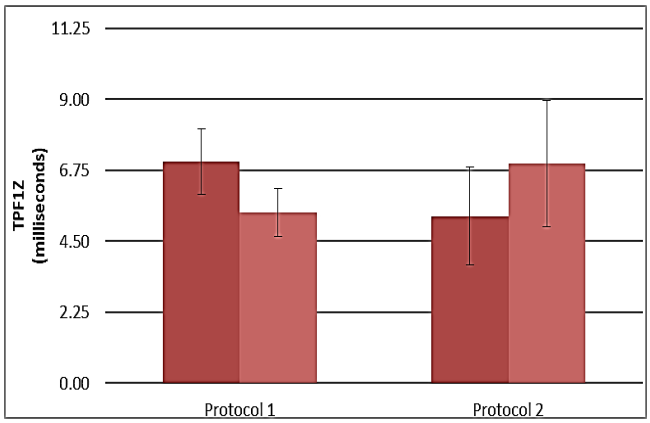

Fig 13: Comparison among two protocols in regard to the variable TPF1Z

The findings of the conducted study as a whole reflects that:

1. There was significant effect of step aerobics training (Protocol 1, Protocol 2) on the selected kinetic variables namely PF1X, PF1Y, PF1Z, PF2X, PF2Y, PF2Z, TPF1X, TPF1Y, TPF1Z, TPF2X, TPF2Y and TPF2Z.
2. A comparison among the two protocols of the selected kinetic (ground reaction force) variables projected that

a) There was a decreasing trend following the adaptation and an increasing trend following the increase of intensity of step aerobic training in regard to the variable PF2X.
b) There was an increasing trend following the adaptation and an increasing trend following the increase of intensity of step aerobic training in regard to the variable PF2Y.
c) There was a decreasing trend following the adaptation and an increasing trend following the increase of intensity of step aerobic training in regard to the variable PF2Z.
d) There was a decreasing trend following the adaptation and an increasing trend following the increase of intensity of step aerobic training in regard to the variable PF1X.
e) There was an increasing trend following the adaptation and an increasing trend following the increase of intensity of step aerobic training in regard to the variable PF1Y.
f) There was a decreasing trend following the adaptation and an increasing trend following the increase of intensity of step aerobic training in regard to the variable PF1Z.

g) There was an increasing trend following the adaptation and no definite trend following the increase of intensity of step aerobic training in regard to the variable TPF2X.
h) There was an increasing trend following the adaptation and no definite trend following the increase of intensity of step aerobic training in regard to the variable TPF2Y.
i) There was an increasing trend following the adaptation and a decreasing trend following the increase of intensity of step aerobic training in regard to the variable TPF2Z.
j) There was an increasing trend following the adaptation and no definite trend following the increase of intensity of step aerobic training in regard to the variable TPF1X.
k) There was a decreasing trend following the adaptation in protocols with lower step platform height namely in protocol 1 and protocol 2, whereas there was an increasing trend in protocols with higher step platform height namely protocol 1 and protocol 2. Further, there was a decreasing trend following the increase of intensity of step aerobic training in regard to the variable TPF1Y.
l) There was a decreasing trend following the adaptation and an increasing trend following the increase of intensity of step aerobic training in regard to the variable TPF1Z.

The purpose of this study was to examine the magnitude of the impacts created while performing a typical step aerobic movement pattern, on different step platform height (6 inches step platform and 8 inch step platform) with the same music speed(126 BPM). This study compared the vertical impact Right Lead followed by Left Lead PF2X, PF2Y, PF2Z, PF1X, PF1Y and PF1Z force patterns for each of the four steps in a typical single lead Basic step sequence (up 1, up 2, down 1, down 2). The impact which occurred when the first foot struck the floor during the descent phase of the up-up-down-down sequence, PF1X, PF1Y and PF1Z revealed that this impact produced the largest impact force of the four steps.

A comparism of the Kinetic (Ground Reaction Force) and Kinematic (Temporal) Variables of Protocol1 (Step height 6 inches and Music 126BPM) and Protocol 2 (Step height 8 inches and Music 126BPM). The study concluded that the GRF of stepping on 8 inches with music 126BPM was greater that stepping on 6 inches with music 126 BPM. Further this was The present study also documents effect of adaptation to these factors collectively and independently hence the effect to the ground reaction force as well as adaptation to the same.

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