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## Effect of step aerobic training for six weeks with 8 inches step platform at 118 and 126 beats per minute (BPM) on kinematic (Partial temporal) variables

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### Abstract

A study conducted with the objective to test the effect of Step Aerobic training for six weeks with 8 inches step platform at 118 and 126 beats per minute (BPM) on selected kinematic (Partial Temporal) variables. The study was delimited to female subjects only (N=30), age ranging from 18 to 22 years and the intensity of training set to 118 and 126 beats per minute as protocol 1 and protocol 2 respectively. The study delimited to selected kinematic (Partial Temporal) variables namely as Leg Step up, Leg Step down, Upward Arm Swing, Downward Arm Swing and Ratio Variables. The Data Recording and quantification for pre-test and post-test were administered by Video Analysis (analysis for partial temporal variables) post-test was conducted immediately after step aerobic training for 6 weeks with eight inches step platform at 118 BMP as well as 126 BMP independently. Collected data was computed with mean, standard deviation and t-test. The selected variables for the study were Leg Step up Variable-Right (T1), Leg Step Up Variable-Left (T2), Leg Step Down Variable-Right (T3), Leg Step Down Variable-Left (T4), Leg Step up Variable-Left (T5), Leg Step Up Variable-Right (T6), Leg Step Down Variable-Left (T7), Leg Step Down Variable-Right (T8), Upward Arm Swing while performing variable T1-Variable (T9), Downward Arm Swing Variable while performing variable T2 (T10), Upward Arm Swing while performing variable T3-Variable (T11), Downward Arm Swing Variable while performing variable T4 (T12), Upward Arm Swing while performing variable T5-Variable (T13), Downward Arm Swing Variable while performing variable T6 (T14), Upward Arm Swing while performing variable T7-Variable (T15), Downward Arm Swing Variable while performing variable T8 (T16), Ratio Variables (T17-T32). It was concluded that there was significant effect of step aerobic training on the selected kinematic (Partial Temporal) variables namely as T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31 and T32 in both of the protocols. Effect of step aerobic training for six weeks in different protocol were found to be significant for biomechanical adaptation. All the selected 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, kinematic, temporal, BPM

### Introduction

Step aerobic training is a popular form of group exercise which incorporates stepping up and down on step platforms of varying heights, using a variety of stepping patterns and upper body movements similar to an aerobics class. Research available states that step aerobic training is a valid means of improving aerobic capacity and has been promoted as a low impact physical activity.

Biomechanics is the study of the motion of the body and the effects of forces on it. Measuring the effect of the forces exerted during exercise is much more difficult than measuring either heart rate or oxygen uptake i.e. the physiological effects. This is due to the fact that, with few exceptions, it is impossible to put measuring devices inside living tissues to determine the amount of stress that may be caused by vigorous exercise. Researchers must, therefore, use other methods to study the effects of mechanical stress of exercise on the body. These methods can be used to examine the long-term effects of participation and the immediate effect of participation.

Long-term effects can be estimated from a survey of the aches, pains and injuries suffered by

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the participants. This approach can reveal the incidence and types of discomfort and injuries suffered, therefore statistical analysis can be carried out in an attempt to identify factors that may give clues about the causes of these discomforts and injuries. The immediate effects of participation can be examined using a various techniques that are available in biomechanics laboratories. These techniques include force-measuring devices and computer assisted analysis of video recordings.

Step aerobic training has been promoted as a low impact physical activity recommended for the improvement of cardio respiratory and muscular fitness. This recreational activity can also be recommended to improve bone health since mechanical load plays an important role in the normal development of the skeleton. Rita Alexandra Santos-Rocha's (2006) main purpose was to characterize 100 step sessions and to calculate osteogenic index (OI) according to Turner and Robling:  $OI$  (one session) = peak ground reaction force (BW) x n (number of loading cycles +1).

### Objectives of the study

The objectives of the study were to study the effect of step aerobic training with the Protocol 1- of step platform height (8 inches) and lower music tempo [118 beats per minute (BPM)] and Protocol 2- platform height (8 inches) and higher music tempo [126 beats per minute (BPM)] with adaptation to the same independently on selected kinematic (temporal) variables.

### Selection of the subjects

Adopting random sampling method, depending upon the willingness of the female subjects, 30 subjects were selected for the purpose of the study. The age of the subjects ranged from 18 years to 22 years. The objectives of the study and the procedure of the testing was explained to all the volunteers in advance before the experimentation was conducted. The consent form was obtained from all the participants in the study in advance.

### Selection of the variables

#### Details of kinematic (Partial temporal) variables



Fig 1: Kinematic variable - starting position

Keeping in view the objectives of the study, following Kinematic (partial temporal) categorized variables were selected:

#### Leg step up variables

**Variable T1:** Variable T1 refers to the time taken (milliseconds) to place the right foot (Basic Right, first foot up) on the step platform.

**Variable T2:** Variable T2 refers to the time taken (milliseconds) to place the left foot (Basic Right, second foot

up) on the step platform from T1 position.

**Variable T5:** Variable T5 refers to the time taken (milliseconds) to place the left foot (Basic Left, first foot up) on the step platform.

**Variable T6:** Variable T6 refers to the time taken (milliseconds) to place the right foot (Basic Left, second foot up) on the step platform.

#### Leg step down variables

**Variable T3:** Variable T3 refers to the time taken (milliseconds) to place the right foot (Basic Right, first foot down) on the floor, while stepping down from T2 position.

**Variable T4:** Variable T4 refers to the time taken (milliseconds) to place the left foot (Basic Right, second foot down) on the floor, while stepping down from T3 position.

**Variable T7:** Variable T7 refers to the time taken (milliseconds) to place the left foot (Basic left, first foot down) on the floor, while stepping down from T6 position.

**Variable T8:** Variable T8 refers to the time taken (milliseconds) to place the right foot (Basic Right, second foot down) on the floor, while stepping down from T7 position.

#### Upward arm swing variables

**Variable T9:** Variable T9 refers to the time taken (milliseconds) to swing arms up in front of the body while performing variable T1.

**Variable T11:** Variable T11 refers to the time taken (milliseconds) to swing arms up in front of the body while performing variable T3.

**Variable T13:** Variable T13 refers to the time taken (milliseconds) to swing arms up in front of the body while performing variable T5.

**Variable T15:** Variable T15 refers to the time taken (milliseconds) to swing arms up in front of the body while performing variable T7.

#### Downward arm swing variables

**Variable T10:** Variable T10 refers to the time taken (milliseconds) to swing arms back to the starting position from variable T9, while performing variable T2.

**Variable T12:** Variable T12 refers to the time taken (milliseconds) to swing arms back to the starting position from variable T11, while performing variable T4.

**Variable T14:** Variable T14 refers to the time taken (milliseconds) to swing arms back to the starting position from variable T13, while performing variable T6.

**Variable T16:** Variable T16 refers to the time taken (milliseconds) to swing arms back to the starting position from variable T15, while performing variable T7.

#### Ratio variables

**Variable T17:** Variable T17 refers to the ratio of variable T1 and variable T5. [Basic Right (first foot) and Basic Left (first foot) stepping up ratio].

**Variable T18:** Variable T18 refers to the ratio of variable T2 and variable T6. [Basic Right (second foot) and Basic Left (second foot) stepping up ratio].

**Variable T19:** Variable T19 refers to the ratio of variable T3 and variable T7. [Basic Right (first foot) and Basic Left (first foot) stepping down ratio].

**Variable T20:** Variable T20 refers to the ratio of variable T4 and variable T8. [Basic Right (second foot) and Basic Left (second foot) stepping down ratio].

**Variable T21:** Variable T21 refers to the ratio of variable T9 and variable T13. [Ratio of time taken to swing arms up while

performing Basic Right (first foot up) and time taken to swing arms up while performing Basic Left (first foot up)].

**Variable T22:** Variable T22 refers to the ratio of variable T10 and variable T14. [Ratio of time taken to swing arms up while performing Basic Right (second foot up) and time taken to swing arms up while performing Basic Left (second foot up)].

**Variable T23:** Variable T23 refers to the ratio of variable T11 and variable T15. [Ratio of time taken to swing arms up while performing Basic Right (first foot down) and time taken to swing arms up while performing Basic Left (first foot down)].

**Variable T24:** Variable T24 refers to the ratio of variable T12 and variable T16. [Ratio of time taken to swing arms up while performing Basic Right (second foot down) and time taken to swing arms up while performing Basic Left (second foot down)].

**Variable T25:** Variable T25 refers to the ratio of variable T1 and variable T9. [Ratio of the time taken to place Basic Right (first foot up) on the step platform and the time taken to swing arms upward].

**Variable T26:** Variable T26 refers to the ratio of variable T2 and variable T10. [Ratio of the time taken to place Basic Right (second foot up) on the step platform and the time taken to swing arms downward].

**Variable T27:** Variable T27 refers to the ratio of variable T3 and variable T11. [Ratio of the time taken to place Basic Right (first foot down) on the floor and the time taken to swing arms up]

**Variable T28:** Variable T28 refers to the ratio of variable T4 and variable T12. [Ratio of the time taken to place Basic Right (second foot down) on the floor to the time taken and swing arms downward].

**Variable T29:** Variable T29 refers to the ratio of variable T5 and variable T13. [Ratio of the time taken to place Basic Left (first foot up) on the step platform and the time taken to swing arms upward].

**Variable T30:** Variable T30 refers to the ratio of variable T6 and variable T14. [Ratio of the time taken to place Basic Left (second foot up) on the step platform and the time taken to swing arms downward].

**Variable T31:** Variable T31 refers to the ratio of variable T7 and variable T15. [Ratio of the time taken to place Basic Left

(first foot down) on the floor and the time taken to swing arms up].

**Variable T32:** Variable T32 refers to the ratio of variable T8 and variable T16. [Ratio of the time taken to place Basic Left (second foot down) on the floor and the time taken to swing arms downward].

**Administration of the tests and collection of the data**

The video recording for the kinematic (partial temporal) variables were also conducted at the Judo hall of I.G.I.P.E.S.S., the Badminton hall of I.G.I.P.E.S.S., Fitness First and at Ozone Fitness Club. The Data Recording and quantification for pretest and posttest were administered by Video Analysis (analysis for partial temporal variables). Post-test was conducted immediately after step aerobics training for 6 weeks with eight inches step platform at 118 BMP as well as 126 BMP independently.

**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 kinematic variables. The research hypothesis was tested using the following formula:

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

Where,

N = Sample Size

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

Σd<sup>2</sup> = Sum Total of Square of Difference between Pre-test and Post-test

(Σd)<sup>2</sup> = 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 1:** Effect of step aerobic training for six weeks with 8 inch step platform at 118 beats per minute (BPM) on kinematic (Partial temporal) variables protocol 1

S. No.	Variable	Test	Mean	SD	ΣD	ΣD <sup>2</sup>	(ΣD) <sup>2</sup>	t
1.	T1	Pre-test	0.14	0.01	0.07	0.00	0.00	3.03*
		Post-test	0.14	0.01				
2.	T2	Pre-test	0.16	0.01	0.056	0.01	0.31	18.20*
		Post-test	0.14	0.00				
3.	T3	Pre-test	0.16	0.01	0.26	0.00	0.07	6.22*
		Post-test	0.16	0.00				
4.	T4	Pre-test	0.12	0.01	0.28	0.00	0.08	7.03*
		Post-test	0.12	0.00				
5.	T5	Pre-test	0.14	0.01	0.19	0.00	0.04	7.20*
		Post-test	0.13	0.01				
6.	T6	Pre-test	0.16	0.01	0.41	0.01	0.17	13.69*
		Post-test	0.14	0.01				
7.	T7	Pre-test	0.16	0.00	0.15	0.00	0.02	5.48*
		Post-test	0.16	0.00				
8.	T8	Pre-test	0.12	0.01	0.30	0.00	0.09	9.49*
		Post-test	0.13	0.01				
9.	T9	Pre-test	0.00	0.00	4.12	0.57	16.97	146.89*
		Post-test	0.14	0.00				
10.	T10	Pre-test	0.00	0.00	4.33	0.63	18.75	141.48*
		Post-test	0.13	0.00				
11.	T11	Pre-test	0.00	0.00	4.71	0.74	22.18	163.49*

		Post-test	0.16	0.00				
12.	T12	Pre-test	0.00	0.00	3.92	0.51	15.37	113.79*
		Post-test	0.13	0.01				
13.	T13	Pre-test	0.00	0.00	4.08	0.56	16.65	63.56*
		Post-test	0.13	0.01				
14.	T14	Pre-test	0.00	0.00	4.30	0.62	18.49	146.06*
		Post-test	0.14	0.00				
15.	T15	Pre-test	0.00	0.00	4.70	0.74	22.09	143.91*
		Post-test	0.16	0.00				
16.	T16	Pre-test	0.00	0.00	4.02	0.54	16.16	96.93*
		Post-test	0.13	0.01				
17.	T17	Pre-test	1.04	0.05	1.39	0.09	1.94	8.29*
		Post-test	1.01	0.03				
18.	T18	Pre-test	1.03	0.03	1.21	0.08	1.48	6.79*
		Post-test	0.99	0.03				
19.	T19	Pre-test	1.01	0.05	1.22	0.07	1.49	8.24*
		Post-test	1.01	0.03				
20.	T20	Pre-test	1.00	0.09	2.46	0.26	6.07	10.62*
		Post-test	0.99	0.02				
21.	T21	Pre-test	0.00	0.00	31.60	33.52	998.83	66.85*
		Post-test	1.05	0.06				
22.	T22	Pre-test	0.00	0.00	30.82	31.74	950.06	115.65*
		Post-test	1.03	0.09				
23.	T23	Pre-test	0.00	0.00	30.43	30.95	925.94	103.79*
		Post-test	1.01	0.05				
24.	T24	Pre-test	0.00	0.00	29.53	29.17	871.99	90.68*
		Post-test	0.98	0.06				
25.	T25	Pre-test	0.00	0.00	30.43	30.91	925.80	131.93*
		Post-test	1.01	0.04				
26.	T26	Pre-test	0.00	0.00	29.91	29.86	894.91	162.59*
		Post-test	1.00	0.03				
27.	T27	Pre-test	0.00	0.00	31.16	32.41	971.19	173.26*
		Post-test	1.04	0.03				
28.	T28	Pre-test	0.00	0.00	28.84	27.79	831.68	111.34*
		Post-test	0.96	0.05				
29.	T29	Pre-test	0.00	0.00	31.31	32.75	980.17	111.61*
		Post-test	1.04	0.05				
30.	T30	Pre-test	0.00	0.00	30.67	31.43	940.75	114.68*
		Post-test	1.02	0.05				
31.	T31	Pre-test	0.00	0.00	31.06	32.20	964.94	169.69*
		Post-test	1.04	0.03				
32.	T32	Pre-test	0.00	0.00	28.57	27.26	816.32	134.35*
		Post-test	0.95	0.04				

\* Significant at 0.05 level, T1 – T16 = milliseconds, T17 - T32 = numeric, Notes: N = 30

Pre-test = Test conducted before starting the experimental protocol.

Post-test = Test conducted after six weeks of training of the experimental protocol.

Protocol 1 = Performing 'Basic Step' on 8 inch high step platform at 118 beats per min.

The analysis of data in Table 1 documented the Mean, Standard Deviation and 't' ratio on 32 variables of Protocol 3. According to the table, the variable T1 has a mean and standard deviation of  $0.14 \pm 0.01$  for pre-test and  $0.14 \pm 0.01$  for post-test with significant 't' ratio ( $t=3.02$ ) at .05 level. Variable T2 has a mean and standard deviation of  $0.16 \pm 0.01$  for pre-test and  $0.14 \pm 0.00$  for post-test with significant 't' ratio ( $t=18.20$ ) at .05 level. The variable T3 has a mean and standard deviation of  $0.16 \pm 0.01$  for pre-test and  $0.16 \pm 0.00$  for post-test with significant 't' ratio ( $t=6.22$ ) at .05 level. The variable T4 has a mean and standard deviation of  $0.12 \pm 0.01$  for pre-test and  $0.12 \pm 0.00$  for post-test with significant 't' ratio ( $t=7.03$ ) at .05 level. The variable T5 has a mean and standard deviation of  $0.14 \pm 0.01$  for pre-test and  $0.13 \pm 0.01$  for post-test with significant 't' ratio ( $t=7.20$ ) at .05 level. The variable T6 has a mean and standard deviation of  $0.16 \pm 0.01$  for pre-test and  $0.14 \pm 0.01$  for post-test with significant 't' ratio ( $t=13.69$ ) at .05 level. The variable T7 has a mean and standard deviation of  $0.16 \pm 0.00$  for pre-test and  $0.16 \pm 0.00$  for post-test with significant 't' ratio ( $t=5.48$ ) at .05 level. The

variable T8 has a mean and standard deviation of  $0.12 \pm 0.01$  for pre-test and  $0.13 \pm 0.01$  for post-test with significant 't' ratio ( $t=9.49$ ) at .05 level. The variable T9 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.14 \pm 0.00$  for post-test with significant 't' ratio ( $t=146.89$ ) at .05 level. The variable T10 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.13 \pm 0.00$  for post-test with significant 't' ratio ( $t=141.48$ ) at .05 level. The variable T11 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.16 \pm 0.00$  for post-test with significant 't' ratio ( $t=163.49$ ) at .05 level. The variable T12 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.13 \pm 0.01$  for post-test with significant 't' ratio ( $t=113.79$ ) at .05 level. The variable T13 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.13 \pm 0.01$  for post-test with significant 't' ratio ( $t=63.56$ ) at .05 level. The variable T14 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.14 \pm 0.00$  for post-test with significant 't' ratio ( $t=146.06$ ) at .05 level. The variable T15 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.16 \pm 0.00$  for post-test with significant 't'

ratio ( $t=143.91$ ) at .05 level. The variable T16 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.13 \pm 0.01$  for post-test with significant 't' ratio ( $t=96.93$ ) at .05 level. The variable T17 has a mean and standard deviation of  $1.04 \pm 0.05$  for pre-test and  $1.01 \pm 0.03$  for post-test with significant 't' ratio ( $t=8.29$ ) at .05 level. The variable T18 has a mean and standard deviation  $1.03 \pm 0.03$  for pre-test and  $0.99 \pm 0.03$  for post-test with significant 't' ratio ( $t=6.79$ ) at .05 level. The variable T19 has a mean and standard deviation of  $1.01 \pm 0.05$  for pre-test and  $1.01 \pm 0.03$  for post-test with significant 't' ratio ( $t=8.24$ ) at .05 level. The variable T20 has a mean and standard deviation of  $1.0 \pm 0.09$  for pre-test and  $0.99 \pm 0.02$  for post-test with significant 't' ratio ( $t=10.62$ ) at .05 level. The variable T21 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.05 \pm 0.06$  for post-test with significant 't' ratio ( $t=66.85$ ) at .05 level. The variable T22 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.03 \pm 0.09$  for post-test with significant 't' ratio ( $t=115.65$ ) at .05 level. The variable T23 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.01 \pm 0.05$  for post-test with significant 't' ratio ( $t=103.79$ ) at .05 level. The variable T24 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test

and  $0.98 \pm 0.06$  for post-test with significant 't' ratio ( $t=90.68$ ) at .05 level. The variable T25 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.01 \pm 0.04$  for post-test with significant 't' ratio ( $t=131.93$ ) .05 level. The variable T26 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.00 \pm 0.03$  for post-test with significant 't' ratio ( $t=162.59$ ) at .05 level. The variable T27 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.04 \pm 0.03$  for post-test with significant 't' ratio ( $t=173.26$ ) at .05 level. The variable T28 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.96 \pm 0.05$  for post-test with significant 't' ratio ( $t=111.34$ ) at .05 level. The variable T29 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.04 \pm 0.05$  for post-test with significant 't' ratio ( $t=111.61$ ). The variable T30 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.02 \pm 0.05$  for post-test with significant 't' ratio ( $t=114.68$ ) at .05 level. The variable T31 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.04 \pm 0.03$  for post-test with significant 't' ratio ( $t=169.69$ ) at .05 level. The variable T32 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.95 \pm 0.04$  for post-test with significant 't' ratio ( $t=134.35$ ).

**Table 2:** Effect of step aerobic training for six weeks with 8 inches step platform at 126 beats per minute (BPM) on kinematic (Partial temporal) variables protocol 2

S. No.	Variable	Test	Mean	SD	$\Sigma D$	$\Sigma D^2$	$(\Sigma D)^2$	T
1.	T1	Pre-test	0.13	0.01	0.17	0.00	0.03	2.78*
		Post-test	0.12	0.00				
2.	T2	Pre-test	0.14	0.01	0.41	0.01	0.17	9.95*
		Post-test	0.14	0.01				
3.	T3	Pre-test	0.16	0.00	0.19	0.00	0.04	6.35*
		Post-test	0.16	0.01				
4.	T4	Pre-test	0.12	0.00	0.13	0.00	0.02	4.79*
		Post-test	0.12	0.00				
5.	T5	Pre-test	0.13	0.01	0.20	0.00	0.04	4.63*
		Post-test	0.13	0.00				
6.	T6	Pre-test	0.15	0.02	0.38	0.02	0.14	3.06*
		Post-test	0.15	0.01				
7.	T7	Pre-test	0.16	0.01	0.15	0.00	0.02	2.45*
		Post-test	0.16	0.00				
8.	T8	Pre-test	0.12	0.02	0.48	0.05	0.23	2.36*
		Post-test	0.12	0.00				
9.	T9	Pre-test	0.00	0.00	3.89	0.51	15.13	108.03*
		Post-test	0.13	0.00				
10.	T10	Pre-test	0.00	0.00	4.04	0.54	16.32	147.85*
		Post-test	0.13	0.00				
11.	T11	Pre-test	0.00	0.00	4.72	0.74	22.28	168.29*
		Post-test	0.16	0.00				
12.	T12	Pre-test	0.00	0.00	3.86	0.50	14.90	54.88*
		Post-test	0.13	0.01				
13.	T13	Pre-test	0.00	0.00	3.90	0.51	15.21	159.22*
		Post-test	0.13	0.00				
14.	T14	Pre-test	0.00	0.00	4.36	0.64	19.01	61.99*
		Post-test	0.15	0.01				
15.	T15	Pre-test	0.00	0.00	5.05	0.96	25.50	15.42*
		Post-test	0.15	0.01				
16.	T16	Pre-test	0.00	0.00	4.83	1.13	23.33	8.15*
		Post-test	0.13	0.01				
17.	T17	Pre-test	1.01	0.07	802.54	29880.66	644070.45	8.75*
		Post-test	1.00	0.03				
18.	T18	Pre-test	0.98	0.07	955.52	35570.81	91318.47	13.33*
		Post-test	0.94	0.04				
19.	T19	Pre-test	1.03	0.05	742.57	27636.25	551410.20	7.72*
		Post-test	1.04	0.03				
20.	T20	Pre-test	1.03	0.05	814.64	31770.86	663638.33	8.29*
		Post-test	1.04	0.08				
21.	T21	Pre-test	0.00	0.00	987.99	43266.28	976124.24	9.54*

		Post-test	1.01	0.04				
22.	T22	Pre-test	0.00	0.00	995.74	41048.69	991498.15	11.13*
		Post-test	0.94	0.04				
23.	T23	Pre-test	0.00	0.00	893.87	35182.40	799003.58	9.67*
		Post-test	1.03	0.04				
24.	T24	Pre-test	0.00	0.00	865.34	34539.72	748813.32	8.84*
		Post-test	1.04	0.13				
25.	T25	Pre-test	0.00	0.00	227.42	7330.27	51719.86	8.04*
		Post-test	1.00	0.00				
26.	T26	Pre-test	0.00	0.00	291.94	8550.39	85228.96	3.86*
		Post-test	1.01	0.03				
27.	T27	Pre-test	0.00	0.00	639.74	25974.41	409267.27	5.76*
		Post-test	1.03	0.02				
28.	T28	Pre-test	0.00	0.00	716.29	23509.35	513071.36	8.95*
		Post-test	0.97	0.13				
29.	T29	Pre-test	0.00	0.00	384.97	14942.57	148201.90	3.85*
		Post-test	1.00	0.01				
30.	T30	Pre-test	0.00	0.00	521.53	23548.75	271993.54	4.33*
		Post-test	1.02	0.02				
31.	T31	Pre-test	0.00	0.00	497.73	19135.84	247735.15	4.77*
		Post-test	1.02	0.02				
32.	T32	Pre-test	0.00	0.00	841.10	30079.99	710817.61	10.55*
		Post-test	0.94	0.04				

\* Significant at 0.05 level, T1 – T16 = milliseconds, T17 - T32 = numeric, Notes: N = 30

Pre-test = Test conducted before starting the experimental protocol.

Post-test = Test conducted after six weeks of training of the experimental protocol.

Protocol 2 = Performing 'Basic Step' on 8 inch high step platform at 126 beats per min.

The analysis of data in Table 2 documented the mean, standard deviation and 't' ratio on 32 variables of Protocol 2. According to the table, the variable T1 has a mean and standard deviation of  $0.13 \pm 0.01$  for pre-test and  $0.12 \pm 0.00$  for post-test with significant 't' ratio ( $t=2.78$ ) at .05 level. The variable T2 has a mean and standard deviation of  $0.14 \pm 0.01$  for pre-test and  $0.14 \pm 0.01$  for post-test with significant 't' ratio ( $t=9.95$ ) at .05 level. The variable T3 has a mean and standard deviation of  $0.16 \pm 0.00$  for pre-test and  $0.16 \pm 0.01$  for post-test with significant 't' ratio ( $t=6.35$ ) at .05 level. The variable T4 has a mean and standard deviation of  $0.12 \pm 0.00$  for pre-test and  $0.12 \pm 0.00$  for post-test with significant 't' ratio ( $t=4.79$ ) at .05 level. The variable T5 has a mean and standard deviation of  $0.13 \pm 0.01$  for pre-test and  $0.13 \pm 0.00$  for Post-test with significant 't' ratio ( $t=4.63$ ) at .05 level. The variable T6 has a mean and standard deviation of  $0.15 \pm 0.02$  for pre-test and  $0.15 \pm 0.01$  for post-test with significant 't' ratio ( $t=3.06$ ) at .05 level. The variable T7 has a mean and standard deviation of  $0.16 \pm 0.01$  for pre-test and  $0.16 \pm 0.00$  for post-test with significant 't' ratio ( $t=2.45$ ) at .05 level. The variable T8 has a mean and standard deviation of  $0.12 \pm 0.02$  for pre-test and  $0.12 \pm 0.00$  for post-test with significant 't' ratio ( $t=2.36$ ) at .05 level. The variable T9 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.13 \pm 0.00$  for post-test with significant 't' ratio ( $t=108.03$ ) at .05 level. The variable T10 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.13 \pm 0.00$  for post-test with significant 't' ratio ( $t=147.85$ ) at .05 level. The variable T11 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.16 \pm 0.00$  for post-test with significant 't' ratio ( $t=168.29$ ) at .05 level. The variable T12 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.13 \pm 0.01$  for post-test with significant 't' ratio ( $t=54.88$ ) at .05 level. The variable T13 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.13 \pm 0.00$  for post-test with significant 't' ratio ( $t=159.22$ ) at .05 level. The variable T14 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.15 \pm 0.01$  for post-test with significant 't' ratio ( $t=61.99$ ) at .05 level. The variable T15 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and

$0.15 \pm 0.01$  for post-test with significant 't' ratio ( $t=15.42$ ) at .05 level. The variable T16 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.13 \pm 0.01$  for post-test with significant 't' ratio ( $t=8.15$ ) at .05 level. The variable T17 has a mean and standard deviation of  $1.01 \pm 0.07$  for pre-test and  $1.00 \pm 0.03$  for post-test with significant 't' ratio ( $t=8.75$ ) at .05 level. The variable T18 has a mean and standard deviation of  $0.98 \pm 0.07$  for pre-test and  $0.94 \pm 0.04$  for post-test with significant 't' ratio ( $t=13.33$ ) at .05 level. The variable T19 has a mean and standard deviation of  $1.03 \pm 0.05$  for pre-test and  $1.04 \pm 0.03$  for post-test with significant 't' ratio ( $t=7.72$ ) at .05 level. The variable T20 has a mean and standard deviation of  $1.03 \pm 0.05$  for pre-test and  $1.04 \pm 0.08$  for post-test with significant 't' ratio ( $t=8.29$ ) at .05 level. The variable T21 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.01 \pm 0.04$  for post-test with significant 't' ratio ( $t=9.54$ ) at .05 level. The variable T22 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.94 \pm 0.04$  for post-test with significant 't' ratio ( $t=11.13$ ) at .05 level. The variable T23 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.03 \pm 0.04$  for post-test with significant 't' ratio ( $t=9.67$ ) at .05 level. The variable T24 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.04 \pm 0.13$  for post-test with significant 't' ratio ( $t=8.84$ ) at .05 level. The variable T25 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.00 \pm 0.00$  for post-test with significant 't' ratio ( $t=8.04$ ) .05 level. The variable T26 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.01 \pm 0.03$  for post-test with significant 't' ratio ( $t=3.86$ ) at .05 level. The variable T27 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.03 \pm 0.02$  for post-test with significant 't' ratio ( $t=5.76$ ) at .05 level. The variable T28 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.97 \pm 0.13$  for post-test with significant 't' ratio ( $t=8.95$ ) at .05 level. The variable T29 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.00 \pm 0.01$  for post-test with significant 't' ratio ( $t=3.85$ ). The variable T30 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.02 \pm 0.02$  for post-test with significant 't' ratio ( $t=4.33$ ) at .05 level. The variable T31 has a mean and

standard deviation of  $0.00 \pm 0.00$  for pre-test and  $1.02 \pm 0.02$  for post-test with significant 't' ratio ( $t = 4.77$ ) at .05 level. The variable T32 has a mean and standard deviation of  $0.00 \pm 0.00$  for pre-test and  $0.94 \pm 0.04$  for post-test with significant 't' ratio ( $t=10.55$ ).

### Discussion of the findings

A comparison between the pre-test and post-test scores of selected kinematic (partial temporal) variables projected that:-

1. There was decreasing trend was observed following the adaptation and no definite trend was observed following the increase of intensity of step aerobic training in regard to variable T1, T2, T5, T6, T7, T17, T18 and T20.
2. There was increasing trend was observed following the adaptation and no definite trend was observed following the increase of intensity of step aerobic training in regard to variable T9, T10, T11, T12, T13, T14, T15, T16, T19, T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31 and T32.
3. There was no definite trend was observed following the adaptation and following the increase of intensity of step aerobic training in regard to the variable T3, T4 and T8.

### Conclusions

1. There was significant effect of step aerobics training (Protocol 1 and Protocol 2) on the selected kinematic variables.
2. Six weeks of step aerobic training with two distinct protocols i.e. intensity of training, were found to be sufficient length of training (training cycle) for biomechanical adaptation.
3. It is finally concluded that the chronology of administration of step aerobic training should be as following
  - a) Step platform height (8 inches) and lower music tempo [118 beats per minute (BPM)].
  - b) Step platform height (8 inches) and higher music tempo [126 beats per minute (BPM)].

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