The International Journal Of Engineering And Science (IJES)
||Volume||2 ||Issue|| 5 ||Pages|| 06-13||2013||
ISSN(e): 2319 – 1813 ISSN(p): 2319 – 1805

Effect of Resistance Exercice on Linear Accleration

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----------ABSTRACT----------
Training is a learning process that involves the acquisition of knowledge, sharpening of skills concept and rules. The field of training and development changed significantly during the 1990s and early 2000s, reflecting both its role and importance in achieving higher employee performance and meeting organizational goals..The benefits of resistance training are well –documented and ongoing research continue to prove that it is an important activity for games and sports to be engaged in. Acceleration is the crucial to winning performance across numerous sports. Forget for speed alone. Athletes that can increase their speed more rapidly than their rivals can gain an incredible and often unassailable performance advantage.The investigator was interested to determine the effect of various resistance exercises on linear acceleration ability of the university level students. For the purpose of the present study thirty six (N = 24) male students from B.P.Ed, section in the year of 2010 and 2011 of UCT College, Berhampore, in the district of Murshidabad, West Bengal, India were selected as the subject of the present project. The age of the subjects were ranged from (21- 30) years. The students were chosen randomly from a total no of 97 populations.In the present study multiple equated group design were used. For the purpose of the study the subjects were divided into two equated groups viz. control group (CG) and experimental group (EG). Prior the implementation of treatment the initial test (test and re-test) had been conducted related to linear acceleration. Then after implementation of treatment for the periods of six weeks, the final test had been conducted on test re-test basis according to the requirement of the study. The timing of the athlete for sprinting in the linear path were measured. The time was taken nearest to 0.01sec. For each distance interval the average of the two timers were taken as time data. Results of the present study confirmed that the acceleration of each of the group continues up to 30-40m in case of linear motion. The acceleration rapidly increased for first 30m and then the acceleration goes to a saturation value i.e. the change of velocity with respect to time minimises. It had also been observed that there is no statistically significant difference between the acceleration data taken at the time of pre and post treatment for control group for each and every distance interval in linear motion. In case of experimental group it is found that the acceleration for certain intervals are statistically significant between the pre and post treatment.The treatment procedure (resistance training) may be considered as a significant tools or way for developing linear as well as angular acceleration.

Key Words: *Resistance exercise, Linear acceleration, Linear velocity, Sprint running, Sports Training.*

Date Of Submission: 06 May 2013 Date Of Publication: 20,May.2013

I. INTRODUCTION:

Long ago, the world was different. Everything was unsystematic as well as games and sports. To enhance the performance level of an athlete, there was no planned training schedule. As a result, the performance level of the athlete was not satisfactory. But, in the passage of time science and technology has made a rapid progress. With this dynamic passion of developmental perspective, the sports training method were also developed to its own way. Several training schedule has been developed by the sports scientists, eminent coaches and distinguished Olympians around the world. The newly invented training methods are pressure training, complex circuit training, fartlek training etc. Resistance training is one of them.Training is a learning process that involves the acquisition of knowledge, sharpening of skills concept and rules. The field of training and development changed significantly during the 1990s and early 2000s, reflecting both its role and importance in achieving higher employee performance and meeting organizational goals. This field has become more important because employees need to learn new skills, advance their knowledge and meet the challenges of technology in achieving high performance.To be effective training and development must meet a number of goals. Firstly, they must be focused on individual training needs but still reflect organizational goals in terms of desired or expected performance. Secondly, training and development must reflect learning goals or outcomes outlying what will be accomplished by this process.

Thirdly, they must be based on sound learning principles, be perceived as important by trainees and be conducted in a manner that maximises learning. Lastly they must be evaluated to determine effectiveness.
The benefits of resistance training are well –documented and ongoing research continue to prove that it is an important activity for athletes to be engaged in. Long ago in hunter gather societies, human muscle got a work out by building shelter, hunting, forming and all the other manual chores necessary to live. Today however we have engineered in activity into our lives with labour saving devices to the extent that our muscles rarely need to be pushed very hard.If anyone wants to radically improve your sprint times you need to understand not just muscle physiology but the bio-mechanics of running as well. Again, this is no boring textbook primer. Instead we dive into the little known areas that could mark all the difference to your next sports performance. For example- did anyone know how much influence his/ her toes can have or his/ her running power? In training for sprinting, speed and acceleration we give his /her answer to his seldom asked question –as well as details of three toe and foot training exercises that are sure to boast your speed **(Cooper, et al.)[6].** Believe it or not, the only sport equipment that is required for the toe – strengthening exercises is a carpet.

Acceleration is the crucial to winning performance across numerous sports. Forget for speed alone. Athletes that can increase their speed more rapidly than their rivals can gain an incredible and often unassailable performance advantage. The most obvious example is the 100 meter run. Sprinter, who might not attain the highest top speed, but reaches the finish line first because he or she is able to attain their top speed before the other competitors .The event may be won or lost in the first 10 or 20 meters**,. Ozolin (1987)[1]** suggested that the acceleration in 100m begins with the shot from the starter's pistol, following by the first reaction of the rear leg driving from the starting blocks. **Dyson (1986)[7]** states that during acceleration the problem of balance are complicated because of variation in the horizontal component of leg drive. In positive acceleration the faster a man runs the more difficult it is for him to exert a large force against the ground.So, in training for sprinting speed and acceleration we analyse what makes for a quick getaway for a technical point of view and identify the best training methods to develop this crucial aspect of sports performance .Crucially, maximal acceleration was found to require more than simply maximum muscular power –particularly as stride length get longer and ground contact time reduce.The investigator was interested to determine the effect of various resistance exercises on linear acceleration ability of the university level students. The present project was an attempt to assess the effect of selected resistance exercises on linear, angular and centripetal acceleration. Thus the problem was stated as "Effect of resistance exercises on linear acceleration".

II. METHODS:

For the purpose of the present study thirty six (N = 24) male students from B.P.Ed, section in the year of 2010 and 2011 of UCT College, Berhampore in the district of Murshidabad, West Bengal, were selected as the subject of the present project. The age of the subjects were ranged from (21- 30) years. The students were chosen randomly from a total no of 97 populations.

2.1 EXPERIMENTAL DESIGN:

In the present study multiple equated group design were used. For the purpose of the study the subjects were divided into two equated groups viz. control group and experimental group. Prior the implementation of treatment the initial test (test and re-test) had been conducted related to linear acceleration. Then after implementation of treatment for the periods of six weeks, the final test had been conducted on test re-test basis according to the requirement of the study.

2.2 TREATMENT PROCEDURE:

To enhance the acceleration ability opf the subjects, five resistance exercises were selected such as- 1) Running with resistance belt, 2) Moving with equal weight, 3) Arm swing with dumble (5kg. each), 4) Squating with equal weight, 5) Arm press with partner. All the selected exercise were given to the subjects thrice a week (Monday, Wednesday & Friday) and exercises were given in morning session (6.30am -7.00am).

2.3 PROCEDURE FOR COLLECTING DATA:

The data were collected into two steps. In the first steps date of birth of all subjects were recorded from their School admit card or certificate. Exact age (in year) as on the date of data collection for all subjects was calculated. The height and weight of all subjects were then measured. In the second steps the timing of linear path of all the subjects were measured in two phases. In first phase the pre-treatment time (in seconds) data were

collected by test re-test method in two separate days. In the same way in second phase post treatment time (in seconds) data for different distance interval were also collected by test re-test method.

2.4 MEASUREMENT OF TIME IN PRE AND POST TREATMENT FOR LINEAR PATH:

The timing of the athlete for sprinting in the linear path were measured by the following way-

2.4.1 MEASUREMENT OF TIME TAKEN TO CROSS DIFFERENT DISTANCE INTERVAL IN A LINEAR PATH:

The linear path used for the purpose of collecting data for the present study was 100mts long and 1.22mts wide. The total linear path was divided into 10 equal segments each of 10mts long from starting to finishing line. A total number of 20 timers were involved for collecting the timing data for each and every subject. The timers were placed both side of the path. Two timers in the opposite side for each other were placed in the finishing line of each distance interval. In the **figure - 4** the diagram of linear path is shown. The time taken by the timers for the distance interval of 10 m for both sides (left and right) were assigned to be ${}^{L}T_{10}$ & ${}^{R}T_{10}$ respectively. By the same way the times taken by the timers, both for the left and right side for 20mts, 30mts etc were ${}^{L}T_{20}$ & ${}^{R}T_{20}$ and ${}^{L}T_{30}$ & ${}^{R}T_{30}$ respectively and so on. One starter, assistant starter, recalls starter were also served as testing personnel for conducting data collection procedure. By the word, "on your mark" the subject takes his initial position behind the starting line then on the command "set", the subject fixes his position on the starting block and with the sound of the 'Clapper', the subject started to run. Any type of false start was not allowed. The timers were directed to take their time as soon as the runner touches the respective finish line, if not, the first step just after the finish line for minimising the time error. SCORE: The time was taken nearest to 0.01sec. For each distance interval the average of the two timers were taken as time data. As for example, for 10mts, the timing were as follows- ${}^{L}T_{10}$ & ${}^{R}T_{10}$ sec. So the average timing at the 10 m line is suppose to be T_{10} In the same way T20, T30 etc were computed.

2.4.2 DETERMINATION OF LINEAR VELOCITY:

In the present study the linear velocity for different distance intervals were determined by using the respective timing data measured by the timers in different distance intervals already discussed in 3.6.3.1, by using the following equations –Linear velocity = Linear displacement / time taken For the first distance interval i.e. to cross the distance from starting line to 10m distance, the velocity had been calculated by the following equation

$$V_{10} = \frac{(10 - 0)}{(T_{10} - T_0)}$$

Where, V_{10} is the velocity of the athlete while crossing 10mt. line, T_{10} = measured time data while crossing 10mt. line, T_{10} is the time while the athlete is in starting block.

In the field of sports a 100 meter sprinter moves in an enormous rapidity from his starting line towards changes his velocity with respect to time which means he has certain linear acceleration with varying magnitude towards his total path way.

The units of linear acceleration in different systems of measurements are a) in CGS system cm / Sec^2 b) in F.P.S system ft /sec^2 c) in S.I system m / sec^2. If the magnitude of linear acceleration decreases with respect to time, then it is called negative linear acceleration.

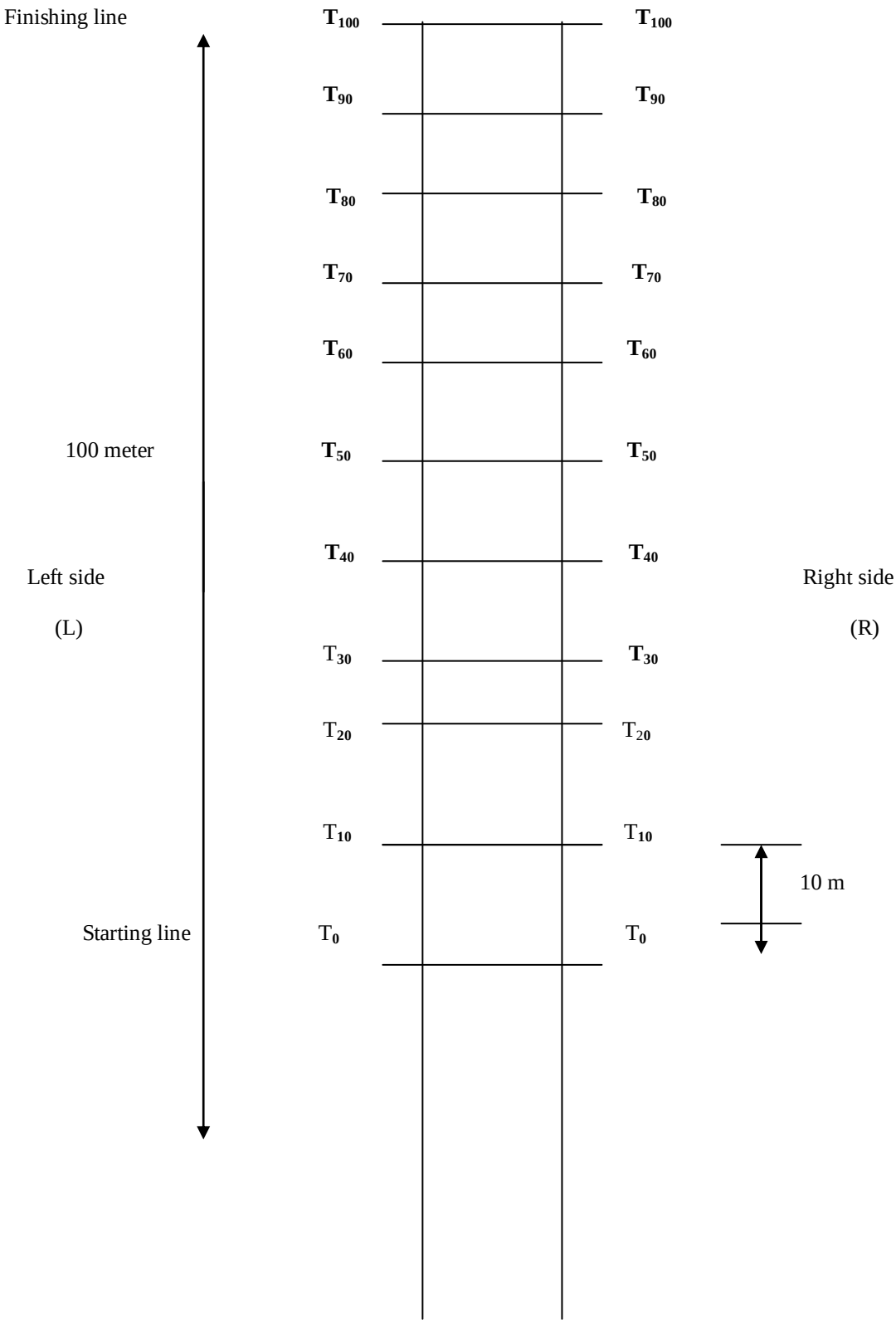

Figure -1 Linear path of 100m divided into 10 equal distance interval of 10m each

III. RESULTS:

For better presentation the data of different variables for different groups have been presented separately one after another in Table No.-1 and 2.

Table No.-1 Pre-treatment Mean value different kinematical (linear) parameters for different distance intervals of both control group and experimental group .

Name of the group	Name of the kinematic parameters	Mean value of different parameters for different distance intervals									
		D10	**D20**	**D30**	**D40**	**D50**	**D60**	**D70**	**D80**	**D90**	**D100**
CG	Time(Sec.)	2.29 ± 0.13	3.68 ± 0.13	5.02 ± 0.18	6.31± 0.29	7.57± 0.30	8.92± 0.42	10.20 ± 0.43	11.58 ± 0.48	12.86 ± 0.58	14.50 ± 0.63
	Acceleration (m/Sec^2)	1.96 ± 0.23	2.75 ± 0.60	1.84 ± 0.99	0.294 ± 0.95	0.382± 1.15	0.323 ± 1.50	0.329 ± 1.19	0.378 ± 0.88	-0.56± 1.32	-1.07± 0.63
EG	Time(Sec.)	2.29 ± 0.14	3.70 ± 0.21	5.10 ± 0.23	6.32± 0.30	7.61±0.41	8.98± 0.50	10.17 ± 0.59	11.62 ± 0.66	13.0± 0.77	14.49 ± 0.89
	Acceleration (m/Sec^2)	1.90 ± 0.24	4.01 ± 0.91	2.04 ± 0.89	2.34± 1.72	0.34± 2.16	0.31± 0.87	0.84± 1.59	0.96± 1.45	-0.22± 1.29	-0.35± 0.87

Table No.-2 Post-treatment Mean value different kinematical (linear) parameters for different distance intervals of both control group and experimental group.

Name of the group	Name of the kinematic parameters	Mean value of different parameters for different distance intervals									
		D10	**D20**	**D30**	**D40**	**D50**	**D60**	**D70**	**D80**	**D90**	**D100**
CG	Time(Sec.)	2.25 ± 0.13	3.78 ± 0.18	4.97 ± 0.26	6.24± 0.30	7.44± 0.32	8.81 ± 0.48	10.02 ± 0.53	11.46 ± 0.60	12.64 ± 0.59	14.20 ± 0.75
	Acceleration (m/Sec^2)	1.99 ± 0.23	2.77 ± 0.77	1.85 ± 1.74	0.364 ± 0.30	0.39± 1.54	0.37 ± 2.31	0.284 ± 1.22	0.466 ± 0.99	-0.42± 1.51	-1.01± 1.24
EG	Time(Sec.)	2.29 ± 0.14	3.70 ± 0.21	5.10 ± 0.23	6.32± 1.02	7.61±0.41	8.98 ± 0.50	10.18 ± 0.58	11.62 ± 0.66	13.01 ± 0.77	14.50 ± 0.89
	Acceleration (m/Sec^2)	1.99 ± 0.26	2.77 ± 0.73	1.85 ± 0.89	0.36± 1.72	0.39± 2.16	0.37 ± 0.87	0.28± 1.59	0.46± 1.45	-0.42± 1.29	-1.01± 0.87

t-values of the pre and post treatment time acceleration value of the control group are presented in Table No.-3 and same values of experimental group are presented in Table No.-4.

Table no.-3 Significance of the difference between two means of pre and post treatment of control group for linear acceleration.

Distance Interval	Mean Linear Acceleration in (m/Sec²)				Mean Diff.	SE	't'
	Pre-treatment time		Post-treatment time				
	Mean	SD	Mean	SD			
D10	1.96980	0.22923	1.99185	0.22721	0.0220	0.09317	0.2366
D20	2.75255	0.47104	2.77458	0.17740	0.0220	0.14530	0.1515
D30	1.84942	0.33383	1.85792	0.54195	0.0085	0.18374	0.0462
D40	0.29416	0.56891	0.36423	0.74439	0.0700	0.27046	0.2590
D50	0.38231	1.00025	0.39034	0.94439	0.0080	0.39711	0.0202
D60	0.32380	1.00181	0.37034	0.86141	0.0465	0.38140	1.1220
D70	0.32935	1.12459	0.28489	0.87270	-0.0444	0.41092	0.1082
D80	0.37886	0.84778	0.46631	0.65731	0.0874	0.30967	0.2824
D90	-0.5812	0.8545	-0.4233	0.54348	0.1579	0.29234	0.5401
D100	-1.0683	0.57598	-1.0065	0.65731	0.0618	0.25229	0.2450

t (0.05) 11 = 1.796

Table no.-4 Significance of the difference between two means of pre and post treatment of experimental group for linear acceleration.

Distance Interval	Mean Linear Acceleration in (m/Sec²)				Mean Diff.	SE	't'
	Pre-treatment time		Post-treatment time				
	Mean	SD	Mean	SD			
D10	1.907599	0.241154	2.008647	0.255268	0.10104	0.101373	0.996794
D20	4.01537	0.396135	3.822687	0.311037	0.19268	0.145392	1.325268
D30	2.046708	0.590915	2.444629	0.520442	0.39792	0.22731	1.750564
D40	2.348813	0.54365	1.74184	0.54365	0.60697	0.221944	2.734796
D50	0.34293	0.902817	0.129526	0.902817	0.47245	0.368574	0.281842
D60	0.31351	0.864007	1.12107	0.864007	0.8755	0.352729	0.289456
D70	0.846625	0.461882	0.633281	0.461882	0.21334	0.188562	0.131426
D80	0.96949	0.675377	0.47465	0.675377	0.49484	0.275722	0.794717
D90	-0.220322	0.74616	-0.70701	0.74616	0.48669	0.304619	0.597724
D100	-0.35052	0.549674	-0.48584	0.549674	0.13531	0.224404	0.603004

t(0.05) 11 = 1.796

IV. DISCUSSION:

Results of the present study confirmed that the acceleration of each of the group continues up to 30-40m in case of linear motion. The acceleration rapidly increased for first 30m and then the acceleration goes to a saturation value i.e. the change of velocity with respect to time minimises. That means the subjects reaches to the maximum velocity in between (30-40)m and after that it just maintained for certain distance and after 70-80m deceleration starts. **Ozolin (1987)[1]** observed that acceleration takes place over the first 30m of a100m race during which time the athlete reaches about 90-95% of maximum speed. At the same time, **Arnold (1992)[2]** studied on the effect of specific sprint training programme on stride length and frequency of under twelve and under fourteen year's boys. He concluded that the pick-up to top speed in sprinting (acceleration or rate of change of forward motion) requires a very fast application of force where the maximum stride length is reacted at the same time as top speed.

It had also been observed that there is no statistically significant difference between the acceleration data taken at the time of pre and post treatment for control group for each and every distance interval in linear motion. In case of experimental group it is found that the acceleration for certain intervals are statistically significant between the pre and post treatment. Again in some intervals there is no significant difference between the pre and post treatment acceleration, but the value of 't' is very nearer to the significant value. This indicates that the resistance training has significant effects on linear acceleration ability. **Mero et al. (1983)[5]**

recognised that pre-stretching of the calf muscles (specially the gastrocnemius ans soleus muscles) might aid starting performance, which partly signifies the present study. **Johnson et.al (2001)[4]** studied on six male sprinters with a mean 100m time of 10.75sec to assess the role of the lower limb joints in generating velocity in the mid acceleration those of sprinting, muscle power patterns of the hip, knee and ankle. The subjects were allowed to perform repeated maximal sprints along a 35m indoor track. The result showed a proximal to distal timing in the generation of peak extensor power during stance at the hip, the knee and then ankle, with the plantar flexors producing the greatest peak power. **John Shepherd (2008)[3]** studied on thirty six (36) athletes performed maximal effort sprint from which video and G.R.F data were collected at the sixteen meter mark. The result showed that the faster accelerating sprinters displayed less vertical impulse in their accelerating phase i.e. more force was directed horizontally thus pushing them forward. The sprinter with the fastest acceleration also had fastest ground contact times. The present study showed that for first 30-40m the tendency of 't' value is greater as in these intervals the acceleration actually exists but the rest of the intervals the subjects move with almost uniform velocity or with very little acceleration which may be considered also an uniform velocity. So the present study is very much consistent with other studies conducted by many eminent authors or bio-mechanists. **Delecluse et al. (1994)[8]** also determined that there are three distinguishable phases within a 100m sprint performance: an initial acceleration phase (from 0m to 10m), a continued acceleration phase (from 10m to 36m) and a phase of maximum running speed and speed endurance (from 37m to 100m).

V. CONCLUSION:

Let us now conclude that the acceleration for linear motion lasts from starting up to 30-40m. No significant difference observed between the acceleration ability of control group measured in pre and post treatment time for linear motion. The acceleration ability for first few distance intervals between the pre and post treatment for linear motion differ significantly. Therefore, the treatment procedure (resistance training) may be considered as a significant tool or away for developing linear acceleration.

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