International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 5 Issue 1, November-December 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Clinical Effectiveness of Modified Wheel Chair Skills Training Program (MWSTP) on Energy Expenditure in Patients with Spinal Cord Injury

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ABSTRACT

BACKGROUND;-

The wheel chair skills training program (WSTP) is a structured protocol that incorporates several principles of motor learning. Extensive motor learning literature suggests effective methods of facilitating long term retention of skills in Rehabilitation settings. The WSTP has been shown to be an effective addition to conventional wheel chair training during the initial rehabilitation of wheelchair users (84) and in the training of able-bodied subjects acting as caregivers.

OBJETIVES;-

To investigate the effectiveness of Modified Wheelchair skills training program (MWSTP) on energy expenditure in patients with spinal cord injury over conventional wheelchair training program

DESIGN:

Pre test post test control group design.

SETTING

Occupational Therapy department, Inpatient Rehabilitation ward, National Institute for the Orthopaedically Handicapped (NIOH), B.T.Road, KOLKATA – 90, West Bengal.

PARTICIPANTS

Study was conducted on a convenient sample of 30 participants from Spinal cord injury population attending outpatient Occupational Therapy department, Inpatient Rehabilitation ward, All the patients were randomly allocated into two groups of 15 each. In Experimental group mean age is 37.93 and standard deviation of 4.63.In Control group mean age is 35.93 and standard deviation of 4.39.Experimental Group and Control Group consists of 12male and 3 female each.

INTERVENTION

All the patients were randomly allocated into two groups of 15 each. Group A was the experimental group (conventional training+Modified wheel chair skills training). Group B was the control group (Conventional Training alone). The subjects in both the groups underwent a 60 days wheelchair skills training program. Subjects trained five times a week. Each training sessions lasted 30 minutes. Sessions were recorded in 5min increments and at the end of each 5min period; the skill training being practiced at that time was recorded. The first 20min of each session was dedicated to learning skills according to training curriculum. Practice took place in a blocked manner (repeatedly) until a particular skill was successfully completed. During practice, subjects had two attempts to complete the task. If the skill was successfully completed during either attempt; training of next appropriate skill began.

Evaluation of entire outcome measures both pre test and post test training were done by another therapist unaware of the study results.

MAIN OUTCOME MEASURES

Energy expenditure, Heart rate, Oxygen consumption.

KEYWORDS: *The wheel chair skills training program, spinal cord injury, Energy expenditure, Heart rate, Oxygen consumption. Convenient sample, motor learning*

How to cite this paper: Manoj Kumar Sethy | Mrs Damayanti Sethy | Dr. P K Lenka "Clinical Effectiveness of Modified Wheel Chair Skills Training Program (MWSTP) on Energy Expenditure in Patients with Spinal Cord Injury" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-1, December 2020, pp.116-124, URL: www.ijtsrd.com/papers/ijtsrd35858.pdf

IJTSRD35858

RESULTS
Between group analysis suggested that for oxygen values for pot 30 days training was ($p<0.11$), 60 days training p(<0.24) same as Heart rate T30 ($p<0.16$), T60($p<0.21$) Energy expenditure T30($p<0.85$) and T60($p<0.11$)and energy expenditure Though the result suggests that the both of the training are effective in reducing HR, O2 consumption and EE post training, but there was a significant difference found between both the groups, suggesting modified wheel chair skills training program to be better over conventional wheel chair training.

CONCLUSIONS
The use of MWSTP can be recommended in rehabilitation settings instead of conventional wheelchair training for the SCI patients as there is a significant decrease in O2 consumption, HR and EE in MWSTP group over conventional training. Thus the MWSTP is a safe, practical and effective method of improving wheelchair skills knowledge and performance. It has also a clinically significant effect on the independent wheeled mobility of new wheelchair users. These findings have implications for the standards of care and clinical use in rehabilitation program.

INTRODUCTION

Spinal cord injury is a catastrophic event that immeasurably alters activity and health. Depending on the level and severity of injury, functional and homeostatic decline of many body systems can be anticipated in a large segment of the paralyzed population. The level of physical inactivity and deconditioning imposed by SCI profoundly contrasts the pre injury state in which most individuals are relatively young and physically active. [1]

With complete lesion, it is seen that prognosis of motor and sensory part is very poor by which their ambulation is very much affected, eventually they are dependent on the compensatory mode of treatment or ambulatory device.[14]For most of the people, walking is a relatively efficient method of moving from place to place particularly if a self selected speed is used. [15, 16] If serious damage to the neurological or musculoskeletal system occurs, as with people who have sustained a spinal cord injury, walking becomes less efficient . When the energy cost of ambulation in Spinal Cord Injury is too high other methods of mobility are sought. [16, 17]

Most patients with SCI will use a wheel chair as the primary means of mobility, even the patient with paraplegia who has mastered ambulation with crutches and orthosis will choose a wheel chair as a primary means of locomotion, because it provides a lower energy expenditure and greater speed and safety. Because it provides a means of mobility for persons with movement limitation, the wheel chair is an invaluable device in rehabilitation [18].

Wheel chair propulsion is more efficient than walking for people with extensive paralysis [19-22] but less efficient than normal walking. The inefficiency of wheel chair propulsion is due, in part to the small muscle mass of the arms and biomechanical disadvantage of using hand rims to propel the wheel chair [23]. In people with spinal cord injury, others factors such as impaired sympathetic vascular responses [24-26]; respiratory compromise [26] and trunk instability [27] further impair the effectiveness of wheel chair propulsion. Because of the relative efficiency of wheel chair propulsion for the people with spinal cord injury and large number of people with spinal cord injury in wheel chairs, considerable efforts have been made to identify the propulsion technique and training that maximize the efficiency of wheel chair propulsion [25, 28-35].

The different propulsion systems require use of different musculature and biomechanics. The cardiovascular fitness of the wheelchair dependent persons decline due to sedentary lifestyle and physiological deconditioning due to illness, prolonged wheelchair confinement and limited functional use of skeletal muscle mass placing them at greater risk of cardiovascular disease.[36]

Unfortunately, wheelchair users frequently encounter environmental obstacles [37] Overuse syndromes [38] and acute injuries [39-41] that are well documented. This disparity of inaccessibility can segregate wheel chair users from the general public[42] and prevent them from fully contributing to life within their communities.[43]

High performance in wheelchair locomotion requires a combination of low energy cost and optimal comfort. Hand rim wheelchair propulsion is a means of locomotion with quite a high exertion demand. Weak propulsive output is obtained [44-47] with relatively high cardio respiratory stress[48-50] .Thorough studies of metabolic and physiological responses to muscular exercise[51-52])and of propulsion techniques [53-55]as well as investigations on wheelchair designs[56-59], have all contributed to reaching the optimal man machine interaction objective.

Other researchers have investigated the kinematics of wheel chair propulsion [30, 60] and muscle activity during wheel chair propulsion [61-63]. Investigations of maximal aerobic capacity in subjects with spinal cord injury [26, 64, 65] have added further information about physiological responses during wheel chair propulsion.

Spinal cord injury patients prefer wheel chair for ambulation due to less energy expenditure and safety and speed ambulation [14]. Past research comparing the daily activity levels of individuals who have Spinal cord injury with those of several ambulatory populations provide evidence that people with Spinal cord injury may be at the lowest level of activity spectrum [66].

Individual with spinal cord injury undergo numerous changes in body composition as a result of their injury. These changes include muscle paralysis, a reduction in lean tissue mass and bone mineral density and an increase in fat mass. Because of the extreme inactivity imposed by acute spinal cord injury and subsequent wheelchair confinement, this population is at increased risk for obesity related disorder. From preview it is evident that Spinal cord injured patient prefer less energy expenditure for doing any activity. A reduction in energy expenditure may predispose Spinal cord injured persons to weight gain and obesity in the event that energy intake exceeds daily energy expenditure.[67, 68]

If propulsion techniques cause a decrease in energy expenditure, then those techniques can be used to increase the length of time a wheelchair user can push his or her chair before fatiguing due to energy loss, which will increase participation as the wheelchair user will have more energy to get through the day if less energy is utilized in propulsion. To increase the efficiency of wheel chair propulsion and wheel chair activities, the daily energy expenditure of energy for wheel chair activities has to be reduced.

The study hypothesizes that though there is a reduction in resting energy expenditure in SCI due to lower activity level, but while performing activities involving wheel chair, patients with Spinal cord injury may expends more energy and if training is given for wheel chair skills, with the training the amount of energy expenditure may reduce.

Although many aspects of wheel chair use have been extensively studied [67-74], few studies have focused on the training of independent manual wheel chair skills, despite suggestions that such training could improve independence [75], freedom of movement and quality of life [76]. Several training protocol relevant to independent in manual wheel chair mobility have been developed [77-79]and numerous resources describe wheel chair skills training methods used by clinicians.[80, 81] There are several wheel chair skills training program being used conventionally on different clinical setups.

The wheel chair skills training program (WSTP) is a structured protocol that incorporates several principles of motor learning. Extensive motor learning literature suggests effective methods of facilitating long term retention of skills in Rehabilitation settings.[82, 83] The WSTP has been shown to be an effective addition to conventional wheel chair training during the initial rehabilitation of wheelchair users [84] and in the training of able-bodied subjects acting as caregivers.[85]

The studies on the effect of wheel chair skills training program on energy expenditure in tharaco lumbar spinal cord injury are either less in number or were conducted on very small sample size. Thus the effect of wheel chair skills training program on energy expenditure need to be investigated. The purpose of this study was to determine the difference in energy expenditure with wheelchair skills training program in patients with spinal cord injury (thoraco-lumbar level) over conventional wheelchair training provided in a traditional rehabilitation setting.

AIMS AND OBJECTIVES

- To investigate the effectiveness of modified wheelchair skills training program (MWSTP) on energy expenditure in patients with spinal cord injury over conventional wheelchair training program.
- To investigate the difference in energy expenditure on Day 30 and on Day 60 of the both wheel chair training program.

HYPOTHESIS

- **NULL HYPOTHESIS:**

Modified Wheelchair Skills Training Program and conventional wheel chair training are equally effective in lowering energy expenditure in patients with SCI.

- **EXPERIMENTAL HYPOTHESIS:**

Modified Wheelchair Skills Training Program has a better effect over conventional wheel chair training in lowering energy expenditure in patient with SCI.

METHODOLOGY

DESIGN:

Pre test post test control group design.

PARTICIPANTS:

Study was conducted on a convenient sample of 30 participants from Spinal cord injury population attending outpatient Occupational Therapy department, Inpatient Rehabilitation ward, National Institute for the Orthopaedically Handicapped (NIOH), B.T.Road, KOLKATA – 90, West Bengal. All the patients were randomly allocated into two groups of 15 each. Group A was the experimental group (conventional training+Modified wheel chair skills training). Group B was the control group (Conventional Training alone).

Evaluation of entire outcome measures both pre test and post test training were done by another therapist unaware of the study results.

INCLUSION CRITERIA:

1. Age group 30-45 years.
2. Complete Spinal Cord Injury at Thoracic level
3. Spinal cord injury having muscle power greater than 3 of upper extremity.
4. Patients having ability to sit in the wheelchair.
5. No other associated orthopaedic or neurological complications diagnosed during assessment.

EXCLUSION CRITERIA:

1. Acute case of SCI, incomplete thoracic level.
2. Patients with orthostatic hypotension.

ETHICAL ISSUES:

On the basis of earlier studies with WSTP, the risk of participation has to be minimal. So as per the Indian context and the capacity of the patients, only 16 skills of the wheel chair skills training program were selected for the study. The study was approved by ethical committee of West Bengal University of Health Sciences.

DEMOGRAPHIC AND CLINICAL DATA:

The age, gender and diagnosis from Subjects health records were documented. Subjects' wheelchair use including the duration and location of use (indoor and outdoor) were also noted.

WHEELCHAIR SKILLS:

A pilot study with 16 wheel chair skills completed on WSTP version found that it was a practical, well tolerated and safe test with good measurement properties.

CONVENTIONAL WHEEL CHAIR TRAINING:

To better understand the type and amount of WCS learned in conventional training, Occupational therapists and Physical therapists either of which may responsible for wheelchair skills training, were asked to complete a short questionnaire. From this it was found that mostly in our setup and hospital we spent the largest amount of time on training wheelchair transfers including wheel chair propulsion only rather than Wheelchair skill training. Thus in conventional training for the patients, wheel chair transfers and propulsion training were provided.

MODIFIED WHEELCHAIR SKILLS TRAINING PROGRAM:
Before training started, the organization and structure of the training sessions was verbally described to each subject in the WSTP group. Participants were underwent a 60 days wheel chair training program, following the guidelines recommended by the ACSMS exercise management for the persons with chronic disease and disabilities.

From experimental group, it was found that some subjects unable to perform all the skills given by the WSTP version4.1.For this only 16 skills were selected, which were suitable for all the subjects of experimental group. The following skills were selected for training.

1. Rolls forward 10m
2. Rolls forward 10m in 30s
3. Rolls backward 5m
4. Turns 90degree while moving forward
5. Turns 90degree while moving backward
6. Turns 180degree in place
7. Maneuvers sideways
8. Gets through hinged door in both directions.
9. Reaches 1.5m high object
10. Picks object from floor
11. Transfers from wheelchair to bench and back
12. Rolls 100m
13. Avoids moving obstacles
14. Ascends 10degree incline
15. Descends 10degree incline
16. Gets from ground into wheelchair

The subjects in both the groups underwent a 60 days wheelchair skills training program. Subjects trained five times a week. Each training sessions lasted 30 minutes. Sessions were recorded in 5min increments and at the end of each 5min period; the skill training being practiced at that time was recorded. The first 20min of each session was dedicated to learning skills according to training curriculum. Practice took place in a blocked manner (repeatedly) until a particular skill was successfully completed. During practice, subjects had two attempts to complete the task. If the skill was successfully completed during either attempt; training of next appropriate skill began.

APPARATUS AND MATERIAL USED:

1. Wheel chair
2. Cosmed K4b^2 metabolic analyzer

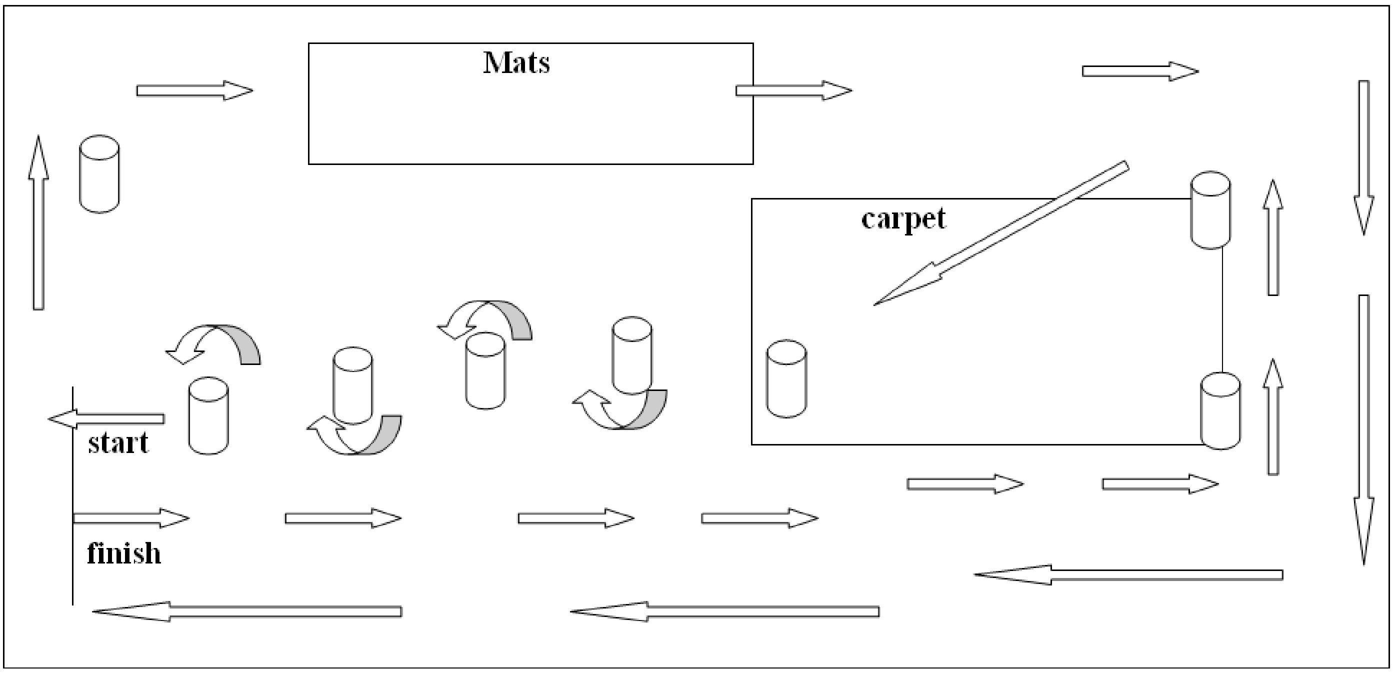
OUT COME MEASURES:

1. Energy expenditure
2. Heart rate
3. Oxygen consumption.

DURATION OF TRAINING:
60 days of wheelchair training. Five times a week. Each training sessions lasted 30mins.

PROCEDURE:
All the patients were tested for wheelchair sitting, balancing in wheel chair and their ability to propel the wheel chair at NIOH following approval of the West Bengal University of Health Science review board. Written consent to participate was obtained from all subjects after explanation of test procedures and the rights of human subjects.

The data was recorded before training at (T0) and at 30(T30), 60(T60) days after the training program. All the data were recorded after propelling the wheelchair about 150m of a designed driving course. Data was taken by the help of Cosmed analyzer which was attached to chest of subjects and a base line measure of oxygen consumption, heart rate and energy expenditure taken once all the parameters had stabilized. Prior to commencing this designed course a steady base line heart rate and oxygen consumption levels were achieved. The subjects were asked to propel the wheelchair round the designed course at their own speed .At the completion of course data was recorded on T0. The same procedures followed for recording data on T30 and T60 days.



The total length of the driving course was 150m.Subjects were initially asked to propel wheelchair across the gymnasium floor for 30m and complete a 90 degree left turn and continue for 10m.A further 45 degree left hand turn took user onto carpet. The carpet was 30m long and included slalom of four closely placed bollard markers which required tight 10 degree right and left hand turns. At the end of the carpet, the user completed a 90 degree right hand turn back onto the gym floor for 10m.A further propel 90 degree right turn took the user to 6m of sponge matting. At the end of the matting was a further 90 degree hand turn back onto the gymnasium floor for 10m.A final 90 degree right hand turn and 10m of propelling took the user back to the start/finish line. (Figure below)

After baseline evaluation on T0, conventional training of wheelchair given to control group and conventional training as well as MWSTP were given to experimental group. The control group did not receive any wheelchair skills training, beyond what was given with in a typical rehabilitation stay.

Both the groups have undergone 60 days of training program, five times a week and each training session included some warm up exercises. The warm up exercise included stretching of their shoulder muscles, triceps, and wrist muscles for 5min. Post warm up exercise, 30 min of wheel chair skills training were given to the subjects in both the groups. At the end of the individual training session, cool down period was given to each patient.

In the MWSTP group, sessions were recorded in 5min increments and at the end of each 5min period; the skill training being practiced at that time was recorded. The first 20min of each session was dedicated to learning skills according to training curriculum. Practice took place in a blocked manner (repeatedly) until a particular skill was successfully completed. During practice, subjects had two attempts to complete the task. If the skill was successfully completed during either attempt; training of next appropriate skill began.

The skills training were given as follows;

1. Rolls forward 10m /2. Rolls forward 10m in 30s /3. Rolls backward 5m /4. Turns 90degree while moving forward /5. Turns 90degree while moving backward /6. Turns 180degree in place /7. Maneuvers sideways /8. Gets through hinged door in both directions. /9. Reaches 1.5m high object /10. Picks object from floor /11. Transfers from wheelchair to bench and back /12. Rolls 100m /13. Avoids moving obstacles /14. Ascends 10degree incline /15. Descends 10degree incline/16 Gets from ground into wheelchair Post training, energy expenditure, HR, O2 consumption was measured on T30 and T60days for the both groups. Then all the subjects were asked to answer open ended questions regarding current and future wheelchair use. Subjects in the experimental group were also asked to comment on the WSTP and give suggestions for improvement.


Gets through hinged door in both directions


Rolls forward 10m


Reaches 1.5m high object

Respiratory Analyser System COSMED ® K4 b^2 (Cosmed-spl-Italy)

STATISTICAL ANALYSIS

Statistical analyses were performed using the SPSS software.

- One way ANOVA with repeated measures was used to analyse change among training sessions.
- Bonfeeroni(Post hoc analysis) test for a significant F value was applied to specify where significant differences occurred.
- A probability level of $p<0.05$ was accepted as significant.
- Data were presented as arithmetic means +/- standard deviation(X+/-SD).

RESULTS

A total number of 30 Spinal cord injury patients were recruited for the study with age range from 30 to 45 years.There were 24 male and 6 female patients in the study. There was no drop out during the study. Data were collected at the 1st day visit and after the completion of 30th and 60th day.

TABLE -1: Within group comparison of O2, HR and EE in Experimental group.

variable	Day 0 Mean (SD)	Day 30 Mean (SD)	Day 60 Mean (SD)	ANOVA		Post hoc analysis (Bonferroni)		
				F	P	0 -30	30-60	0-60
O2	.834(.064)	.878(.084)	.728(.069)	87.67	.000	.018	.000	.000
HR	132.2(3.90)	124.8(5.26)	114.8(5.7)	134.3	.000	.000	.000	.000
EE	4.88(.52)	5.03(.49)	4.05(.52)	91.02	.000	.009	.000	.000

TABLE.2: Within group comparison of O2, HR, and EE in Control group.

	Day 0 Mean (SD)	Day 30 Mean (SD)	Day 60 Mean (SD)	ANOVA		Post hoc analysis (Bonferroni)		
				F	P	0 -30	30-60	0-60
O2	.808(.059)	.820(.054)	.784(.059)	32.94	.000	.042	.000	.000
HR	130.4(2.99)	128.9(3.17)	127.6(3.57)	42.40	.000	.000	.000	.000
EE	4.72(.64)	4.84(.72)	4.63(.65)	10.59	.000	.144	.005	.000

The result of this above analysis shows that there is significant decrease in O2, HR and EE after taking WSTP comparing with day 0 today 60.But comparing with day0 to day 30 it showed that there is no significant decrease in EE and o2 consumption, rather it increased.

Table .3: Between group comparison of O2.

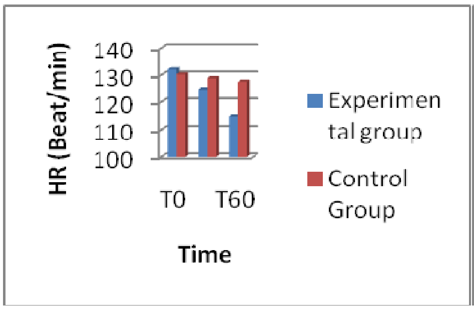
	Experimental Group Mean (SD)	Control Group Mean (SD)	T-test	
			T	P
Day 0	.834(.064)	.808(.059)	1.148	.261
Day 30	.878(.084)	.820(.054)	2.238	.033
Day 60	.728(.069)	.784(.059)	-2.379	.024

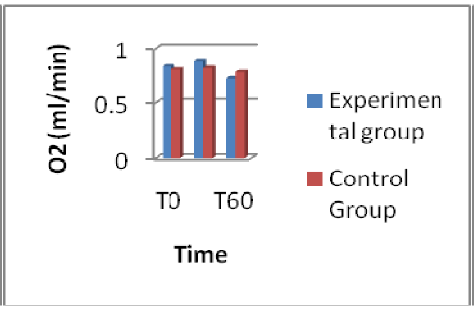
Table.4: Between group comparison of HR.

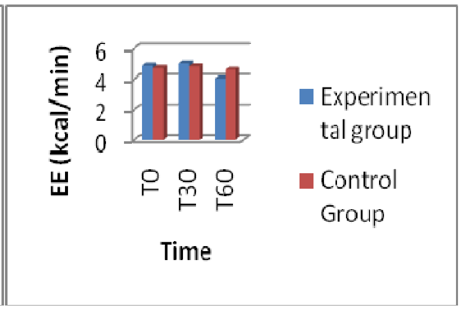
	Experimental Group Mean (SD)	Control Group Mean (SD)	T-test	
			T	P
Day 0	132.2(3.93)	130.4(2.99)	1.46	.155
Day 30	124.8(5.26)	128.9(3.17)	-2.56	.016
Day 60	114.8(5.76)	127.6(3.57)	-7.30	.000

Table.5: Between group comparison of EE.

	Experimental Group Mean (SD)	Control Group Mean (SD)	T-test	
			T	p
Day 0	4.88(.52)	4.72(.64)	.742	.464
Day 30	5.03(.49)	4.84(.72)	.853	.853
Day 60	4.05(.52)	4.63(.65)	2.715	.011







Though the result suggests that the both of the training are effective in reducing HR, O2 consumption and EE post training, but there was a significant difference found between both the groups, suggesting modified wheel chair skills training program to be better over conventional wheel chair training.

DISCUSSION

The result of the study shows statistically significant result in both the experimental and control group which says that both the training programs are effective in lowering the energy expenditure in patients with spinal cord injury. But there is highly significant improvement after giving MWSTP in experimental group than the control group and there is a statistically significant difference between both the groups, showing MWSTP to be more effective in reducing the EE of the SCI patients.

This results accords with those of literature led by S.de Groot, M de Bruin etal, 2008, they described that 7wk wheelchair training improved the mechanical efficiency which lead to significant decrease in metabolic cost of individual.

It firmly establishes that average able bodied adult can increase their cardiorespiratory fitness by 20% to 30% by participating in a well designed training program that involves the large muscle of the body. Such a learned techniques can have a substantial influence on an individual's mechanical efficiency during wheelchair propulsion.

In accordance with the ACSM's exercise management for persons with chronic diseases and disabilities, the recommended intensity for exercise training in experimental participants is 50-70% of the HR reserve determined during aerobic exercise. In this respect, our exercise intensity was at the low end of recommended spectrum (our subjects trained at 50% of their reserve, determined serially during the training program).

The result of the study showed that there is an early decrease in HR and increase in O2 consumption and EE in both the training groups from day 0 today 30.This might have happened due to the readjustment in autonomic nervous activity apparently carried out and/or the cardiac contractile force might have increased early in the exercise training periods. Oxygen consumption and EE in SCI participants showed a tendency to increase with training, from day 0 today 30.These increase were significant after one month. This finding seems to be related to no improvement in myocardial contractility in SCI participants with training. Patients with SCI consume higher level of oxygen to perform same intensity of work as compared to person without SCI. (Mark S.Nash, 2005)

The findings of the study also support the literature of Glaser and Collaborates (1981), Midha M etal, 1999, Flandroies etal, 1986, Coutts etal, 1995, where they had stated that 5wk wheelchair training helped in 29% increase in power output, showed reduction in HR and in the minute volume of respiration during sub maximum work.

The increase in O2 consumption and decrease in HR after 30 days of training is supported by the study of Zwiren and Bar-Or, 1975, where they have stated that comparisons of paraplegic subjects at different fitness level suggested that conditioning of upper limb and trunk muscle was effective in increasing aerobic power, reducing the HR response to sub maximum effort. They have also showed that there was an increase in maximum O2 intake from 19% to 37%.Wheel chair skills training program and conventional wheel chair training used upper extremity and trunk muscles repeatedly during skills training, which might have helped conditioning of upper extremity and trunk muscles, thereby increasing O2 consumption and decreasing HR.

The results when compared from Day 30 to Day 60, it was found that there was a significant decrease in HR, O2 consumption and EE. This results is supported by literature led by Glaser et al(1981), who conducted wheelchair ergo meter exercises on thirteen participants and after 5 week training, sub maximal heart rate, pulmonary ventilation and oxygen uptake of the seven wheel chair ergo meter exercise group were found to be significantly lower during the post exercise test. Thus they concluded that wheelchair ergo meter exercise might have contributed to adaptation of upper body muscle, improved cardio respiratory function and higher level of skills for wheel chair propulsion.

This result also supports the literature given by Klausen, K. and Knuttgen, H. G, (1971), their experiment on bicycling downhill on a motor driven treadmill showed that during cycling downhill, it was found in 3 young, male subjects that the oxygen consumption (VO2) continued to increase over a 25–50 min exercise period. The increase from the 10th to the last min of exercise was more than 25%. After 3–5 weeks of training with negative work of higher numerical work intensity, a marked decrease in VO2 was seen.

In earlier studies by Fukuoka et al, 2006, it was found that VO2 kinetics is very sensitive to exercise training which is also found in this study. There was an increase in O2 consumption early in the training program with subsequent reduction after 30 days of training. The early increase in O2 consumption may be attributed to wheel chair training that induced an improvement in O2 delivery ability in exercising muscles, consequently accelerating VO2 consumption. Subsequently due to prolonged wheel chair skills training for 60 days and cardio respiratory adaptation to training, there is an inherent reduction in myocardial aerobic requirements, thus reducing HR and O2 consumption.

As per the exercise frequency, interval training programs with 2-3 work bouts per week have been widely adopted for exercise training on the subjects of disabled persons, because such exercise programs have the advantage of being relatively short exercise bouts, being less boring and more closely resembling the intermittent nature of daily activity patterns.

This MWSTP indirectly induces a significant improvement in physical work capacity and endurance. Indeed, training effects were observed in maximal values in endurance capacity, while sub maximal power outputs encountered during activities induces a smaller physiological stress. These improvements can be related to the protocols specificities that precisely respect the guidelines observed in the literature for SCI population training.

From this study we concluded that wheel chair skills training cause a decrease in energy expenditure, so these techniques can be used to increase the length of time a wheelchair user can push his or her chair before fatiguing due to energy loss, which will increase participation as the wheelchair user will have more energy to get through the day if less energy is utilized in propulsion.

CONCLUSION

It is generally agreed that cardio respiratory fitness for the wheelchair dependent individuals could be improved with an appropriate training program. On the basis of the findings of this study, it can be concluded that both modified wheel chair skills training program and conventional training are effective in lowering the energy expenditure in patients with spinal cord injury. The use of WSTP can be recommended in rehabilitation settings instead of conventional wheelchair training for the SCI patients as there is a significant decrease in O2 consumption, HR and EE in MWSTP group over conventional training. In SCI participants, this training program adopted in clinical rehabilitation centre results very quickly, in adaptation of physiological variables determined during constant exercise.

Thus the MWSTP is a safe, practical and effective method of improving wheelchair skills knowledge and performance. It has also a clinically significant effect on the independent wheeled mobility of new wheelchair users. These findings have implications for the standards of care and clinical use in rehabilitation program.

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