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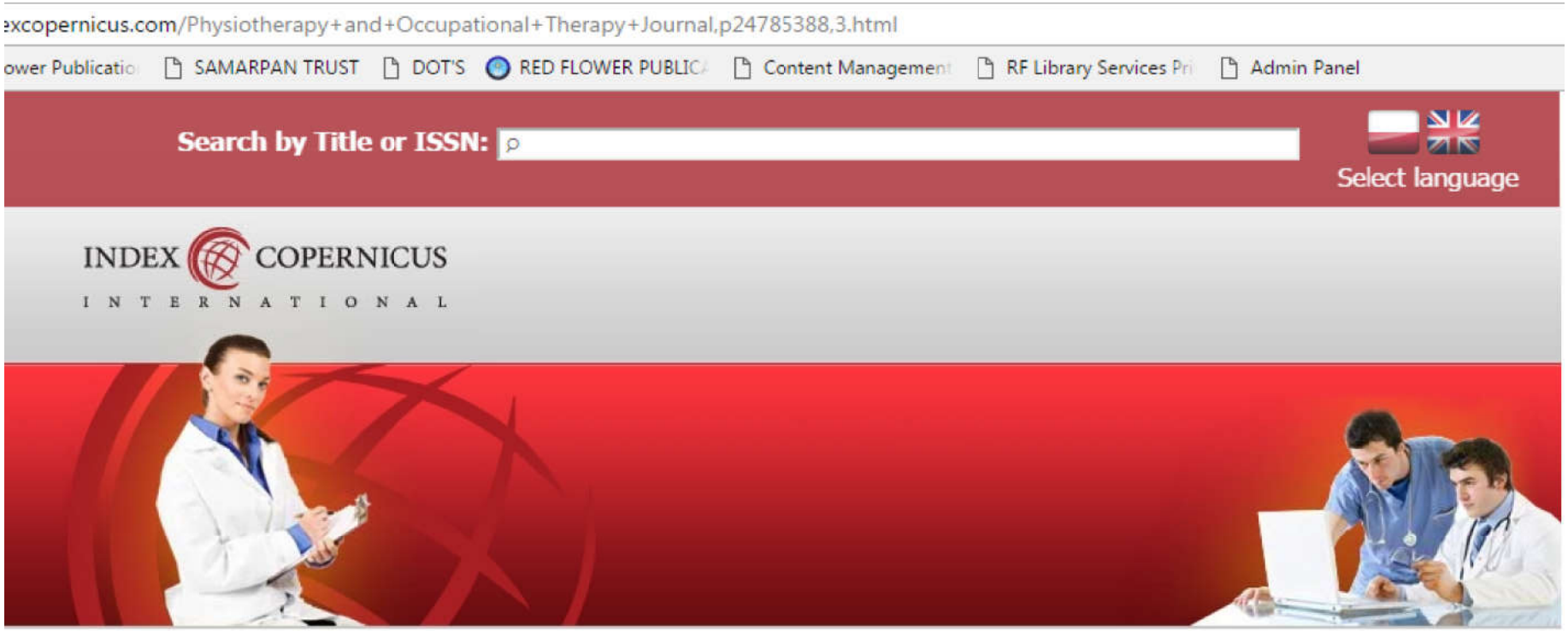

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Correlation of Foot Posture Index-6 and Navicular Drop Test with Functional Ankle Stability in Running Male Athletes

Kaner Tayal*, Davinder Kumar Gaur, Jitender Munjal***, Jyoti Dahiya****

Abstract

Human foot posture is highly variable among healthy individuals and ranges from flat- to high-arched. The Foot Posture Index (FPI) is a validated method for quantifying standing foot posture, and is being used in a variety of clinical settings. Therefore objective of the study was to find correlation between Foot Posture Index-6 (FPI-6) and Navicular Drop Test (NDT) with functional Ankle Stability in Running Male Athletes. 60 Male Running athletes participated in the study. Foot Posture Index- 6, Navicular Drop Test, Side Hop Test were performed by them and data was recorded. Correlation between them was determined by Pearson correlation coefficient. Functional Ankle Stability using side hop test were calculated of both the feet and correlation with FPI & NDT. Results showed that there is significant correlation between the foot posture index - 6, Navicular Drop Test and Side Hop Test for ankle stability. Hence it was concluded that the ankle instability is correlated with foot posture & navicular drop in healthy running athletes.

Keywords: Foot Posture Index- 6; Navicular Drop Test; Side Hop Test.

Introduction

Human foot posture is highly variable among healthy individuals and ranges from flat- to high-arched. Differences in muscle activity in people with flat-arched feet may reflect neuromuscular compensation to reduce overload of the medial longitudinal arch [1]. Historically, foot mechanics are considered to contribute to lower extremity malalignment and pathology proximal to the foot via joint coupling with tibial internal rotation [2].

Considering the hypothesized link between foot posture and lower extremity injury, static foot posture is frequently assessed in the clinical setting, with a belief that this may provide indications for biomechanical interventions (e.g. foot orthoses). Commonly employed assessment methods to assess foot posture include, but are not limited to, Navicular drop, resting calcaneal eversion, the longitudinal arch angle and the Foot Posture Index (FPI) [2].

A six-item criterion reference tool (the Foot Posture Index, or FPI) was developed in response to a requirement for a quick, easy and reliable method for measuring foot position in a variety of clinical settings [3]. Navicular drop test is used in evaluating the amount of pronation in runner's foot.

Acute and chronic lateral ankle instability is common in high-demand patient populations. If not managed appropriately, patients may experience recurrent instability, chronic pain, osteochondral lesions of the talus, premature osteoarthritis, and other significant long-term disability. Proposed risk factors include prior ankle sprain, elevated body weight or body mass index, female gender, neuromuscular deficits, postural imbalance, foot/ankle malalignment and exposure to at-risk athletic activity [4].

Subjects with excessive pronation were found to have no difference in invertor strength, but decreased concentric plantar flexion strength when compared to normal's [5]. No studies have been done to identify the relationship of excessive foot pronation or supination and ankle musculature.

However, to our knowledge, no studies have been published to identify if the tools that are used to measure foot posture and stability can be correlated

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and the values of one can be used to predict the value or outcome of other. Therefore the aim of study was to find correlation between Foot Posture Index-6 and Navicular Drop Test with Functional Ankle Stability in Running Male Athletes.

Operational Definitions

1. Runner - A person who runs competitively as a sport or hobby. Ex-a 400 metres runner [6].

Methodology

60 subjects were included in the study fulfilling the iinclusion criteria of runners in age group 15- 18 years, athlete participating in school level running sports since Two and a half year, Dorsiflexors strength normal (5 grade) on MMT Scale, BMI between 18.5 to 24.9 kg/m^2. Any subject with any history of musculoskeletal dysfunction for which athlete is undergoing physicians consultancy which may affect outcome of the study, any history and / or diagnosed cardiovascular disorders, neurological disorders, respiratory disorders, psychosomatic disorders, hormonal disorders & metabolic dysfunction, any history of lower extremity injury and/or surgery for which athlete is undergoing physicians consultancy, and Sprinters (≤400 meters) were excluded [11].

Procedure

Potential subjects were apprised of the procedure and its benefits. Prior to testing, the subjects were familiarized with the testing procedure.

After that Examiner examined each athlete individually to fill up the *Foot Posture Index* himself. Subjects were divided into 3 subgroups- supinated (-1 to -5), neutral (0-5), and pronated (6 & above), on the basis of their FPI- 6 scores [11,12].

After five minutes of rest Subject was placed in the sitting position and *Navicular Drop Test* was conducted with their feet flat on a firm surface with their knees flexed to 90* and ankle in neutral position. While maintaining this position index card was placed in the inner aspect of the hind foot, with the card placed vertical on the ground passing the Navicular bone. The most prominent point of the Navicular was marked on the card.

After five minutes of rest the athlete was asked to perform warm up of about 5 minutes followed by *Side Hop Test* to measure ankle stability. The warm up consisted of 5 minutes of jogging.

Each Participant was instructed to hop on one limb laterally over a 30-cm distance. One repetition constituted of hopping laterally 30 cm and back to the starting location. Each participant completed 10 repetitions and was instructed to do so as quickly as possible. Test was conducted on concrete floor. Three trials were taken with rest in between of one minute. Average of the three trials was selected for the statistical analysis. If a participant fell, put the contralateral foot down, missed the stopwatch pad, or did not completely clear the 30-cm distance while hopping the trial was rejected and the participant repeated the trial again [7,8,9,10].

The Outcome Measures recorded were **s**cores of Foot Posture Index- 6, scores of Navicular height and Side Hop Test time.

Results

60 Male running athletes with mean age 16.13 ± 1.09 years, Height 64.4 ± 5.05 inches and weight 54.7 ± 10.4 were taken to carry out the study. Following results were obtained in the study.

Table 1: Relationship (correlation coefficient) of FPI- Right with HOP -Right

Fpi-Right	N	Hop Right
Supinated	10	r = 0.262*, p=0.043
Neutral	26	r = 0.144, p=0.481
Pronated	24	r = 0.875*, p=0.000

*correlation coefficient value significant at p<0.05

Table 2: Relationship (correlation coefficient) of FPI – Left with HOP- Left

Fpi- Left	N	Hop- Left
Supinated	10	r = 0.297*, p=0.04
Neutral	26	r= 0.174, p=0.394
Pronated	24	r= 0.734*, p=0.000

*correlation coefficient value significant at p<0.05

Table 3: Relationship (correlation coefficient) of NDT- RIGHT with HOP- Right

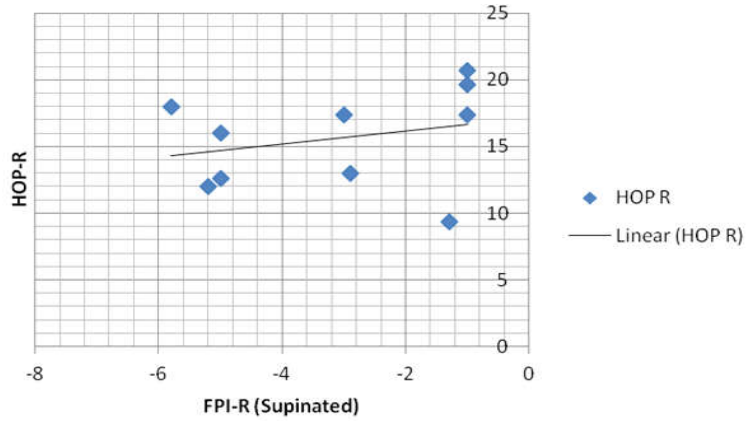
	N	HOP-Right
NDT- Right	60	r =0.305*, p=0.017

*correlation coefficient value significant at p<0.05

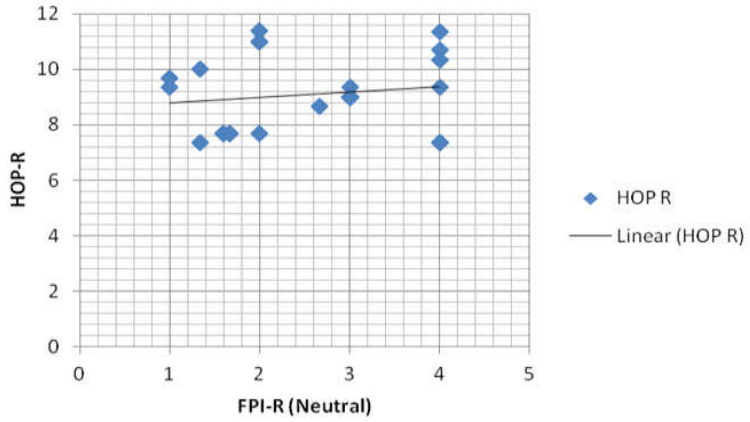
Table 4: Relationship (correlation coefficient) of NDT-Left with HOP Left

	N	HOP-Left
NDT-Left	60	r = .518, p=0.000

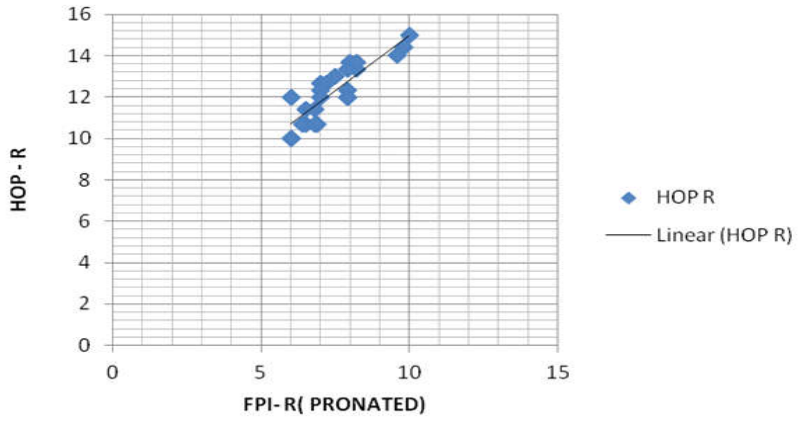
*correlation coefficient value significant at p<0.05



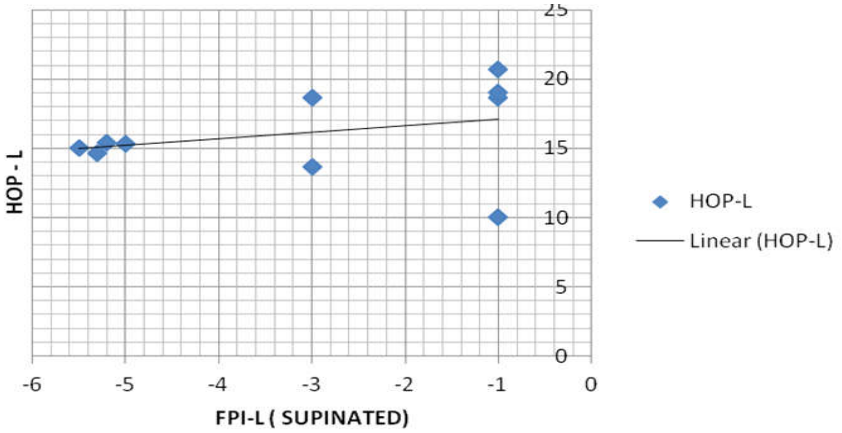
Graph 1: Correlation of FPI-R (Supinated) with HOP-R



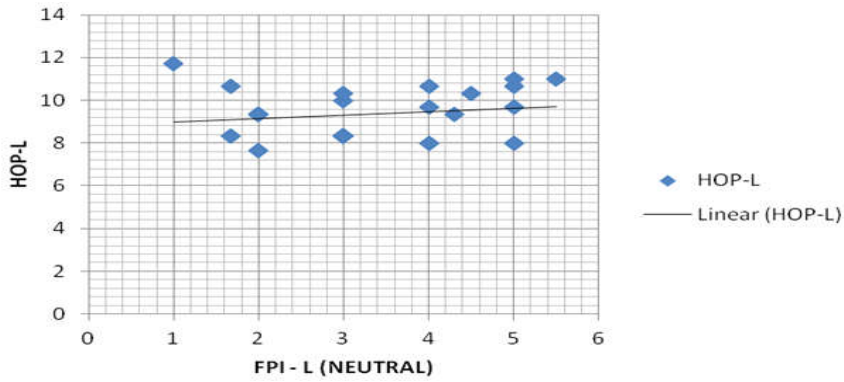
Graph 2: Correlation of FPI-R (Neutral) with HOP-R



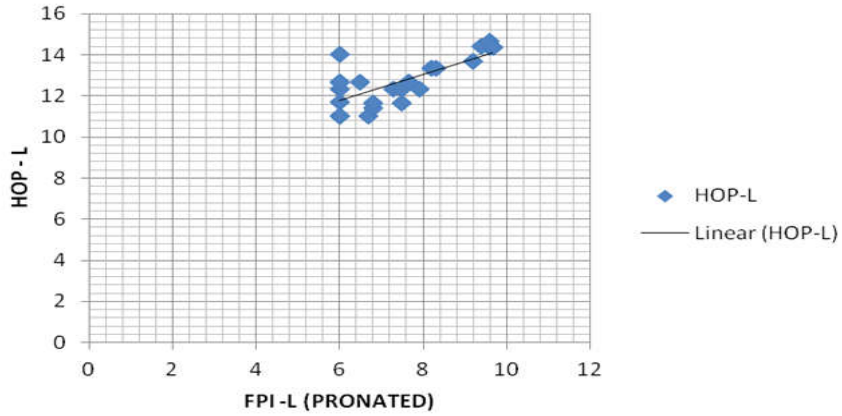
Graph 3: Correlation of FPI-R (Pronated) with HOP-R



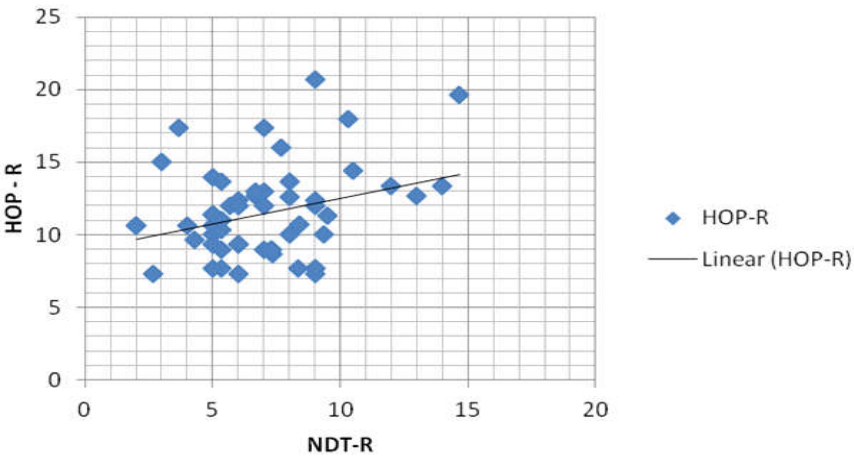
Graph 4: Correlation of FPI-L (Supinated) with HOP-L



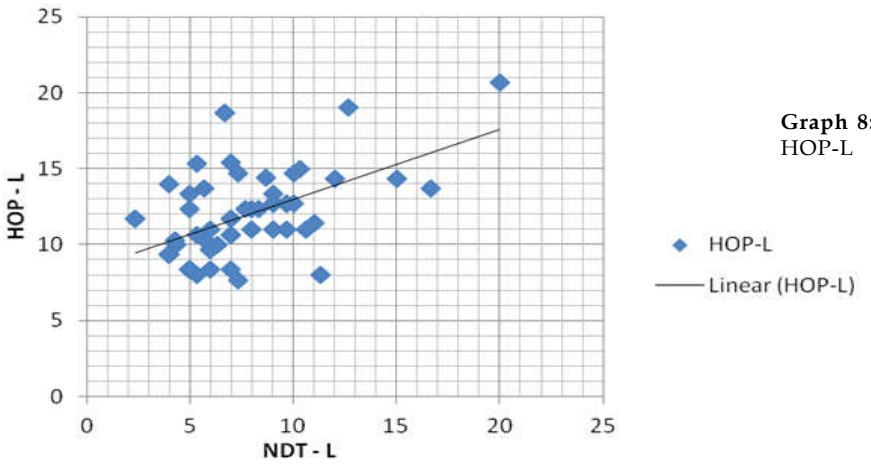
Graph 5: Correlation of FPI-L (Neutral) with HOP-L



Graph 6: Correlation of FPI-L (Pronated) with Hop-L



Graph 7: Correlation of NDT-R with HOP-R



Graph 8: Correlation of NDT-L with HOP-L

Discussion

Novice runners face a challenge when taking up running because of the high risk of sustaining a running-related injury (RRI) when compared with experienced recreational runners [2]. Of all the non-modifiable risk factors, foot posture and knee alignment have been of special interest among clinicians because mal-alignment of the foot and knee are believed to be associated with development of RRI [13].

60 male running athletes were included in the study with mean age 16.13 ± 1.09 years, Height 64.4 ± 5.05 inches and weight 54.7 ± 10.4.

For the purpose of statistical analysis the FPI-6 scores of 60 subjects were divided into three groups i.e. less than 0 (supinated), between 0-5(neutral), more then 5 (pronated). The data of FPI-6 of above groups was then correlated with corresponding values of Side hop test. There was found to be significant correlation between the scores of FPI-6 & Hop test for supinated and pronated foot types [Supinated (R) r= 0.876, $p<0.05$, Supinated (L) r= 0.297, $p<0.05$ Pronated (R) r= 0.262 $p<0.05$, Pronated (L) r= 0.736,$p<0.05$] while for the normal foot there was found to be moderately weak correlation [neutral (R) r= 0.145, $p<0.05$, Neutral (L) r= 0.175, $p<0.05$). Similarly there was significant correlation between the scores of NDT and Side Hop Test [Right= 0.306,$p<0.05$, Left = 0.518, $p<0.05$]

A more pronated foot type as measured by the FPI was associated with greater peak forefoot abduction and earlier peak rearfoot eversion in the PFPS group, and greater rearfoot eversion range of motionin the control group. In both individuals with and without PFPS, there was fair to moderate association between the FPI and some parameters of dynamic foot function [14].

The Foot Posture Index, normalized Navicular Drop, and calcaneal angle relative to subtalar joint neutral are all reliable and sensitive to group differences when used in a population with PFPS. Individuals with PFPS possess a more pronated foot posture and increased foot mobility compared to controls [15].

Chuter et al in his study stated that there are several limitations to this study that should be considered. This study was restricted to normal and pronated foot types as determined by FPI score. A supinated foot type, classified by a score -5 to 0 on the FPI scale, was not included. Due to the nature of the ordinal scale used in the FPI, i.e. evenly distributed categories and directional, it suggests that the predictive capacity of the FPI may extend to a negatively scored supinated foot type however this is currently an assumption [16]. However the current study takes into consideration all the three components of FPI-6.

Hop test scores should be evaluated as *both* a comparison with known distance and time standards based on sex and level of competition and relative to an individual athlete's limb symmetry index. Based on the results of this study, hop test scores should be evaluated based on normative data that are specific to the individual's sex and level of competition as well as the individual's limb symmetry index [17].

Therefore from the present study it can be interpreted that the hypothesis " There is significant correlation between Navicular Drop Test with Functional Ankle Stability in Running Male Athletes." And "There is significant correlation between Foot Posture Index-6 and Functional Ankle Stability in Running Male Athletes" are accepted.

Conclusion

Results show that There is low correlation between Navicular Drop Test with Functional Ankle Stability in Running Male Athletes. And there is low correlation between Foot Posture Index-6 and Functional Ankle Stability in Running Male Athletes.

Ethical Clearance: Taken from ethical committee

Source of Funding: Self

Conflict of Interest: nil

References

1. George S Murley et al. Foot posture influences the electromyographic activity of selected lower limb muscles during gait.
2. Bradley S Neal et al. Foot posture as a risk factor for lower limb overuse injury: a systematic review and meta-analysis.
3. Anthony C. Redmond et al. Normative values for the Foot Posture Index.
4. Management and prevention of acute and chronic lateral ankle instability in athletic patient populations. Brendan J McCriskin, Kenneth L Cameron, Justin D Orr, Brian R Waterman].
5. Snook AG et al. The relationship between excessive pronation as measured by navicular drop and isokinetic strength of the ankle musculature.
6. Website reference from oxford open dictionary, https://en.oxforddictionaries.com/definition/runner/as on 25.3.2017.
7. Caffrey E, et al. The Ability of 4 Single-Limb Hopping The Functional Performance Deficits in Individuals With Functional Ankle Instability J orthop Sports phys Ther 2009; 39:799-806.
8. Buchanan A et al. Functional performance testing in participants with functional ankle instability and in a healthy non-FAI group. J Athl Train 2008; 43: 342-6.
9. Chambers RB. Surgical reconstruction for calcaneonavicular coalition: evaluation of function and gait. J Bone Joint Surg Am 1982; 64:829-36.
10. Docherty CL, et al. Functional-performance deficits in volunteers with functional ankle instability. J Athl Train 2005; 40:30-4.
11. Mark W. Cornwall et al. Reliability of the Modified Foot Posture Index.
12. Stewart C Morrison and Jill Ferrari. Inter-rater reliability of the Foot Posture Index (FPI-6) in the assessment of the paediatric foot.
13. Daniel Ramskov, et al,Association Between Q Angle And Foot Posture With Running Related Injuries: A 10 Week Prospective FollowUp Study IJSPT 2013 August; 8(4):407.
14. Christian J Barton,et al Relationships between the Foot Posture Index and foot kinematics during gait in individuals with and without patellofemoral pain syndromeJournal of Foot and Ankle Research 2011; 4:1 DOI: 10.1186/1757-1146-4-10.
15. Christian J. Barton et al. Foot and Ankle Characteristics in Patellofemoral Pain Syndrome: A Case Control and Reliability StudyJournal of Orthopaedic & Sports Physical Therapy, 2010 40(5):286–296. DOI:10.2519/jospt.2010.3227.
16. Vivienne H Chuter et al. Relationships between foot type and dynamic rearfoot frontal plane motionJournal of Foot and Ankle Research 20103: 9DOI: 10.1186/1757-1146-3-9. Published: 16 June 2010.
17. Smita Rao, PT, et al. Musculoskeletal Conditions of the Foot and Ankle:. Author manuscript; available in PMC 2013 Jun 1.

Original Article

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Effect of Carrying 20% of Body Weight in Backpack on Physiological Responses & Energy Expenditure in School Children

Kayinat Hassan*, R.K. Meena, Anshika Singh*, Danish Nouman*, Rita Upadhyay*****

Abstract

Objective: The purpose of this study was to determine the changes in heart rate, respiratory rate, blood pressure and energy expenditure while walking without and with backpack in school going children. *Method*: Forty six subjects, (24 boys and 22 girls) were taken in the study. Their resting parameters ie H.R, R.R and B.P were recorded. Then subjects were asked to walk for 6 minutes on the level ground and their parameters were recorded immediately, after 3 minutes and 5 minutes and their physiological cost index was calculated. Resting time was given to the subjects to bring their parameters to baseline and then subjects were asked to walk again for 6 minutes with 20% of their body weight in backpack and the same procedure was repeated. *Result*: There was a significant difference in H.R, R.R and P.C.I in walking without and with backpack ($p<0.01$). However their was no significant difference in B.P. in without backpack walk and with backpack walk.

Keywords: Heart Rate (H.R.); Respiratory Rate (R.R.); Physiological Cost Index (P.C.I.); Systolic Blood Pressure (S.B.P) and Diastolic Blood Pressure (D.B.P).

Introduction

Backpack use among school children is the most popular means of transporting belongings to and from school. The backpack is an appropriate way to load the spine closely and symmetrically, while maintaining stability.

Overloaded children backpacks may lead to the development of back pain, musculoskeletal injuries, alteration in posture to accommodate backpack and maintain upright equilibrium [1]. The relative load carried by school children (expressed as percentage of Body Weight) has been considered as one of the contributory factors for developing musculoskeletal problems among the children.

Authors have discussed association between backpack load and physiological responses which includes cardiovascular, pulmonary and metabolic changes. Cardiovascular changes due to backpack use include responses in heart rate, blood pressure, and metabolic rate, as well as brachial artery flow. Heart rate and oxygen uptake are both influenced by the backpack weight while walking. Heart rate also increases while standing with a backpack, regardless of weight or support [2].

Even studies have reported significant decrease in brachial artery blood flow in school age children carrying a backpack of 20% bodyweight which further decreases when the backpack load is worn high on the back as compared to lower on the back[3].

Lung function is also compromised in children by carrying 10, 20, & 30% of body weight in backpack compared standing with or without backpack, or with a kyphotic posture [4]. With increased backpack loads, thoracic volume (activation of thoracic respiratory muscles) also increases [5]. There is a linear relationship between the energy expenditure while walking with a backpack load [6].

The load carried in a double strap backpack requires less oxygen consumption in children as compared to a load carried on one shoulder (which required 37% more energy than the backpack) or a load carried in one hand (which required 82% more energy than the backpack [7]. Mean work intensity

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measurements of oxygen consumption and energy expenditure in children increases as the weight in backpack increases.

Need of the Study

The previous studies deals with parameters like musculoskeletal pain, biomechanical changes in gait, posture, cardio respiratory adjustments, energy expenditure and fatigue. However, there is a less literature available which has studied influence of load carriage in backpack on physiological system in normal school going children.

Operational Definition

- *Arterial Blood Pressure*: It is the lateral pressure on the walls of the arteries due to flowing column of the blood.
- *Heart Rate:* The number of heartbeats per unit time, usually per minute.
- *Physiological Cost Index:* It is an energy index based on heart rate. It determines the relative cost of walking per unit distance walked.
- *Respiratory Rate:* The number of breaths per minute .
- *Borg Scale:* It is a simple method of rating perceived exertion. RPE scale runs from 0 to 10. The numbers use to rate how easy or difficult one finds an activity.
- *Sedentary Lifestyle*: It is a type of lifestyle with no or irregular physical activity.

Materials and Methodology

Methodology

The methodology adopted for this study is described below.

Study Design

Pre-post study design

Study Duration

Six months

Sampling Method

Purposive sampling

Place of Study

Different schools of Meerut

Inclusion Criteria

- School going children aged 8 to 10 years

Exclusion Criteria

- Any congenital and structural abnormalities**.**
- Presence of musculoskeletal problems**.**
- History of any neurological problems.
- History of cardio respiratory problems.
- Acute illness (e.g.; fever, cough etc)

Outcome Measures—BP, HR, RR, P.C.I

Materials Required

- Stop watch
- digital blood pressure apparatus
- weighing machine
- Measuring tape

Procedure

Ethical approval was obtain from the board of studies department of physiotherapy, Swami Vivekanand Subharti University.

Forty six subjects, 8 to 10 years old school children were taken in the study. Voluntary participation for the study was considered. An informed consent was taken from the principal of the school. For each participant backpack questionnaire was filled by interview method.

Subjects were fully explained about the procedure and then their resting parameters i.e heart rate, blood pressure and respiratory rate were recorded.

After that subjects were asked to walk for 6 minutes on the level ground and after 6 minutes walk their BP, HR, RR were recorded immediately, 3 minutes and 5 minutes and their physiological cost index was calculated.

Resting time of 10 minutes was given to subjects to bring their parameters to baseline. Then again they were asked to walk for 6 minutes with backpack which contain 20% of their body weight and after that their BP, HR, RR were recorded immediately, 3 minutes, 5 minutes and again their physiological cost index was calculated. Rating of perceived exertion was asked after the child had walked without and with backpack.

Data Analysis

- All analysis was done by using the SPSS version

20.0 (for window 7)

- Demographic data of subjects were summarised.
- To analyze the difference between the two groups, paired t-test was used. A level of 0.01 was used to determine the statistical significance.

Results

TOTAL NO OF CHILDREN – 46

NO OF BOYS- 24
NO OF GIRLS – 22
NO OF 7 TO 8 YEARS STUDENTS – 10
NO OF 9 TO 10 YEARS STUDENTS – 36

For H.R., R.R., B.P. & P.C.I. in All Children

Table 1 shows the comparison between the different positions of H.R, R.R, P.C.I. and B.P. (by paired 't"test) in children.. It shows a significant difference for each pair of position of H.R, R.R. and P.C.I. at 0.01 level of significance. i.e. ($p<0.01$). It also shows significant difference for S.B.P and D.B.P between at resting and without backpack walk, resting and with backpack walk, and no significant difference at without backpack walk & with backpack walk at 0.01 level of significance ($p<.01$).

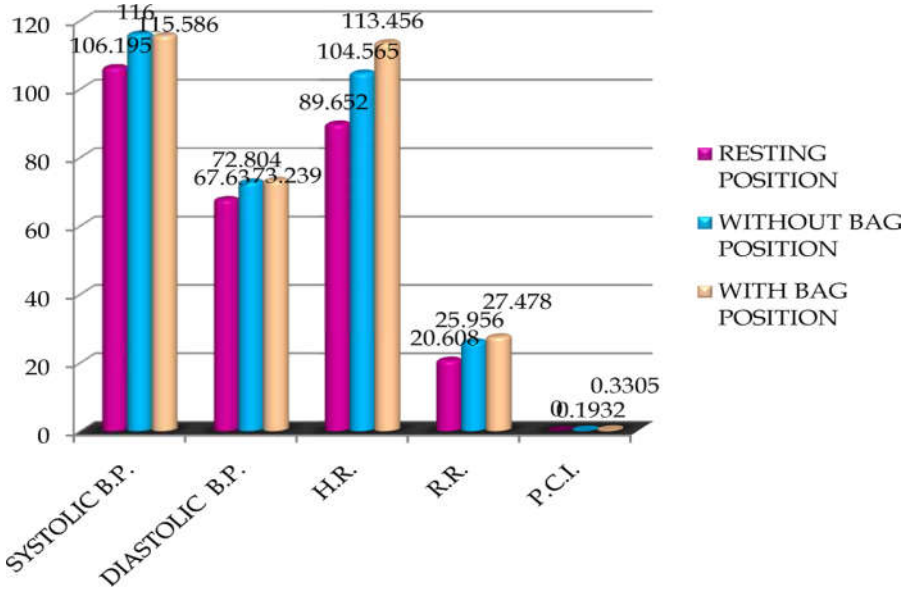
Table 2 shows a significant difference for each pair of position of H.R.,R.R., and P.C.I. at 0.01 level of significance. i.e. ($p<.01$).It also shows significant difference for S.B.P and D.B.P between resting & without backpack walk and resting & with backpack walk and no significant difference between without backpack walk & with backpack walk($p<.01$).

Table 1: Comparsion between different positions (in pairs)

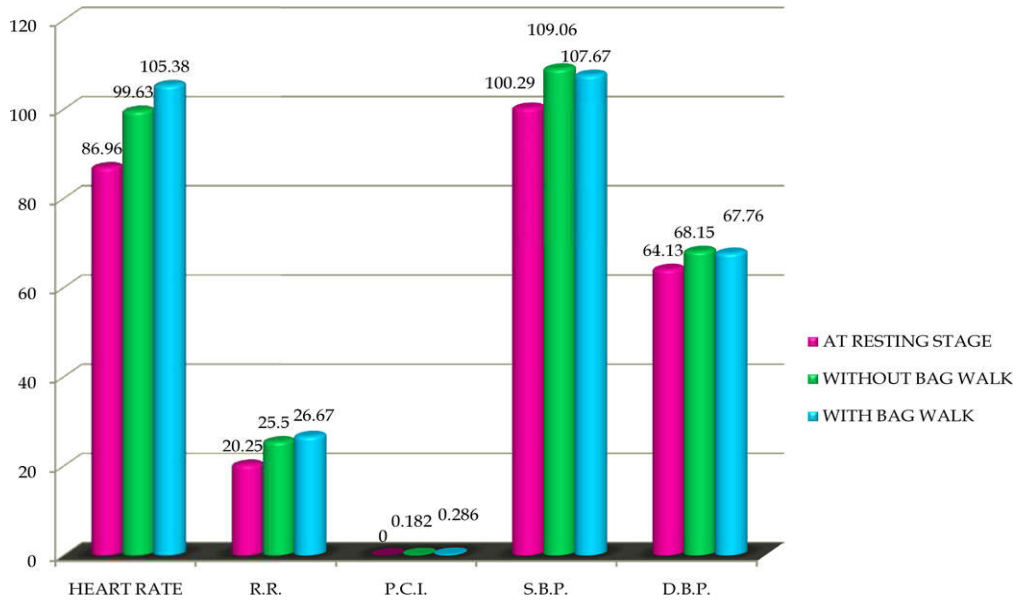
S. No.	Comparsion between the positions	Probability of paired "t" TEST FOR				
		H.R.	R.R.	P.C.I.	S.B.P.	D.B.P.
1	Resting & Without Backpack Walk	.0000*	.0000*	-----	.0000*	.0000*
2	Resting & With Backpack Walk	.0000*	.0000*	-----	.0000*	.0000*
3	Without Backpack Walk & With Backpack Walk	.0000*	.0000*	.0000*	.0906	.4280

Table 2: Comparsion between different positions (in pairs) for H.R., R.R., B.P & P.C.I. in male children

S. No.	Comparsion between the positions in male children	Probability of paired "t" Test For				
		H.R.	R.R.	P.C.I.	S.B.P.	D.B.P.
1	Resting & Without Backpack Walk	.0000	.0000	----	.0000*	.0063*
2	Resting & With Backpack Walk	.0002	.0000	----	.0000*	.0081*
3	Without Backpack Walk & With Backpack Walk	.0001	.0000	.0013	.0977	.7155



Graph 1: The bar diagram of average scores of s.b.p., d.b.p., h.r., r.r. and p.c.i. for all children at resting, with backpack walk & with out backpack walk positions

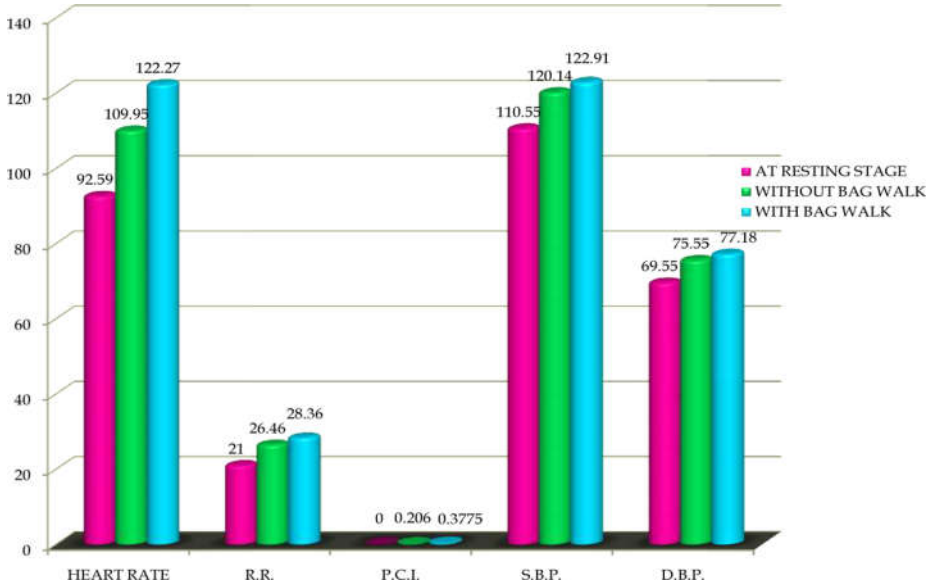


Graph 2: The bar diagram of average scores of h.r., r.r.,p.c.i., s.b.p. & d.b.p. at resting position, without backpack walk position & with backpack walk position in the male children

Table 3: Comparsion between different positions (in pairs) for H.R., R.R., B.P & P.C.I. in female children

S. No.	Comparsion between the Positions	PROBABILITY OF PAIRED "t" TEST FOR				
		H.R.	R.R.	P.C.I.	S.B.P.	D.B.P.
1	Resting & Without Backpack Walk	.0000	.0000	-----	.0000*	.0027*
2	Resting & With Backpack Walk	.0000	.0000	-----	.0000*	.0023*
3	Without Backpack Walk & With Backpack Walk	.0000	.0014	.0000	.1274	.2921

Table **3** shows the comparison between the different positions of H.R, R.R, P.C.I, S.B.P & D.B.P. (by paired 't" test) in female children. It shows that a significant difference was present for each pair of position of H.R, R.R & P.C.I at 0.01 level of significance. i.e. (p<.01). It also shows significant difference for S.B.P and D.B.P between resting & without backpack walk and between resting & with backpack walk and no significant difference between without backpack walk & with backpack walk (p<.01).

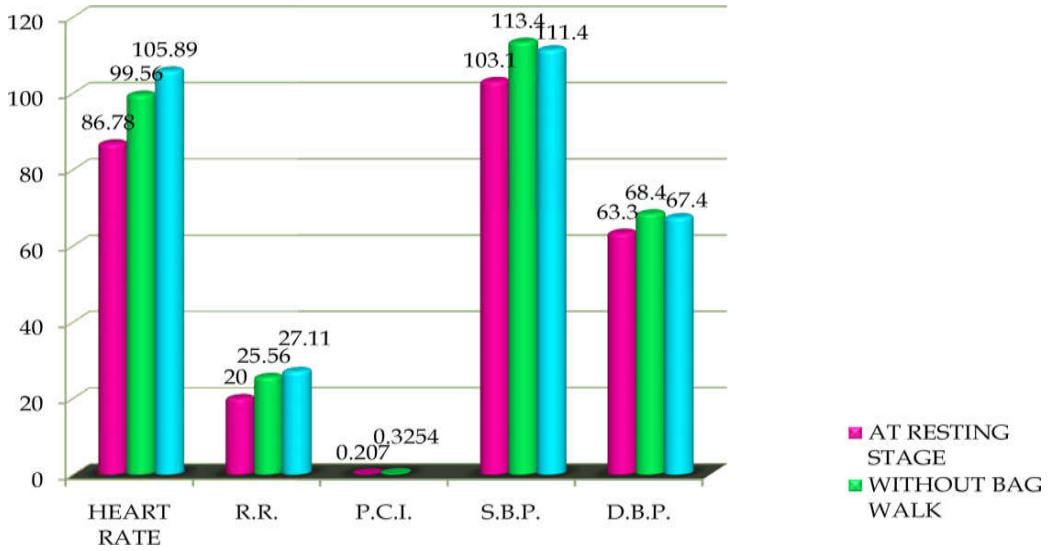


Graph 3: The bar diagram of average scores of H.R., R.R., P.C.I., S.B.P & D.B.P at resting position, without backpack walk position & with backpack walk position in the female children

Table 4 shows a significant difference was present for each pair of position of H.R, R.R, P.C.I. at 0.01 level of significance. i.e. (p<.01). It also shows that a significant difference was present for S.B.P between resting & without bag walk at 0.01 level of significance (p<.01). No significant difference was present in S.B.P & D.B.P between resting & with backpack walk and between without backpack walk & with backpack walk. However significant difference in S.B.P was present in resting & without backpack walk.

Table 4: Comparsion between different positions (in pairs) for H.R., R.R., B.P. & P.C.I. IN 7-8 years children

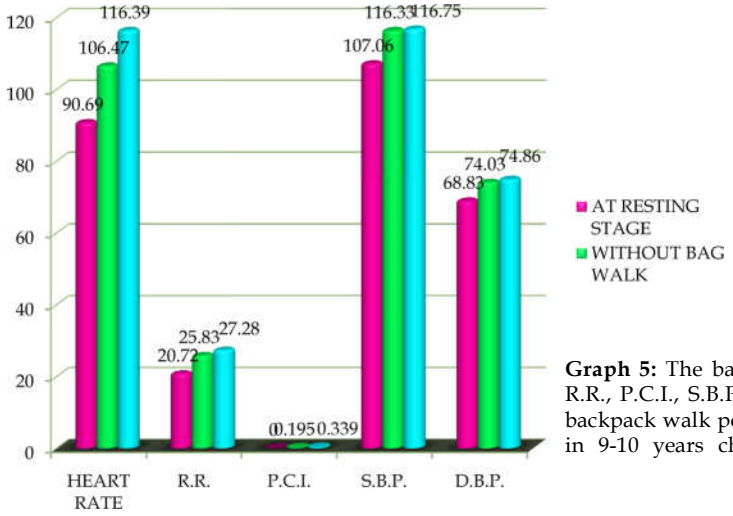
S. No.	Comparsion between the positions Test in 7-8 years children	Probability of paired "t" Test For H.R.	R.R.	P.C.I.	S.B.P.	D.B.P.
1	Resting & without backpack walk	.0002*	.0002*	----	.0002*	.0233
2	Resting & with backpack walk	.0000*	.0002*	----	.0229	.1984
3	Without backpack walk & with backpack walk	.0111*	.0081*	.0050*	.3136	.7759



Graph 4: The bar diagram of average scores of H.R., R.R., P.C.I., S.B.P & D.B.P at resting position, without backpack walk position & with backpack walk position in 7-8 years children

Table 5: Comparsion between different positions (in pairs) for H.R., R.R., B.P. & P.C.I. by paired "t" in 9-10 years children

Comparsion between the positions Test in 9-10 years children	Probability of paired "t" test for H.R.	R.R.	P.C.I.	S.B.P.	D.B.P.
Resting & without backpack walk	.0000*	.0000*	----	.0000*	0000*
Resting & with backpack walk	.0000*	.0000*	----	.0000*	.0001*
Without backpack walk & with backpack walk	.0000*	.0006*	.0000*	.7815	.4960



Graph 5: The bar diagram of average scores of H.R., R.R., P.C.I., S.B.P & D.B.P at resting position, without backpack walk position & with backpack walk position in 9-10 years children

Table 5 shows a significant difference was present for each pair of position of H.R., R.R. and P.C.I at 0.01 level of significance. i.e. ($p<.01$). It also shows significant difference for S.B.P and D.B.P between resting & without backpack walk and between resting & with backpack walk at 0.01 level of significance and no significant difference between without backpack walk & with backpack walk ($p<.01$).

Discussion

The purpose of this study was to determine the effect of 20% body weight in backpack on physiological responses (H.R., R.R., B.P.) and energy expenditure. In this study alternate hypothesis was accepted ie, there are significant physiological changes while walking with the backpack. Our result shows that there was increase in energy expenditure while walking with the backpack as compared to walking without backpack. There was also increase in H.R. and R.R. in without backpack walk and with backpack walk as compared to baseline. Difference in blood pressure was also noted in without backpack walk and with backpack walk as compared to baseline. However, there was no significant difference in blood pressure as compared to without backpack and with backpack walk.

Overall, we found increase in H.R. and R.R. in without backpack walk and with backpack walk as compared to baseline. Our result is in accordance with Hong et ol who examined heart rate, blood pressure and energy expenditure in children carrying backpacks weighing 10, 15, and 20% BW compared to not wearing a backpack, and found increased heart rates across all loads, which returned to normal after a brief recovery period[8]. This is also supported by the study done by Li JX, Hong Y Robinson PD(2003) that breathing frequency increases with the load carriage[9]. Like the results of You lian hong and Bruggeman GP decrease in walking speed with backpack was also observed[10].

Measurements of blood pressure immediately after walking without backpack and with backpack for 6 minutes show significant difference as compared to baseline. We also found increase in S.B.P while walking. However, there was no difference in blood pressure in walking without backpack and with backpack ,this could be due to decrease in walking speed with 20% load carriage. Also, adaptive responses that occur during without backpack walking could be a contributing factor for not increasing B.P. after 20% load carriage walk. Therefore, the changes of blood pressure in this study indicate that the load of 20% of body weight produced a greater stress on the cardiovascular system in terms of H.R and R.R.

We found increase in energy expenditure while walking with backpack as compared to walking without backpack. This was also seen in the study done by Veisteinas, Merati & Negrin who found increase in H.R and net energy cost of locomotion while walking with the backpack. We also noticed higher Rating of perceived exertion while walking with backpack [11]. This is in accordance with study done by Quesada PM et ol who also reported higher energy cost and RPE with increased back pack [6].

We also studied effect of gender on physiological parameters and energy expenditure with load carriage. We found no statistically significant differences on H.R., R.R. and B.P. on the basis of gender. This could be attributed as all children included in our study were in prepubescent phase. Before puberty physiological responses are same in male and females[12].

We also noticed that children with the sedentary lifestyle required more time for H.R, R.R. and B.P recovery. However, statistical test couldn't be done because of less sample size in sedentary children group.

Clinical Implication

- Sedentary lifestyle children were encouraged to exercise regularly and indulge in outdoor games (Cycling, running, skipping etc) and the teachers were asked to add regular games period in the school timetable.
- Teachers\ Guardians were educated about the harmful effects of heavy backpack and they were asked to reduce the weight of backpack.
- Teachers\Guardians were also educated about the type of backpack to be used by children. (Backpack with double strap , chest and waist band requires less energy as compared to other types of backpack).

Future Scope of the Study

- Study can be done comparing energy expenditure between ground walking and staircase climbing or ramp walking.
- Study can be done on the children with special needs
- Effect of BMI on physiological parameters with load carriage can be studied.

Conclusion

Data analysis of this study concluded the following :-

- There was increase in H.R. and R.R. while walking without backpack and walking with backpack as compared to baseline.
- There was also increase in energy expenditure and perceived exertion while walking with backpack as compared to walking without backpack.
- There was no effect of gender on physiological parameters and energy expenditure with 20% load carriage.

Refrences

1. Moore MJ, White GL, Moore DL. Association of relative backpack weight with reported pain, pain sites, medical utilization, and lost school time in children and adolescents. J Sch Health 2007; 77(5):232-239.
2. Hong Y, Brueggemann GP. Changes in gait patterns in 10-year-old boys with increasing loads when walking on a treadmill. Gait Posture 2000; 11(3): 254-259.
3. Lai JP, Jones AY. The effect of shoulder-girdle loading by a school bag on lung volumes in Chinese primary school children. Early Hum Dev 2001; 62(1):79-86.
4. Mackenzie WG, Sampath JS, Kruse RW, Sheir-Neiss GJ. Backpacks in children. Clin Orthop Relat Res 2003; (409):78-84.
5. Malhotra M, Sen Gupta J. Carrying of school bags by children. Ergonomics.1965; 8:55-60.
6. Quesada PM, Mengel koch LJ, Hale RC, Simon SR. Biomechanical and metabolic effects of varying backpack loading on simulated marching. Ergonomics 2000; 43(3):293-309.
7. Mackenzie WG, Sampath JS, Kruse RW, Sheir-Neiss GJ. Backpacks in children. Clin Orthop Relat Res 2003; (409):78-84.
8. Youlian Hong, Jing xian li, Aaron Shun, Robinson PD. Effects of load carriage on heart rate, blood pressure and energy expenditure in children. Ergonomics. 2010 Jun; 43(6):717-27.
9. Li JX, Hong Y, Robinson PD. The effect of load carriage on movement kinematics and respiratory parameters in children during walking. Eur J Appl Physiol 2003; 90(1-2):35-43.
10. Hong Y, Brueggemann GP-Changes in gait pattern in 10 year old boys with increasing loads when walking on trademill. Gait posture 200; 11(3):254-259.
11. Veicsteinas,Merati,Negrini-Effect of school backpack on cardio respiratory adjustments, energy cost of walking and low back pain in children. Medicine and science in sports and exercise. May 2001 May; 33(5).
12. Ahimastos AA, et al. J Clin Endocrinol Metab. Gender difference in large artery stiffness pre and post puberty. 2003.

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Effect of Balance Training on Balance Control and Gait in Hemiplegic Stroke Patients

Eva Snehlata Kujur*, Pankaj Bajpai, Damayanti Sethy***, Sudeshna Sikdar******

Abstract

Objectives: 1. To study the effect of balance training on balance control of Hemiplegics. 2. To study the effect of balance training on gait in Hemiplegics. *Materials and Method*: Thirty hemiplegics were selected and divided into two groups of 15 each. Control group received conventional training and Experimental group received conventional training along with phyaction balance training.Duration of treatment was 30 minutes, five days a week for four weeks. Pre and post training evaluation of Berg Balance Scale (BBS), Wisconsin Gait Scale (WCS), and Global Balance performance Anteroposterior (GBAP), Global Balance performance Mediolateral (GBML) was done for both the groups. Statistical analysis was done by t test. *Result:* Statistically significant improvement was seen in all the outcome measures in experimental group and no significant improvement was seen in case of control group which shows that balance exercise is effective in controlling balance in hemiplegics and has an improvement in gait. *Conclusion:* Balance exercise is effective in controlling balance of Hemiplegics. So Phyaction balance training should be incorporated in the rehabilitation of Hemiplegics.

Keywords: Balance Training; Fedback; Gait; Hemiplegics.

Introduction

Hemiparesis is the most frequent neurological deficit after stroke. Hemiparetic stroke patients frequently present balance abnormalities. Balance impairments increase fall risk, resulting in high economic costs and social problems [1]. Balance is defined as a complex process involving the reception and integration of sensory inputs, planning and execution of movements, to achieve a goal requiring upright posture [2]. Hemiplegics have decreased trunk control, poor bilateral integration and impaired automatic postural control resulting in balance dysfunction [3].

Three sensory modalities are mainly involved in postural control: somatosensory, visual, and vestibular afferents. Integration of information from these systems is crucial for adequate postural control. Sensory information is regulated dynamically and modified by changes in environmental conditions [4]. When one is standing on an unstable surface, for instance, the central nervous System (CNS) increases sensory weighting to vestibular and visual information and decreases the dependence on surface somatosensory inputs for postural orientation. The ability to analyze, compare, and select the pertinent sensory information to prevent falls can be impaired in hemiparetic stroke patients. In patients with stroke, balance impairments and decreased ankle proprioception are positively correlated [4-6]. Abnormal interactions between the three sensory systems involved in balance could be the source of abnormal postural reactions [7-8] .

In situations of sensory conflict, a patient with stroke can inappropriately depend on one particular system over another [7] . Laboratory measurements of sensory organization demonstrate that patients with chronic stroke perform worse in conditions of altered somatosensory information and visual deprivation or inaccurate visual input. Excessive reliance on visual input may be a learned compensatory response that occurs over time [4]. Relying on a single system can lead to inappropriate adaptations and, hence, balance disturbances .

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Furthermore, sensory integration and reweighting can be impaired in patients with stroke, emphasizing visual input even when it provides inaccurate information[4,9-11]. The CNS has an internal representation of stability limits and uses it to determine how to move and maintain balance . In hemiparetic patients, weakness and impaired muscle control of the affected lower limb, decreased range of motion, and pain can lead to changes in the base of support (BS) [12] .

Luciana Barcala et al (2013), conducted a study on Visual Biofeedback Balance Training Using Wii Fit after Stroke.The aim of the study was to investigate the effect of balance training with visual biofeedback on balance, body symmetry, and function among individuals with hemiplegia following a stroke. The therapy program led to an improvement in body symmetry, balance, and function among stroke victims [13].

Soo Jeong Han et al (2013), studied the effect of rhythmic auditory stimulation(RAS) on gait and balance in hemiplegic stroke patients,The results of this study showed that RAS was an effective therapeutic method to improve gait velocity, stride length, cadence, and standing balance in hemiplegic stroke patients [14].

Damayanti Sethy, et al (2009) , in their study on the Effect of balance exercise on balance control in unilateral lower limb amputees,where the experimental group received conventional training along with phyaction balance exercises.They concluded that early phase exercises is effective in controlling balance of unilateral lower limb amputees [15].

Chun Chen et al, **(**2002) conducted a study on Effects of Balance Training on Hemiplegic Stroke Patients, total of 41 ambulatory hemiplegic stroke patients were recruited. Visual feedback balance training with the SMART Balance Master was used in the trained group. After 6 months of training Dynamic balance function of patients in the visual feedback training group had significant improvements when compared with the control group [16].

David Levine et al (1996), performed the Test-retest reliability of the Chattecx Balance System in the patient with Hemiplegia The results using the testing protocol showed COBX(center of pressure of mediolateral direction) to be highly reliable for the static and moderately reliable for linear and angular testing protocols [17].

Traditional balance training is based on the automatic repetition of specific movements. These methods can become repetitive and aimless, and thus reduce the motivation and adherence to treatment.

Given this background of the dynamics of balance, postural control and adaptation and the deficits in these areas among ambulatory hemiplegics, it was postulated that the balance training in ambulatory hemiplegics with Phyaction balance may be a useful exercise and may result in better out comes.

The aim of this study is to evaluate the effect of balance training on balance control and gait in ambulatory hemiplegics .

Aims and Objectives

1. To study the effect of balance training on balance control in ambulatory hemiplegics.
2. To study the effect of balance training on gait in ambulatory hemiplegics.

Materials and Method

The study was conducted in the Department of Occupational Therapy, at National Institute For Locomotor Disabilities on an outpatient basis, on a convenience sample.

Participants

A total of 30 subjects,equally divided to experimental and control group (28 males, 2 female; 20 left hemiplegia, 10 right hemiplegia) secondary to unilateral cerebro vascular accident were tested. Subjects were of age ranging from 40 to 60 years.Time since the onset of hemiparesis ranged from 12 months to 30 months. Subjects were medically stable and their secondary illnesses such as hypertension and diabetes mellitus were under control.

To qualify for this study hemiparetic subjects were required to meet the following criteria,

1. Understand instructions and be oriented to name, time and place.
2. No history of Orthopedic, Vestibular and other neurological conditions.
3. No perceptuo – cognitive deficits like hemispatial neglect, attention, and memory deficits.
4. No wernicke's or global aphasia.
5. Voluntary movements at the hip, knee and ankle present at >3 of Brunnstrom's stages in affected lower limb.
6. Functional and community ambulators with or

without ankle foot orthosis and cane. Before the investigation and assessment, the objectives and design of the study were explained to all subjects.

All subjects gave informed consent and took part in the experiment on a voluntary basis.

Materials

Phyaction balance exercise version 2.0, October 2005.

Laptop and connecting cables.

Apparatus

Phyaction balance exercise is an apparatus having a balance exercise soft ware installed in the personal computer/Laptop and a hard ware (Proprioceptive board/tablet) attached to it with a connecting cable. The apparatus is fitted with an internal electrical supply. The Board is of moving fulcrum type. The fulcrum changes with the changes in the board position. The board rolls on the balancing shapes that have a suitable diameter. Three pairs of interchangeable shapes are available. The board is attached with an encoder that detects its position. The encoder is operated through a lever that is in contact with the floor. The encoder is connected to an electronic card that reads the angle of the board top surface with respect to the floor on which the board rests and sends the reading to the PC through a USB port. The interface graphics of the tablet were designed by using the interactive graphic controls that are typical of the Windows operating systems.

- Dimensions: 420x430x65mm
- Weight 2.5Kg
- Maximum patient's weight: 100Kg
- Movement range:- -15,+15degrees

The equipment provides perturbation along with auditory and visual feedback.

Outcome Measures

Each participant underwent a clinical evaluation including the

1. Berg Balance Scale (BBS),
2. Global balance performance Anteroposterior (GBAP) and Mediolateral (GBML).
3. Wisconsin gait scale.

Experimental Procedure

After completing the evaluation procedure, Balance training was given to the experimtental group as seen in Figure 1 along with the conventional therapy and control group was given only conventional therapy.

Duration of Balance Training

30 minutes a day, five times a week for four weeks

Procedure

The hemiplegic patients who fit the inclusion criteria were allotted to two groups by convenient sampling method after getting informed consent. A general history was taken from the patient and individual patient demographics along with date of onset were saved in the data sheet . Baseline measurement of WCS, BBS, GBAP and GBML stability control were taken. Global performance is weighed average (a number from 0 to 100) of the 8 calculated parameters. The parameters are total area covered within the profile, Extra area outside the profile, Extra time taken and Recovery time. A score of 100 is the worst case and zero is the best. Experimental group received Phyaction balance training with conventional training and control group received conventional training only, which consisted of wobble board, single limb stance ,step up and step down activity walking on a straight line.

Phyaction Balance Training

On the first day of training level of balance training performance of the patients' was evaluated. Patients' stood erect on the moving Board with their hands alongside their bodies. Patients' were instructed to stand with both feet on the floor as motionless as possible to maintain balance while the board sways over a diameter of 40 centimeter both in ML and AP direction. For safety purpose one therapist stood nearby the patient. The movement of the board was set in the exercise program for individual patients. Feet position selected for the patient was bilateral, position of the patient was standing, and Board heading was straight for ML balance control training and transversal for AP balance training. Graphic presentation of the exercise was set complete which will show the board and the graphic presentations on the screen. Each patient got both visual and auditory feedback from the screen. The amplitude and frequency of movement was set to be 3 degrees and 3 cycles/min respectively. Patient was asked to stand on the Proprioceptive board and the program was set starting from level one exercise. If the patient

could do level-1 without any error then the next level of exercise was done. Initially most of the patients could do balance level two, so the exercise was set starting from balance level-3 and progressed to the next levels as the patient's ability to control balance progressed without covering extra area. With the improvement of the patient's ability the level of difficult was increased. All the patients in the Experimental group received 15 minutes of medio-lateral balance control exercise and 15 minutes of antero-posterior balance control exercise. Each 15 minutes were divided into 5 sets of exercise of 3 minutes each set. After each three minutes of exercise patients received 1 minute rest. Each patient received anteropostero balance control exercise after completing 15 minutes of medio-lateral exercise in the same manner. Exercise performance was noted on initial evaluation and after 4 weeks of training.

Results

Paired t- test was used to analyze the data within each group and Un-paired t test was used to analyze the data between the two groups. Result was considered significant at $p<0.05$. Data was analyzed by using SPSS software version 21.0

Table 1 (Demographic Data) shows the distribution of patients in Experimental Group (phyaction balance training) and Control Group (Conventional Occupational Therapy group). Graph 1 shows the mean age.

The table 2 and Graph 2 shows the GBAP it shows significant improvement in balance in the experimental group as compared to the control group in the between group analysis after 4 weeks. P value is significant(0.029).

Table 3, and Graph 3 shows the GBML it shows significant improvement in balance in the experimental group as compared to the control group in the between group analysis after 4 weeks. P value is significant (0.006)

In Table 4 and Graph 4, the BBS shows significant improvement in balance in the experimental group as compared to the control group in the between group analysis after 4 weeks. P value is significant(0.000)

The table 5 and Graph 5, depicts that the WCS shows significant improvement in balance and gait in the experimental group as compared to the control group in the between group analysis after 4 weeks. P value is significant (0.019).

Table 1: Baseline characteristics

Sl. No	Baseline Characteristics	Experimental Group	Control Group
1	Number of subject	15	15
2	Age (Range)	17-79 years	17-79years
3	Age (Mean ± SD)	43.2±15.6 years	43±12.99 years
4	Gender (Male/Female)	14/1	14/1

Table 2: Between Group Post of GBAP

GBAP	Mean (SD)	P value
Experimental Group	91.62±44.25	0.029
Control Group	133.68±69.32	

Table 3: Between group analysis GBML

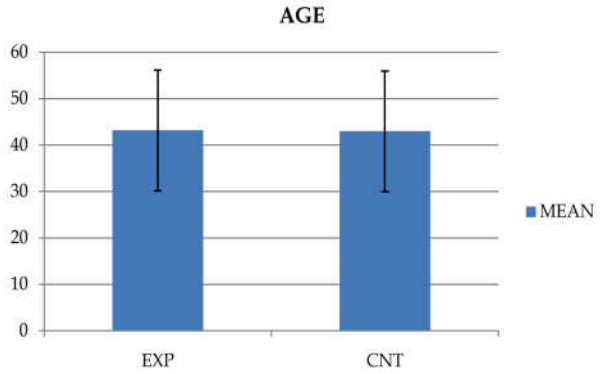
GBML	Mean(SD)	P value
Experimental Group	75.73±38.53	
Control Group	131.37±69.40	0.006

Table 4: Between group analysis of BBS

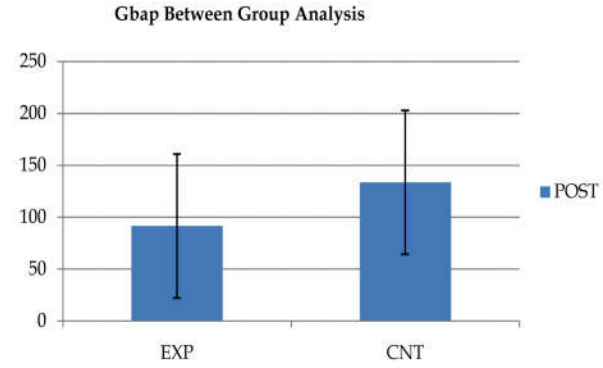
BBS	Mean (SD)	P value
Experimental Group	45.27±3.82	0.000
Control Group	37.93±3.24	

Table 5: Between Group Analysis WCS

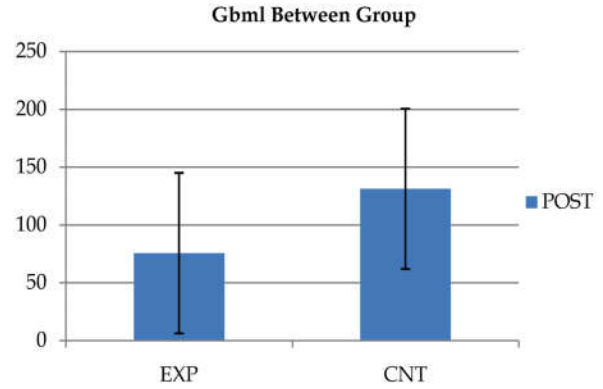
WCS	Mean(SD)	P value
Experimental Group	24.67±4.32	0.019
Control Group	24.67±7.24	



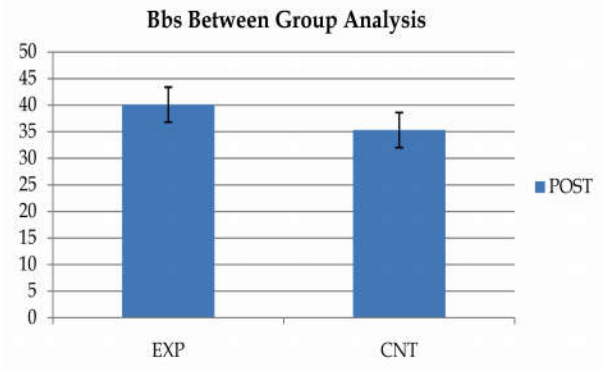
Graph 1: Mean Age



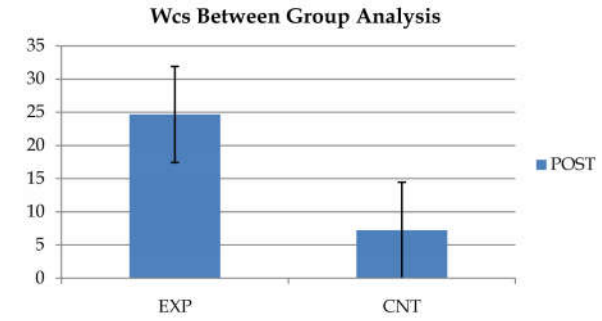
Graph 2: Between Group Post of GBAP



Graph 3: Between Group Analysis GBML



Graph IV: Between Group Analysis of BBS



Graph 5: Between Group Analysis WCS

Fig. 1:

Discussion

The result of the study showed that there is a significant improvement in, balance control (BBS), and the (GBAP), (GBML), and gait (WCS) in the experimental group and no significant improvement in these outcome measures in the control group**.** The subject showed significant results in balance control (BBS) (p= 0.000), and for GBAP (p= 0.029) and GBML (p=0.006) was significant in experimental group.

The phyaction balance board has auditory cues and visual feedback. The post Phyaction Balance training, balance control improved in hemiplegics which is similar to the findings of a study by Michael W. Kennedy et al, in their study Enhanced Feedback was given using the Nintendo Wii Balance Board[18]. Improvement in balance is also corroborated in a similar study by Damayanti et al,

in the study phyaction balance exercise was administered to unilateral lower limb amputees ,and concluded early phase balance exercise is effective in controlling balance [15].

Visual feedback based on objective data is one option to improve the efficacy of balance rehabilitation in stroke patients, and the use of visual center of pressure (COP) feedback as measured with a force plate has been a topic of balance retraining research since the mid-1980's [19]. A number of studies have demonstrated that providing visual feedback yields improvements in postural sway [19,20], symmetry [21-23], dynamic balance [24] , and functional abilities[25]. Change in the post training score on Berg Balance Scale is in agreement with the study by Garland, Williams in Recovery of standing balance and functional mobility after stroke where all subjects showed an improvement in functional balance(BBS) over the course of 1 month of rehabilitation resulting in an increased gait speed [26].

It is thought that training on phyaction balance board provided the patient with proprioceptive feedback at each challenge level. This is supported by the study "Relationship of Sensory Organization to Balance Function in Patients with Hemiplegia "by Richard Fabio, Mary Badke who found that balance behaviour can be influenced by somatosensory, visual and vestibular system [27].

The significant results in the experimental group for improvement in gait (WCS) ($P = 0.019$), is supported by Prassas et al, the study results suggest that acoustic rhythmic signals facilitate the audio-spinal mechanism in the CNS, exerting positive effects on motor activities including gait [28]. Also Horak et al, stated that medial-geniculate nucleus related to the vestibular system in ears mainly affects on standing balance. As auditory stimulation reaches to the organ of Corti, the signal is transmitted to medial geniculate nucleus. Then, the signal reaches to the auditory cortex in the temporal lobe. This activates the vestibular system to improve the standing balance.Following stroke, postural deficits are common . In the hemiparetic gait there is reduced weight-bearing on the paretic limb [29].

The results of the study are supported by another study by Portugal et al. The authors conducted a study on Rehabilitation of postural stability in ataxic/hemiplegic patients after stroke, disability rehabiliataion [30]. The results suggest that a training programme using force platform visual biofeedback improves objective measures of bilateral postural stability in patients with hemiplegia and/or ataxia after stroke. The results are also corroborated by another study done by Ledebt et al, Balance training was given with visual feedback in children with hemiplegic cerebral palsy to the effect on stance and gait [30].

Shumway-Cook et al showed that postural sway biofeedback was more effective than conventional therapy in retraining postural stability in hemiplegic patients.[31].Srivastava et al, in a prospective study, trained the balance on a force plate with visual feedback and verified an improvement in the rate of BBS and stabilometry, that lead to the functional independence observed through the scores of Barthel Index. In the current research also, significant results was obtained on BBS scores [32].

The repercussion related to the CNS recurring from the Stroke change the posture reactions endangering significantly the daily activities, what makes the training of the postural control a fundamental strategy for the rehabilitation of these patients [32-35].

Reesults of study is also supported by Hocherman et al,they concluded that the hemiplegic patients stability of stance on a moving platform could be improved by regular training [36].

However this study has limitations. Limitations of this study are the reduced number of patients and the use of the same instrument for assessment and training. This study has a heterogeneous sample due to various types of stroke, different impairments and different times since stroke, with most patients in a chronic phase. More studies with homogeneous groups of patients are needed.

In conclusion, the results suggest that a training programme using Phyaction Balance Board with visual biofeedback and auditiory cues improves objective measures balance and gait in hemiplegia after stroke, even in a chronic phase when significant motor recovery or neurological gains are not expected.

References

1. Jo se-Antonio Gil-Gomez,Roberto Liorens, Mariano Alcaniz,Carolina Colomer.Effectiveness of Wii balance board syatem (eBaViR) for balance rehabilitation :a pilot randomized clinical trial in patients with acquired brain injury.J Neuroeng Rehabil. 2011; 8:30.
2. Neurological Rehabiitation, Darcy A Umphred, 4th edition.
3. Occupational therapy for Physical Dysfunction, Catherine A Trombly, 5th edition, William and Wilkins.

4. Podsiadlo D,Richardson S.The timed "Up and Go". A test of basic functional mobility for frail elderly persons, J Am Geriatr Soc. 1991; 39(2):142-48.

5. Duncan PW,Weiner DK,Chandler J,Studenski S.Functional reach:A new clinical measure of balance.J Gerontol. 1990; 45(6):192-197.

6. Brauer S,Burns Y,Galley P.Lateral reach:A new clinical measure of medio-lateral postural stability. Physiother Res Int. 1999; 4(2):81-88.

7. Fugl Meyer AR,Jaasko L,Leyman I,Olsson S,Steglind S.The post stroke hemiplegic patient I A method for evaluation of physical performance,Scand J Rehabilitation Medicine. 1975; 7(1):13-31.

8. Stanford J, Moreland J,Swanson LR,Stratford PW, Gowland C.Reliability of Fugl-Meyer assessment for testing motor performance in patients following stroke, Phys Ther, 1993; 73(7):447-54.

9. Benaim C Perennou DA,Villy J,Rousseaux M,Pelissier J Y,validation of a standardized assessment of postural control in stroke patients: The Postural Assessment Scale for Stroke Patients (PASS). Stroke. 1999; 30(9):1862–68.

10. Jonsdottir J, Cattaneo D. Reliability and validity of the dynamic gait index in persons with chronic stroke. Arch Phys Med Rehabil. 2007; 88(11): 1410–15.

11. Chiu YP, Fritz SL, Light KE, Velozo CA. Use of item response analysis to investigate measurement properties and clinical validity of data for the dynamic gait index. Phys Ther. 2006; 86(6):778–87.

12. Clarissa Barros de Oliveira, Ítalo Roberto Torres de Medeiros,Norberto Anizio Ferreira Frota,Mário Edvin Greters, Adriana B. Conforto, , Balance control in hemiparetic stroke patients: Main tools for evaluation, Journal of Rehabilitation Research & Development, 2008; 45(8):1215–1226.

13. Luciana Barcala, Luanda André Collange Grecco, Fernanda Colella, Paulo Roberto Garcia Lucareli, Afonso Shiguemi Inoue Salgado, and Claudia Santos Oliveira· Visual Biofeedback Balance Training Using Wii Fit after Stroke: A Randomized Controlled Trial, J Phys Ther Sci. 2013 Aug; 25(8):1027–1032.

14. Soo Jeong Han,Ho Jeong Kim,Hyun Ju Chong, Effect of rhythmic auditory stimulation on gait and balance in hemiplegic stroke patients. Neurorehabilitation November 2013.

15. Damayanti Sethy, Eva Snehlata Kujur,Kaushik Sau, Effect of balance exercise on balance control in unilateral lower limb amputees,Indian Journal Of Occupational Therapy. 2009. 41(3).

16. Chun Chen, Pao-Tsai Cheng1, Chia-Ling Chen1, Shih-Ching Chen, Chia-Ying Chung1,Tu-Hsueh Yeh, Effects of Balance Training on Hemiplegic Stroke Patients,Chang Gung Med J 2002;25:583-90.

17. David Levine, Michael W. Whittle, Jeannette A. Beach, PamelaG. Test-retest reliability of the Chattecx Balance System in thepatient with Hemiplegia, Journal of Rehabilitation Research and Development 1996 February; 33(1): 36-44.

18. Michael W. Kennedy et al,Enhanced_ Feedback_ in_Balance_Rehabilition Jan 28, 2017.

19. Shumway-Cook A., Anson D., & Haller S. Postural sway biofeedback: Its effects on reestablishing stance stability in hemiplegic patients. Archives of Physical Medicine and Rehabilitation, 1988; 69:395–400.

20. Lee M.Y., Wong M.K., & Tang F.T. Using biofeedback for standing steadiness, weight-bearing training. IEEE Engineering inMedicine and Biology Magazine, 1996; 15:112–116.

21. Winstein C.J., Gardner E.R., McNeal D.R., Barto P.S., & Nicholson D.E. Standing balance training: Effect on balance and locomotion in hemiparetic adults. Archives of Physical Medicine and Rehabilitation, 1989; 70(10):755-762.

22. Sackley C.M., & Lincoln N. B. Single blind randomized controlled trial of visual feedback after stroke: Effects on stance symmetry and function. Disability and Rehabilitation. 1997; 19:536–546.

23. Wong A.M.K., Lee M.Y., Kuo J.K., & Tang F.T. The development and clinical evaluation of a standing biofeedback trainer. Journal of Rehabilitation Research and Development, 1997; 34:322–327.

24. Cheng P.T., Wang C.M., Chung C.Y., & Chen C.L. Effects ofvisual feedback rhythmic weight-shift training on hemiplegic stroke patients. Clinical Rehabilitation. 2004; 18:747-753.

25. Chen I.C., Cheng P.T., Chen C.L., Chen S.C., Chung C.Y., & Yeh, T.H. Effects of balance training on hemiplegic stroke patients. ChangGung Medical Journal,. 2002; 25(9):583-590.

26. Garland, Williams. Recovery of Standing Balance and Functional Mobility after Stroke. Amer J Phys Med 2003; 84:1753-1759.

27. Richard Di Fabio RP,Badke MBPhys Ther, Relationship of sensory organization to balance function in patients with hemiplegia. 1990 Sep; 70(9):542-8.

28. Jee Hyun Suha, Soo Jeong Hana,", Seo Young Jeona, Ho Jeong Kima, Jeong Eun Leeb, Tae Sik Yoona et al, Effect of rhythmic auditory stimulation on gait and balance in hemiplegic stroke patients, NeuroRehabilitation 2014; 34:193–199.

29. Horak, F.B. Clinical measurement of postural control inadults. Phys Ther, 1987; 67:1881-1885.

30. Portugal, Filipa Januario,Ines Campos,Carla Amaral, Rehabilitation of postural stability in ataxic/hemiplegic patients after stroke,disability rehabiliataion, 2010; 32(21):1775-9.

31. Shumway-Cook A., Anson D., & Haller S. Postural sway biofeedback: Its effects on reestablishing stance

stability in hemiplegic patients. Archives of Physical Medicine and Rehabilitation, 1988; 69:395–400.

32. Srivastava A, Taly AB, Gupta A, Kumar S, Murali T. Post-stroke balance training: role of force platform with visual feedback technique. J Neurol Sci. 2009; 287(1-2):89-93.
33. Geiger AR, Allen JB, O'Keefe J, Hicks RR. Balance and mobility following stroke: effects of physical therapy interventions with and without biofeed back/forceplate training. PhysTher. 2001; 81(4): 995-1005.
34. Chen IC, Cheng PT, Chen CL, Chen SC, Chung CY, Yeh TH. Effects of balance training on hemiplegic stroke patients. Chang Gung Med J. 2002; 25(9): 583 90.
35. Lisinski P, Huber J, Gajewska E, Szlapinski P. The body balance training effect on improvement of motor functions in paretic extremities in patients after stroke. A randomized, single blinded trial. ClinNeurolNeurosurg. 2012; 114(1):31-6.
36. Hocherman S, Dickstein R. Platform training and postural stability in hemiplegia.Arch Phys Med Rehabil 1984; 65:588-92.

Original Article

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Physiotherapy Management of Post Operative Case of Temporomandibular Joint Ankylosis: A Case Series

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Abstract

Temporomandibular joint (TMJ) ankylosis involves fusion of the mandibular condyle to the base of the skull. Surgical treatment is the only choice of treatment in this condition. One main drawback is that despite of extreme care during surgery, facial nerve get damage. The present study aims to determine the effect of electrical stimulation & facial exercises for improving the motor function of facial nerve & mouth opening exercises in patients with reduced mouth opening. The commonly used outcome measure was House Brackmann Score & Maximum mouth opening (MMO). Both the parameters showed improvement by the end of the intervention program.

Keywords: Temporomandibular Joint (TMJ) Ankylosis; House Brackmann Score & Maximum Mouth Opening (MMO).

Introduction

Temporomandibular joint (TMJ) ankylosis is usually seen during the first decade of life. The most common etiology of this condition is trauma; other causes may include infections from the middle-ear, inflammation, tuberculosis, etc [1]. During growth period, it can cause gross facial deformities especially, when not identified in time or if treatment is delayed. Surgical treatment is the only choice of treatment in this condition. The approach for the joint is varied; however, preauricular incision and its modifications are mostly preferred.

One main draw back in this approach is the Facial nerve and its branches, which courses along the entire length of the incision. Facial nerve is one of the most vulnerable anatomic structures that should be given utmost importance while performing the surgery for TMJ ankylosis. Despite extreme care taken during the procedure, the facial nerve may get affected [2]. Most frequently involved are the temporal and zygomatic branches leading to weakness of frontal and orbicularis oculi muscle. Therefore, identification, evaluation, and follow-up of this surgical complication are very important. Among the clinical methods employed for evaluation of frequency and degree of nerve injury, the House-Brackmann grading system appears to be quick, comprehensive, and widely used [3].

In this study we treated two postoperative case of TMJ ankylosis, both were suffering from facial palsy and reduced mouth opening.

The decreases in Temporo-mandibular joint mobility were mobilized by forced passive movements & manipulations to permit more mouth opening.

Facial exercises & electrical stimulation were used for the recovery of facial palsy.

Method

The case series were conducted on two young subjects, with the history of TMJ ankylosis. They both were treated surgically by gap arthroplasty. Both the patients were having complain of reduce mouth opening & loss of one side facial movements.

The study was conducted in the out patient department of subharti college of physiotherapy, Subharti University, Meerut.

Before the treatment sessions, mouth opening was assessed as the inter-incisal distance as measured

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from the mesio-incisal edge of the upper left central incisor tooth to the mesio-incisal edge of the lower left central incisor tooth. The measurement was made using a geometric divider and scale and was recorded in millimeters [4].

Temporomandibular joint mobilization was given by Antero-inferior glides to improve jaw depression; lateral glides for improving mandibular deviation with joint distraction were done. Patients were also taught home exercise programme to maintain the joint in distraction by placing ice-cream sticks between the jaws and increasing one by one to provide stretch and maintaining for 3-5 minutes for 2-3 times a day [5,6].

For evaluation of degree of facial nerve injury, the House-Brackmann Grading system were used.

Facial exercises and electrical stimulation were used to stimulate & recover the function of facial nerve. Patients were also asked to do facial exercises at home, infront of the mirror [7,8].

Treatment was given six days per week for three weeks.

Out Come Factors

1. Measurement of maximu mouth opening(M.M.O) in mm. before & three weeks after the treatment.
2. House brackmann score. before & three weeks after treatment.

Subject 1

1st subject was 18 years old female with the known case of tubercular meningitis. There was ankylosis of left TMJ with degenerative changes. There was also history of chronic infarct of left middle cerebral artery territory & her taste sensation was intact.

On assessing her twelve days after surgey her mouth opening was 18mm and her House–Brackmann score was Grade V(severe dysfunction).

After three weeks of the treatment her mouth opening increases to 24mm & House–Brackmann score becomes Grade II (mild dysfunction).

Subject 2

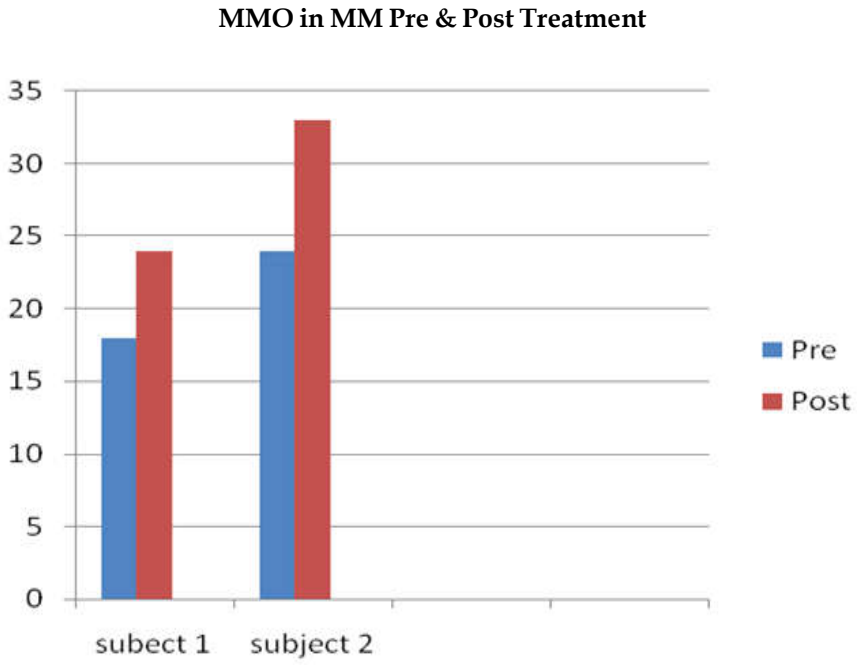
2nd subject was 22 years old male patient with the history of road traffic accident. There was ankylosis of right TMJ due to trauma.

On assessing him fifteen days after surgey his mouth opening was 24mm and his House–Brackmann score was Grade IV(moderately severe dysfunction).

After three weeks of the treatment his mouth opening increases to 33mm & House–Brackmann score becomes Grade II (mild dysfunction).

Results

Fig. 1:



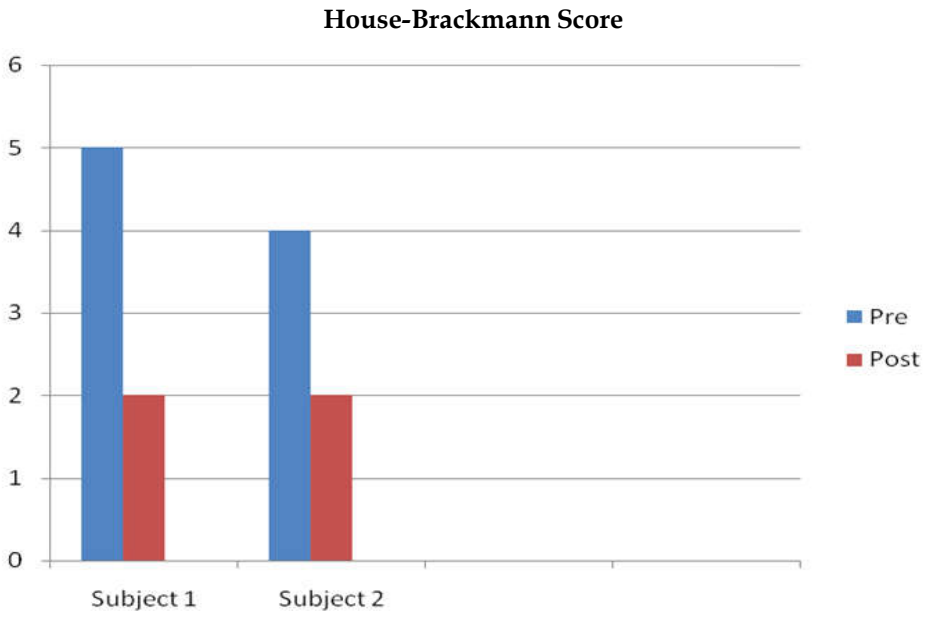


Fig. 2:

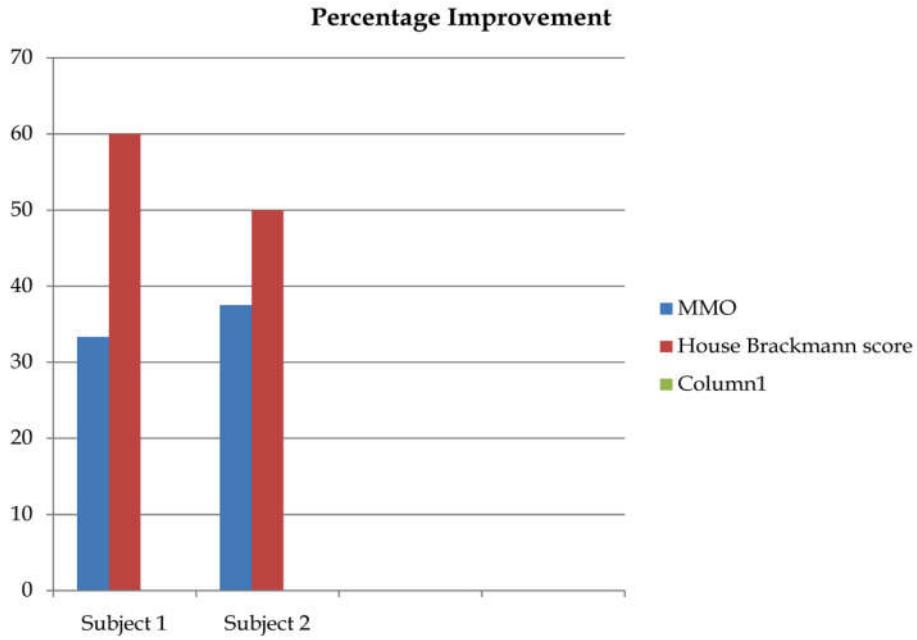


Fig. 3:

Discussion

The case report was conducted on two subjects one female (18 years) & one male (22 years) with the complain of reduce mouth opening and inability to do one side facial movements after gap arthroplasty for treating TMJ ankylosis.

The subjects in our study demonstrated the improvement in mouth opening after three weeks of mouth opening exercises. Our result is in accordance with Vijayakumar M, Priya D who studied role of Physiotherapy for improving mouth opening & tongue protrution in patients with Oral Submucous Fibrosis [5].

There was also improvement in House–Brackmann scores in subjects after giving electrical stimulation and facial exercises. This was also supported by Tucany *et al*. who noted that the addition of Electrical Stimulation to physical therapy and corticosteroids significantly improved House–Brackmann scores in subjects with acute Bell's palsy [9]. And LM Pereira et al who performed a systematic review & found Facial exercise therapy is effective for facial palsy for the outcome functionality [7].

According to Nogueira *et al*. study, out of the 9

patients in whom gap arthroplasty was carried out, 2 patients had Grade 4 injury of which 1 patient recovered to Grade 3 after 1 week, Grade 1 after 1 month. The second patient showed no recovery after 1 week; however, recovered to Grade 2 after 1 month and Grade 1 after 3 months. In contrast, in this study, out of 32 joints in which gap arthroplasty was performed, 2 patients had Grade 4 facial nerve injury after 24 h of surgery which recovered to Grade 3 injury after 1 week and remained so after 1 month. However, 3 months later it recovered to Grade 1 [10].

References

1. Roychoudhury A, Parkash H, Trikha A. Functional restoration by gap arthroplasty in temporomandibular joint ankylosis: A report of 50 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1999; 87:166-9.
2. Gokkulakrishnan S, Singh S, Sharma A, Singh AK, Borah R. Facial nerve injury following surgery for temporomandibular joint ankylosis: A prospective clinical study. Indian J Dent Res 2013; 24:521.
3. Satoh Y, Kanzaki J, Yoshihara S. A comparison and conversion table of 'the House-Brackmann facial nerve grading system' and 'the Yanagihara grading system'. Auris Nasus Larynx 2000; 27:207-12.
4. Abhinav kumar, Anjana Bagewadi, Vaishali Keluskar, Mohitpal Singh. Efficacy of Lycopene in the management of oral submucous fibrosis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006. 2007 Feb; 103(2).
5. Vijayakumar M, Priya D. Physiotherapy for improving mouth opening & tongue protrution in patients with Oral Submucous Fibrosis. International Journal of Pharmaceutical Science and Health Care 2013 April; 3(2).
6. Therapeutic Exercise 5th edition. Carolyn. Lynn Allen Colby. Page 434-435.
7. LM Pereira, K Obara, JM Dias,MO Menacho, EL Lavado and JR Cardoso. Facial exercise therapy for facial palsy: systematic review and meta-analysis. Clinical Rehabilitation 2011.p.1–10 .
8. Simon Goldie, Jack Sandeman, Richard Cole, Simon Dennis, and Ian Swain.Electrical stimulation treatment for facial palsy after revision pleomorphic adenoma surgery. J Surg Case Rep. 2016 Apr; 2016(4):rjw057.
9. Tuncay F, Borman P, Taser B, Unlu I, Samim E. Role of electrical stimulation added to conventional therapy in patients with idiopathic facial (Bell) palsy. Am J Phys Med Rehabil 2015; 94:222–8. [PubMed].
10. Nogueira RV, Vasconcelos BC. Facial nerve injury following surgery for the treatment of ankylosis of the temporomandibular joint. Med Oral Patol Oral Cir Bucal 2007; 12:E160-5.

Review Article

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Effects of Stroke Duration and Subtypes on Peak Expiratory Flow Rate

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Abstract

Background and Purpose: A large number of stroke patients present with dysphagia and aspiration especially in early phase of disease. On the other hand lung functions are also surely affected in stroke patients and constitute the largest factor behind mortality and longer hospital stay in such patients. We believe this might be the prime reason behind dysphagia, aspiration and pulmonary infections in stroke patients. This research with help of bedside assessment tool tries to assess the lung efficiency in acute stroke, chronic stroke and compares it with that of normal nonsmoking age and gender matched controls. *Methodology:* This study was carried out with 60 male subjects between age 50-80 at Himalayan hospital premise. 15 Acute stroke subjects (Group-A), 15 chronic stroke subjects (Group-B) and 30 healthy age and gender matched non-smokers (Group-C) were selected according to the selection criteria for the study. After thorough assessment and informed consent, PEFR readings were obtained at the specified timed during the day. After a visual demonstration and instructions, three consecutive readings of PEFR were recorded in each subject and duly noted according to the type and duration of stroke. *Results:* Comparison of PEFR value among acute stroke, chronic stroke and control group shows that there is a statistically significant difference between the PEFR values. Acute stroke shows PEFR values ≤ 50% of age and gender matched control. While chronic stroke demonstrates PEFR values only 60-70% of normal. *Conclusion:* There exists a statistically significant difference between the PEFR values of acute stroke, chronic stroke and control group. Acute stroke patients has less than half of capacity of exhaling out air as compared to normal age and gender matched subjects, perhaps this is the reason why acute stroke patients are most likely to present with dysphagia and aspiration. Although chronic stroke patients also demonstrate dysphagia and aspiration but at much lower rate. This is in line with their PEFR values which show an improving capacity of force of exhalation. The study points out for more elaborate research on the topic and need of cardiorespiratory rehabilitation in stroke patients as early as possible.

Keywords: Peak Expiratory Flow Rate; Ischemic Stroke; Lung Functions; Dysphagia; Aspiration.

Stroke as defined by WHO is rapidly developing clinical signs of focal (or global) disturbance of cerebral function with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than vascular origin [1].

In other words, Stroke or Cerebrovascular disease is a focal neurological disorder due to either ischemia or hemorrhage that manifests into focal symptoms of weakness, sensory disturbances, speech disturbances and visual disturbances etc.

Stroke is the leading cause of mortality in developing world which accounts for nearly 86% share of stroke population. Stroke occurrence has fallen by 40% in developed world since 1970 to 2008 whereas it has doubled in developing world during same time span, with fatality rate 25% higher for developing countries as compared to developed nations [1].

The 2011 Indian National Census has reported that average age of Indian population increased to 68.89 years as compared to 63 years (2001 Indian National Census) [1] and therefore on an average Indian population is surviving through the peak

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years of occurrence of stroke which is 55-65 years although with lesser mortality rate due to improved health care access [2,3]. The largest community survey in India thus far found the Crude prevalence rate of stroke around 220/100,000 of population.

Stroke has substantial mortality in Indian society perhaps due to the unique lifestyle habits like a large number of people smoke cigarettes and chew oral tobacco. Stroke kills nearly 7.7 lakh people is India and has nearly 10 Disability Adjusted Life Years (DALYs) as marker of disability.

Past cohort trials has identified reduced lung functions as an independent risk factor for stroke. Even after occurrence of stroke reduced lung functions remains one of the biggest complications resulting in mortality. A large trial has shown that 30% stroke subjects with pneumonia die before hospital discharge similarly another study has pointed out that chest aspiration increases 11fold risk of chest infections [2,3]. The voluntary cough is compromised after stroke [2,3], which is in turn associated with increases chances of aspiration pneumonia [2].

Studies has also demonstrated inadequate movement of diaphragm and chest on hemiparetic side, respiratory muscle insufficiency and impaired voluntary cough [2,3,4]. This has been strengthened by a study that used Transcranial Magnetic Stimulation (TMS) demonstrated increase latency and decrease amplitude of motor evoked potentials of respiratory muscles in acute stroke [2]. Perhaps this is also the reason that dysphagia is a common presentation in acute stroke.

Therefore some clinical trials have provided indirect evidences of increase chances of aspiration after occurrence of stroke. Similarly some studies proposed reduce Reflex Cough (RC) and Voluntary Cough (VC) as a measure of compromised lung efficiency after stroke [2].

All ischemic stroke patients has a localized infarct area in brain which is than surrounded by ischemic penumbra which represents neurons that are not necrosed but receiving less than critical blood supply to function normal [2]. This is the salvageable brain tissue which upon receiving blood and oxygen can be revived back [2]. We believe pulmonary rehabilitation would provide improvement in oxygenation capacity and thus might have role in early recovery in stroke as already been proven animal studies yet not conclusively established in humans [2,3,4].

Most studies to this date have used spirometery to evaluate effect of stroke on lung functions. However this is only possible in chronic stroke individuals. Because pulmonary rehab is rarely part of the treatment of acute stroke patients, it is not deemed feasible moving patients into spirometery Lab. Therefore there is a need of bedside clinical procedure that doesn't need transporting patient into respiratory lab, saves time and cost.

In this research we have used Peak Expiratory Flow rate (PEFR) monitor to assess the exhaling capacity of the patient which is essentially required during protective cough against aspiration and for speech production [8,15].

Nature of the Study

A comparison was tried to be drawn between the PEFR values of acute and chronic individual with stroke and that of healthy subjects of same age group. The outcome measure was the standard method of PEFR measurement in both groups by the use of PEFR meter [12].

Research Setting

The study was performed in the Neuromedicine ward and OPD of Department of Physiotherapy, HIHT university, Jolly Grant, Dehradun, UK.

Informed Consent from Patient

Approval from ethical consideration was taken from Ethical Committee and informed consent was taken for each subject to be included in the study.

Design of the Study

Observational Study-comparative design.

Population

Patient admitted to Neuromedicine ward or seeking consultations at Neuromedicine OPD and Physiotherapy OPD.

Sample Size and Sampling Method

Criteria based consecutive sampling of 60 individuals, 15 acute stroke patients, 15 chronic stroke patients, 30 normal individuals.

Selection Criteria

Inclusion Criteria

Acute Stroke (Group-01)

1. Age 50-80 years.
2. Stroke presented within 2 weeks of symptom onset.
3. Stroke as confirmed by physician on CT/MRI.
4. GCS Score above 12.
5. MMSE Score above 25.
6. Lacunar stroke/ recurrent stroke or bilateral stroke was not found to be limitation rather divided into disease category.

Chronic Stroke (Group-02)

7. Age 50-80 years.
8. Stroke presented at 6 months or after 6 months of symptom onset.
9. Stroke as confirmed by physician on CT/MRI.
10. GCS Score 12 or more.
11. MMSE Score 25 or more.
12. Lacunar stroke/ recurrent stroke or bilateral stroke was not found to be limitation rather divided into disease category.

Normal Subjects (Group-03)

13. Age 50-80 years.
14. No long standing neurological/ musculo skeletal/ cardiovascular or respiratory disease/ disorders/trauma that can limit the lung functions.

Age Subgroup in category of Group 01, 02 and 03 were as follows:

i. 50-59.
ii. 60-69
iii. 70-79

Category of Disease Subgroup

A. ACA Stroke.
B. MCAStroke.
C. PCA and Brainstem Stroke.
D. Lacunar Stroke.
E. Bilateral/Recurrent Stroke.

Exclusion Criteria

1. Previous long term chest conditions ex. Asthma, copd, atelectasis etc.
2. Previous congenital cardio-respiratory conditions ex. mitral valve stenosis, Co-arctation of aorta, Fellot's teratology etc.
3. Previous cardiac abnormality ex. Cardiac failure, Symptomatic arrhythmias etc.
4. Musculoskeletal abnormality hampering cardio-respiratory functions ex. Scoliosis, kyphosis, gibbus etc.

Variables of the Study

5. Dependent variable- PEFR (Peak expiratory Flow rate).
6. Independent variable- Type and duration of stroke.

Instrumentation

1. Peak Flow Meter.
2. Inch-tape.
3. Data Collection Sheet.
4. Pen-Pencil-Paper.
5. Stethoscope.
6. Knee Hammer.

Stroke patient performing on peak flow monitor.

Fig. 1:

Fig. 2:

Procedure

60 subjects were divided into 3 intended groups according to their respective category (Group 01 - Acute Stroke, Group 02 - Chronic Stroke, Group 03 - Control Group).

15 acute stroke subjects (mean age 62 ± 8.02 years), as diagnosed by neuro-physician were selected. Subjects were then finalized according to the inclusion and exclusion criteria of the study. They were informed about the study and testing procedure and informed consent was taken from every subject before their participation in the study.

The European Respiratory society guidelines were followed for PEFR Measurements [2]. Subjects were asked to perform the maneuver 3 times in similar way with 20 seconds gap between each attempt. The mean value of three attempts was recorded.

All the necessary adjustments were done for patients comfort during the procedure.

Similarly 15 chronic stroke subjects (mean age 61 ± 6.14 years), were taken for the study with information about study and procedure prior given to them while informed consent was obtained beforehand. The testing procedure was same for the chronic stroke subjects too.

30 normal subjects (mean age 64 ± 8.01) who fitted into the selection criteria were selected from the hospital premises to be the control group. Information about study and testing procedure was given to them and informed consent taken. The subjects were made to sit upright on a chair with back supported. Demonstration was given to them. The Testing procedure was same as that mentioned previously.

PEFR Recording in Facial Palsy

As stroke subjects frequently present with facial palsy of varying degree, it is reasonable to ask how PEFR recording was done with and doesn't air passes between the lips and mouth piece of instrument. Can patient generate a forceful exhalation and execute it as expected?

Authors in this study, having idea about the Neuroanatomy behind the facial palsy can say with confidence that most of the patients, especially those in chronic stage of recovery won't have this trouble if adequate precautions are taken prior the testing procedure.

The lower part of facial nucleus, muscles supplied by it and Genuglossus are the only muscles those do not have bilateral innervations from cerebral cortex. Henceforth most of the facial muscles are expected to have some capability to function normal, except under most severe circumstances.

Slight adjustments were done during the procedure and with the instrument. One of the therapists stood behind the patient and tried to keep his jaw in midline by holding mandible at its angle bilaterally, manual support was given to the side of mouth by pacing middle finger and ring finger below and over the lower and upper lips.

The mouth piece of the instrument was modified by applying 2-3 layers of dynoplast over it so that it becomes easier for patient to hold it in mouth. A flat mouth piece for instrument is further advisable for such subjects.

We had overall 8 patients with facial asymmetry, 5 (2 acute stroke patients, 3 chronic stroke patients) who could perform on Peak flow meter with satisfactory performance after adjustments. Although 3 other subjects had to be excluded with facial palsy that despite adjustment with procedure and instrument could not perform it satisfactorily [6,7].

Stroke and Aphasia

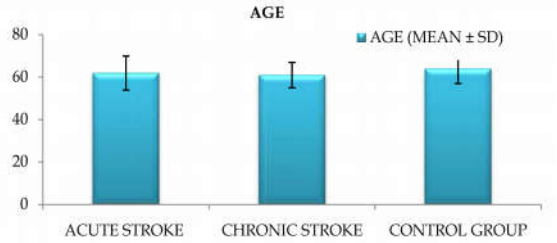
Patients even with Broca's aphasia where comprehension was supposedly intact and able to performed simpler motor commands of examiner, for some reasons these patients too could not perform when asked to exhale into PEFR monitor [11].

Data Analysis

The data was analyzed by SPSS - 22nd version as required. The significance level was set $p < 0.05\%$ and confidence interval was set at 95%. The dependent variable used for the study was duration of stroke (acute stroke and chronic stroke), type of stroke, and age categories of 50-59 years, 60-69 years, 70-79 years. The independent variable for the study was PEFR value.

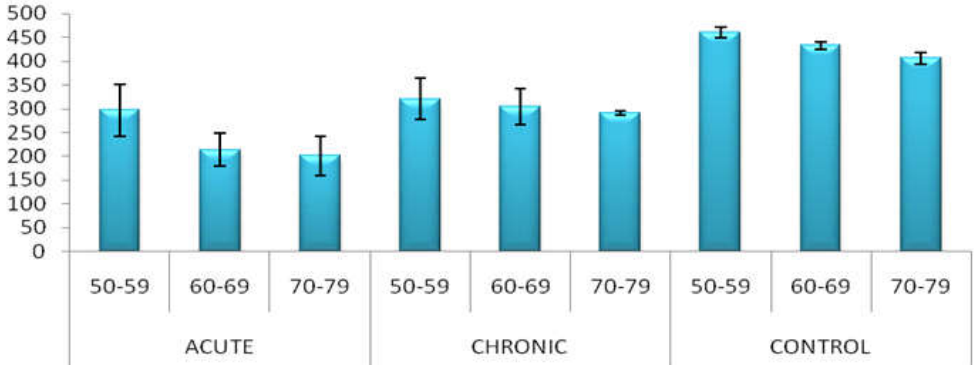
The inter group age analysis was done by one way ANNOVA. The intergroup analysis of mean PEFR, interaction and comparison between categories of disease and age was done by two way univeriate ANNOVA.

Results



Grah. 1: Mean age among acute stroke, chronic stroke.and control subjects

Mean PEFR Values in Different Age Groups of Acute Stroke, Chronic Stroke and Control Group



Graph 2: Comparisons between the mean PEFR values in different age sub-groups in acute stroke, chronic stroke and control subjects

Discussion and Conclusion

Lung efficiency is an important aspect to evaluate in stroke population. These are a group of physiological functions easily and almost certainly adversely affected in such individuals. Large sample cohort trials as noted in review of literature has already proved that many cardiovascular abnormalities and age related changes has effects on lung functions which is an independent risk factor for stroke.

Many of these studies use the absolute or quartile values of PEFR to predict the relative risk of stroke due to abnormal lung functions [2]. For example the Whitehall study over 18, 403 cohorts men found out that those with PEFR <3 liters independent of other risk factor were almost twice as likely to die from stroke as those with an PEFR >3.5 liters [3].

Our outcome variable in this study was Peak Expiratory Flow Rate (PEFR). A large number of physiological, lifestyle and pathological factors in addition to certain medications has impact on Peak Expiratory Flow rates.

Physiological Factors those affect PEFR such as age, height, built, BMI, body surface area, gender, race, ethnicity/ancestry, region, climate, pollution and physical exercise status are important to note. Among the Lifestyle factors Smoking status largely impacts upon the PEFR values. Sedentary lifestyle and stress may also impact PEFR values adversely. Among the Pathological factors, Respiratory anomalies viz, Asthma, COPD, CRPD, bronchiolitis, Pneumonia, chest congestion etc, Cardiac Anomalies viz. ASD, VSD, Teratology of Fallot and valvular defects etc, dorsal spine deformity viz. scoliosis, kyphosis etc, neuromuscular syndromes eg. Myasthenia gravis and a large number of debilitating conditions such as Stroke, MS, Parkinson's, Dementia disorders, Alzheimer's, bulbar and pseudo bulbar palsies might adversely affect the PEFR measurements [2]. Studies has pointed out that Polycythemia, increase hematocrait levels (51% or more) and increased alcohol intake can lead to reduced lung functions and stroke [3,4,5,6].

Dysphagia constitutes a significant problem in stroke and it's reasonable to think that reduced expiratory functions should have some influence on dysphagia. A study by Kidd examining a cohort of 60 patients evaluated on videofluroscopy found that 25 of these patients had aspirations within 72 hours of stroke onset however it remarkably improved at 3 month follow up in all but 3 subjects [2]. A similar study by Smithard et al where they followed 121 acute stroke subjects found 61 (51%) of their subjects had dysphagia which resolved in few days in 33 of patients and at the end of 6 month only 6 of such subjects were left with dysphagia [2].

The primary reason cited for dysphagia and aspiration associated with stroke is due to the disruption of CNS input to associated sensory, motor and protective reflexes [2]. Cough is a protective reflex and lower PEFR values can interfere with cough strength. This inefficient cough strength and dysphagia can ultimately risk an individual to aspire the food content, leading to aspiration related complications. The mortality in stroke patients with dysphagia is mainly due to increase chest infection, dehydration and death [7].

Interpretation of Results

Regarding the PEFR measurements in Indian

Population a few works could be noted here although a large scale cross-sectional study or cohort study in Indian population are missing on normal or diseased population.

A review article by Dikshit, Raje and Agarwal, published in Indian journal of physiology and pharmacology in 2005 discusses the Peak Expiratory flow rate guidelines, measurement tools, normal values, factors affecting PEFR and regression equation to calculate PEFR according to age and height in Indian population [3].

In the same study Dikshit and colleagues predicted the normal values for PEFR for age 50-60 which was 455±19.9. Our observed value for control group in same age category was also in the same limits (460±11.46). Although above 60 years of age Dixit and colleagues had given vague values of 377±71.8. Our observed values in 10 non-smoker healthy subjects in age group 60-70 was 433±8.43 and in 70-80 age group subjects it was 406±13.80 in same number of healthy non-smoker controls. From the Dikshit study adding the standard deviation to obtain upper limits of PEFR values in population above age 60 can be quantified and then it falls in similar numbers as observed by us.

Apart from all the factors described above, the PEFR readings can be significantly altered by diurnal variation, voluntary efforts, depressive status and muscular weakness. To eliminate the diurnal variation in our subjects we measured the PEFR between 11:00 AM to 01:00 PM (2 hours period).

All stroke patients undergo a significant amount of stress and depressive illness which has been established in past through various studies [3]. This factor could not be eliminated from our study yet patients were encouraged all throughout the study, closely monitor for any significant depressive illness and no patient was found to have any previous psychiatric illness before the initiation of study.

Ezeugwu, and Olaogun in their study has proposed muscular weakness of diaphragm, intercostal and abdominal muscles as reason behind the reduced lung functions in stroke survivors. We also propose the same mechanism responsible for reduced PEFR recording in our study.

The lung functions are markedly reduced in stroke and dysphagia/aspiration/chest infections are common problems in such patients. It is probable to think that a correlation exists among them as also pointed out by some researches. Our study not only tries to evaluate the amount of reduced lung functions in different duration and categories of stroke by a cost & time saving, simple bed-side procedure, but it also proposes a mean of quick bedside ventilatory assessment and possible identification of stroke subjects at risk of dysphagia/aspiration who performed low on Peak Flow Meter.

However what threshold of expiratory effort or cough reflex efforts should be taken as a safe limit below which dysphagia becomes increasingly likely to occur is a question this study couldn't look into. Assessing validity of Peak Flow Meter in identifying stroke subject at risk of dysphagia/aspiration is a topic of debate and best left to future research.

Clinical Relevance

This study highlights the need of more attention to the problem of reduced lung functions in stroke and need to address the possible reasons behind it. Patient's unconscious status, more characteristic and prominent other symptoms and physician's priority at dealing with more serious problems might make it difficult for even expert physicians to overlook the reduced respiratory efficiency of patient which may prove harmful for the patient in long run. Therefore it is the view of the authors in this study that an early respiratory assessment and prompt rehabilitation by help of multidisciplinary team would be the best suited practice in present stroke care units. As described in introduction, Animal model has already shown a beneficial effect of cardiovascular exercise on infarct size. It might even have favorable effects on salvageable penumbra which is only speculation at present yet a very strong concept to look at as stroke patients who have been put on early exercise do well on all parameters of mobility, efficiency and endurance as well as on cognitive profile [3,4].

Another reason for early cardio-respiratory rehabilitation is focus on dysphagia which is a disability in its own terms and prominent reason of aspiration and chest infections. This imposes significantly increased mortality, morbidity, substantial increase in economic burden in terms of healthcare expenditure and days lost to disability of the patient.

Future research that correlates and calibrates reduced lung functions and dysphagia might give us a more clinically relevant, quick bedside assessment tool i. e. Peak Flow Meter, to identify the potential aspirators or dysphagics, unlike present time's Videofluoroscopy Swallow Study (VSS) or Fibreoptic Endoscopic Evaluation of Swallow study (FEES), both of which are invasive, unpleasant to patients, relatively costly and time consuming procedures.

Limitations

Small Sample Size.

References

1. Goldstein M, Barnett HJM, Orgogozo JM, Sartorius N, et al. Recommendations on stroke prevention, diagnosis, and therapy. Report of the WHO Task Force on Stroke and other Cerebrovascular Disorders. Stroke 1989; 20:1407-31.
2. Feigin et al (October 2013). "Global and regional burden of stroke during 1990–2010: findings from the Global Burden of Disease Study 2010". *The Lancet*.
3. Demographics of India, http://en.wikipedia.org/wiki/Demographics_of_India
4. Dalal P.M, Burden of Stroke — Indian Perspective, JAPI, 2004; 52:695-696.
5. Dalal PM, Dalal KP, Vyas AC. Strokes in the young population in west-central India - some observations on changing trends in morbidity and mortality. Neuroepidemiology 1989; 8:160-4.
6. Heuschmann PU, Kolominsky-Rabas PL, Misselwitz B, et al. Predictors of in-hospital mortality and attributable risks of death after ischemic stroke. The German Stroke Registers Study Group. Arch Intern Med 2004; 164:1761–1768.
7. Martino R, Foley N, Bhogal S, et al. Dysphagia after stroke: incidence, diagnosis, and pulmonary complications. Stroke 2005; 36:2756–2763.
8. Addington WR, Stephens RE, Gilliland KA. Assessing the laryngeal cough reflex and the risk of developing pneumonia after stroke: an interhospital comparison. Stroke 1999; 30:1203–1207.
9. Smith Hammond CA, Goldstein LB, Zajac DJ, et al. Assessment of aspiration risk in stroke patients with quantification of voluntary cough. Neurology 2001; 56:502–506.
10. Masiero S, Pierobon R, Previato C, et al. Pneumonia in stroke patients with oropharyngeal dysphagia: a six-month follow-up study. Neurol Sci 2008; 29: 139–145.
11. Cohen E, Mier A, Heywood P, et al. Diaphragmatic movement in hemiplegic patients measured by ultrasonography. Thorax 1994; 49:890–895.
12. Lanini B, Bianchi R, Romagnoli I, et al. Chest wall kinematics in patients with hemiplegia. Am J Respir Crit Care Med 2003; 168:109–113
13. Teixeira-Salmela LF, Parreira VF, Britto RR, et al. Respiratory pressures and thoracoabdominal motion in community-dwelling chronic stroke survivors. Arch Phys Med Rehabil 2005; 86: 1974–1978.
14. Harraf F, Ward K, Man W, et al. Transcranial magnetic stimulationstudy of expiratory muscle weakness in acute ischemic stroke. Neurology 2008; 71:2000–2007.
15. Ward K. et al (2010), Acute ischemic hemispheric stroke is associated with impairment of reflex in addition to voluntary cough Eur Respir J 2010; 36: 1383–1390.

Review Article

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Alarming Rate of Maternal Obesity during Pregnancy: Refitting by Exercise

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Abstract

Obesity is a common implication during pregnancy and childbirth. The objective of this review is to provide a comprehensive overview of the effect of physical exercise on pregnancy outcomes, the change of physical activity during pregnancy, with a particular focus on women who are obese. Obese women and their infant are at increased risk of adverse perinatal outcomes, which may be improved by regular physical exercise. Obese women are usually less physically active and tend to further reduce activity levels during pregnancy. This review highlights the potential short- and long-term benefits of exercise in obese pregnant women and their child. Current guidelines recommended that all obese pregnant women without medical complications should engage in low to moderate-intensity exercise on a daily basis. Available literature revealed that there are very few studies supporting the evidence so there is need of more randomized controlled trials to strengthen its evidence.

Keywords: Obesity; Maternal Health; Physical Activity; Pregnancy.

Introduction

The World Health Organization (WHO) has identified obesity as one of the most neglected public health problem of global importance, contributing to the increased risk of cardio-vascular disease, diabetes and other complications [1]. Obesity is defined as abnormal or excessive fat accumulation that presents a risk to health [2].

A widely used tool to assess obesity is BMI (Body Mass Index), which is calculated by a person's weight divided by square of height. A person with BMI ≥30 is considered as obese [3].

Table 1: Classification of obesity by who

Classification	BMI (kg/m²)	Risk of Co-morbidities
Normal	18.5- 24.9	Limited
Overweight	≥25	Medium
Pre- Obese	25- 29.9	Increased
Obese Class I	30 – 34.9	Moderate
Obese Class II	35- 39.9	Severe
Obese Class III	≥40	Very Severe

Obesity incidence is three times higher in urban areas from rural area, probably due to less physical activity. Prevalence of obesity is more in women as compared to men. The percentage of obese women is highest in Punjab (37.5%), followed by Kerala (34%) [1].

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Table 2: Based on the data from National Family Health Survey, Ranking of Obese women with percentage among top 10 States of India as follows

State	Female (%)	Female Rank
Punjab	37.5	1
Kerala	34	2
Goa	27	3
Tamil Naidu	24.4	4
Andhra Pradesh	22.7	5
Sikkim	21	6
Gujarat	17.7	7
Haryana	17.6	8
Karnataka	17.3	9
Jammu & Kashmir	11.1	10

Obesity in women is commonly encountered during pregnancy with an increasing BMI, its measure is tremendously increased in developed countries and the similar trend is observed in developing countries nowadays [4]. Maternal obesity during pregnancy is associated with adverse outcomes on mother's health such as high risk of gestational diabetes, pre-eclampsia (hypertension disorder), cesarean delivery, perinatal mortality and excessive birth weight [5]. Moreover, obese women tend to experience central adiposity after delivery, which may further cause long term health risks [6].

Maternal obesity is also the source of long term health problems to the infant which include greater risk of mortality, congenital malformations such as neural tube defects [7]. Other complications to infant at the time of delivery are birth injuries, perinatal asphyxia, hypoglycemia and respiratory distress [8]. Catalano postulates that maternal obesity leads to fetal overgrowth which subsequently cause post natal obesity. Thus, obese children often tend to become obese adult and among them, the females when get pregnant will give excess nutrient supply to their fetus leading to transference of obesity to the next generation [9].

Table 3: Complications associated with maternal obesity during gestation period [10]

Maternal Risks	
Pregnancy	Gestational diabetes, hypertensive disorders, difficulty with ultrasound scanning
Labor & Birth	Preterm birth, cesarean delivery, induction of labor, anesthetic complication
Post Delivery	Infection, Prolonged hospital stay
Infant Risks	Perinatal death, congenital anomalies, birth trauma, hypoglycemia, jaundice

Impact of Exercise on Maternal and Infant Health

According to Caspersen et al, Exercise is defined as physical activity that is planned, structured & repetitive whose final objective is the improvement or maintenance of physical fitness [11]. Exercises play a vital role in reducing the complications during gestation period and also aid in improving both short & long term health benefits of mother and child. Exercise during pregnancy also reduces the probability of cesarean delivery and decreases the length of hospital stay post delivery [12]. Other exercise benefits may include maintenance & improvement of aerobic capacity, quick return to daily living activities and occupation as well as also helps in weight loss which was gained during pregnancy [13].

Thus, Maternity health care providers should create awareness and encourage obese pregnant women to exercise with proper expert advice during their subsequent hospital visits. It is the duty of health care providers to educate the pregnant women about the absolute & relative contra-indications of exercise which are summarized in Table 4 [12].

Table 4: Contraindications to Exercise during Pregnancy

Absolute	Relative
• Restrictive Lung disease	• Anemia
• Hemo dynamically significant heart disease	• Chronic bronchitis
• Persistant second or third trimester bleeding	• Poorly controlled type 1 diabetes
• Severe anemia	• Orthopedic limitations
• Premature labor during the current pregnancy	• Extreme underweight
• Ruptured membranes	• Heavy smoker
• Pregnancy induced hypertension	• Poorly controlled hypertension
	• Poorly controlled hyperthyroidism
	• History of extremely sedentary lifestyle

It is also important that women should receive adequate supervision about suitable types of exercise, with appropriate intensity, frequency and duration. Therefore, There are evidence based proposed steps from recent studies regarding the exercise prescription among obese pregnant women are tabulated in a Table 5 [14].

Barriers to Exercise among Pregnant Women in India

In Indian population, most of the women are unaware about the role of exercise in pregnancy, while fewer women who are aware could not meet the daily exercise recommendations. There are

Table 5: Exercise Prescription in Obese Pregnant women [14]

Frequency of Exercise	If women is previously sedentary, start at 3 sessions per week on nonconsecutive days and increase up to _4 sessions per week.
Type of Exercise	Recommend low-impact aerobic exercises. Avoid activities that involve a risk of loss of balance, falls, or abdominal trauma.
Intensity of Exercise	Avoid vigorous exercise. If already active, maintain moderate-intensity activities; if sedentary, start at low intensity and gradually increase to moderate intensity. Use validated heart rate ranges for obese pregnant women: Low intensity: 102-124 beats/min (20-29 years of age); 101-120 beats/min (30-39 years of age) Moderate intensity: 125-147 beats/min (20-29 years of age); 121-142 beats/min (30-39 years of age)
Duration of Exercise	If previously sedentary, Include low-intensity warm-up and cool-down Periods. Start with 15 minutes of moderate-intensity exercise and increase in 5-minute increments up to 30 minutes.
Timing of Exercise	If previously sedentary, the second trimester seems to be the best time to commence an exercise program, once morning sickness has subsided.
Contraindication to Exercise	Exclude the women which come under the category of contraindications.

several social and health factors which may hinder the implementation of exercise among pregnant women. These factors are discussed in following steps:

- There are several physiological changes during pregnancy that makes exercise difficult for pregnant women such as increased breathlessness, fear of fall due to change in centre of gravity with alterations of posture and balance [15, 16].
- Increased level of obesity during pregnancy may require more cardio-respiratory effort to meet the demands of exercise [17].
- Some social factors which cause hindrance are time constraints, lack of child care, overly protective family members, lack of outdoor spaces and cost of exercise facilities [18].
- Other common hurdle among obese pregnant women is the perception of their poor self image which hinder them to exercise in public or in groups and they prefer to postpone their weight control after child birth [19].
- Obese women in some areas reported that they receive limited advice about exercise from health care providers; this may suspect their outdated medical knowledge of appropriate exercise during pregnancy. So some modifiable updated knowledge needs to be addressed among medical professionals [20].

Discussion

The aim of this review was to highlight the complications of maternal obesity, benefits of exercise on maternal as well as fetal health and barriers to exercise among obese pregnant women. Available literature from very few studies and a systematic review reported that apart from reducing maternal weight gain, the importance of exercise on maternal and fetal outcome remain unproved. However, till now there are no negative effects have been found. Although there are several studies conducted on normal weight pregnant women, but their findings cannot be directly implicated to obese pregnant women.

Hopkins et al [21] reported that exercise during second half of gestation period may reduce birth weight of infant and provide protection against future obesity. Some recent studies revealed that exercises can also be beneficial in improving glucose tolerance rate as well as increase flexibility in obese pregnant women [22, 23]. Clapp [24] demonstrated that exercise during pregnancy results in reduction of infant birth weight and these changes may persist up to 5 years of age. Although this is the only published report so far on the long term infant outcomes.

Currie et al [25] concluded that health care providers should guide pregnant women to stay physically active and provide guidance about appropriate form of exercise while focusing on planning & personal goals. Moreover, understanding the attitudes and cultural acceptability of exercise among pregnant women from diverse backgrounds should also be improved.

Conclusion

The present review concluded that all obese

pregnant women without medical complications should participate in low to moderate intensity exercise during pregnancy. As a result of limited evidence, there is a need of high quality randomized controlled trials to show the limelight on the importance of exercise on short term and long term benefits for mother as well as child health.

References

1. Kalra S, Unnikrishnan A.G. Obesity in India: The weight of the nation. J Med Nutr Nutraceut. 2012; 1: 37-41.
2. Dodd J.M, Turnbull D, Mcphee A.J, Deussen A.R, Grivell R.M, Yelland L etal. Antenatal lifestyle advice for women who are overweight or obese: LIMIT randomized trial. 2014; 348(2): 1-12.
3. Zhixian Sui, Dodd J.M. Exercise in obese pregnant women: positive impacts and current perceptions. Int J Womens Health. 2013; 5: 389–398.
4. Seneviratne S.N, Parry G.K, McCowan L.M, Ekeroma A, Jiang Y, Gusso S, Peres G, Rodrigues R.O, Craigie S, Cutfield W.S, Hofman P.L Antenatal exercise in overweight and obese women and its effects on offspring and maternal health: design and rationale of the IMPROVE (Improving Maternal and Progeny Obesity Via Exercise) randomised controlled trial. BMC Pregnancy Childbirth. 2014; 26(14):148.
5. Kim S.Y, Dietz P.M, England L, Morrow B, Callaghan W.M. Trends in pre-pregnancy obesity in nine states, 1993-2003. Obesity 2007; 15:986-93.
6. Soltani H, Fraser R.B. A longitudinal study of maternal anthropometric changes in normal weight, overweight and obese women during pregnancy and postpartum. Br J Nutr 2000; 84: 95-101.
7. Stothard K.J, Tennant P.W.G, Bell R, Rankin J. Maternal overweight and obesity and the risk of congenital anomalies: a systematic review and meta-analysis. JAMA 2009; 301:636-50.
8. Vasudevan C, Renfrew M, McGuire W. Fetal and perinatal consequences of maternal obesity. Arch Dis Child Fetal Neonatal Ed2011; 96:F378-82.
9. Catalano P.M. Obesity and pregnancy: the propagation of a viscous cycle? J Clin Endocrinol Metab 2003; 88:3505-6.
10. Sui Z, Dodd J.M. Exercise in Obese Pregnant women: Positive impacts and Current perceptions. Int J Womens Health. 2013;5:389-98.
11. Caspersen C.J, Powell K.E, Christenson G.M. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. Public Health Rep. 1985; 100(2):126–31.
12. Physical activity and exercise during pregnancy and the postpartum period. Committee opinion No. 650. American College of Obstetricians and Gynecologists. Obstet Gynecol. 2015; 126:135-42.
13. Ferraro Z.M, Gaudet L, Adamo K.B. The potential impact of physical activity during pregnancy on maternal and neonatal outcomes. Obstet Gynecol Surv. 2012; 67(2):99-110.
14. Seneviratne S.N, McCowan L.M, Cutfield W.S, Derraik J.G, Hofman P.L. Exercise in pregnancies complicated by obesity: achieving benefits and overcoming barriers. Am J Obstet Gynecol. 2015 ; 212(4):442-9.
15. Huch R, Erkkola R. Pregnancy and exercise: exercise and pregnancy: a short review. BJOG 1990; 97: 208-14.
16. Melzer K, Schutz Y, Boulvain M, Kayser B. Physical activity and pregnancy: cardiovascular adaptations, recommendations and pregnancy outcomes. Sports Med 2010;40:493-507.
17. Lotgering F.K, Gilbert R.D, Longo L.D. Maternal and fetal responses to exercise during pregnancy. Physiol Rev 1985;65:1-36.
18. Dodd J.M, Crowther C.A, Robinson J.S. Dietary and lifestyle interventions to limit weight gain during pregnancy for obese or overweight women: a systematic review. Acta Obstet Gynecol Scand 2008; 87:702-6.
19. Sui Z, Turnbull D, Dodd J. Effect of body image on gestational weight gain in overweight and obese women. Women Birth 2013; 26:267-72.
20. Brown A, Avery A. Healthy weight management during pregnancy: what advice and information is being provided. J Hum Nutr Diet 2012;25:378-87.
21. Hopkins S.A, Cutfield W.S: Exercise in pregnancy: weighing up the long-term impact on the next generation. Exerc Sport Sci Rev 2011, 39(3):120–127.
22. Ong M.J, Guelfi K.J, Hunter T, Wallman K.E, Fournier P.A, Newnham J.P. Supervised homebased exercise may attenuate the decline of glucose tolerance in obese pregnant women. Diabetes Metab 2009;35:418-21.
23. Claesson I.M, Sydsjo G, Brynhildsen J, et al. Weight gain restriction for obese pregnant women: a case-control intervention study. BJOG 2008;115:44-50.
24. Clapp J.F.I. Morphometric and neurodevelop-mental outcome at age five years of the offspring of women who continued to exercise regularly throughout pregnancy. J Pediatr1996; 129:856-63.
25. Currie S, Sinclair M, Murphy M.H, Madden E, Dunwoody L, Liddle D. Reducing the decline in physical activity during pregnancy: a systematic review of behaviour change interventions. PLoS One 2013; 8:66385.

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Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); Strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence (is there a systematic review to refer to, if not, could one be reasonably done here and now?, What this study adds to the available evidence, effects on patient care and health policy, possible mechanisms)? Controversies raised by this study; and Future research directions (for this particular research collaboration, underlying mechanisms, clinical research). Do not repeat in detail data or other material given in the Introduction or the Results section.

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Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O, Kidd EAM,

editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

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