

A Comparative Study on effects of Core Stability Exercises and PNF on Balance, Flexibility and Endurance in Overweight Females

Kaur Jaspreet¹, Malik Manoj¹, Tripathi Priyanka²

¹Assistant Professor, Deptt. of Physiotherapy, GJU S& T, Hisar, ²Assistant Professor, Prem College of Physiotherapy, Panipat

ABSTRACT

Objective: The purpose of the study was to compare effects of PNF and core stability exercise on balance, flexibility and endurance in overweight females. Also to find whether core stability or PNF, which one of these improves flexibility, endurance and balance.

Method: 45 subjects who fulfilled the criteria were divided into three groups of 15 each. Group 1 core stability, group 2 PNF, Group 3 control group. All the three groups were first given warm up for 10 min. then group 1 was given core stability exercises, group 2 PNF techniques for four weeks, and control group was not given any regimen. Pre intervention and post intervention scores were recorded and analysed.

Data Analysis and Results: Related T Test was used to compare pre and post intervention values for statistical significance. One way ANOVA was used analyze data for statistical significance among the groups. Result showed a statistically significant difference among groups for scores of curl up test, Sorensen back extension test and star excursion balance test.

Conclusion: Core Stabilization and P.N.F. techniques of Rhythmic stabilization and combination of isotonics improve endurance and balance. Core stabilization is more effective than P.N.F. techniques of Rhythmic stabilization and combination of isotonics in improving endurance and balance.

Core Stabilization and P.N.F. techniques of Rhythmic stabilization and combination of isotonics have no effect on flexibility.

Keywords: Flexibility, Endurance, Balance, Core Stability, Rhythmic Stabilisation, Combination of isotonics

INTRODUCTION

Overweight goes largely unrecognized, the reason for poor awareness might include denial, reluctance to admit a weight problem or desensitization of excess weight because being overweight has become normal (A N Jeffery 2005)⁴. Heightened rate of

overweight is becoming a serious social issue worldwide. In 2005, the WORLD HEALTH ORGANISATION announced that approximately 1.6 billion adults are overweight by the age of 15 years. The WHO predicted that the number of overweight will be approximately 2.3 billion by the end of 2015 (like being unable to climb a flight of steps without resting (Kibler WB 2006)¹⁰.

Corresponding author:

Jaspreet Kaur

Assistant Professor

Deptt. of Physiotherapy

H. No.-103, Sector -13, Part II, Hisar, Haryana.

Email: - jaspreet_malik16@yahoo.co.in

Ph No.: - 09896221262

The balance level decreases as the BMI increases for subjects in their 20s and 30s and overweight older adults are at a higher risk of fall (Wi-Young 2010, Jerrold 2007)^{5,6}. According to WHO 2003 overweight leads to adverse metabolic effects on blood pressure, cholesterol triglycerides and insulin resistance (WHO

2003)². Excessive weight is associated with an increased incidences of cardiovascular diseases, type 2 diabetes mellitus, hypertension, stroke, dyslipidemia, osteoarthritis and some cancer (Aviva Must 1999)¹. Further overweight is associated with higher rates of knee OA and hand OA and increased weight also decreases the power (Stephen P 2004, Pardis 2012, Wi-Young 2010)^{3,7,5}.

The aim of present study is to compare effect of core stability exercises and PNF on balance, flexibility and endurance in overweight females.

Weight can increase at any age and generally increases with age (K. Park 2000)¹³. Preliminary research suggests that pediatric overweight is associated with eating disorder pathology, however, little is known about which overweight youth are most vulnerable to eating disorder pathology (Kamryn 2007)¹⁵. The pathogenesis of overweight most likely is a combination of genetic, environmental, and behavioral factors that still are being clarified. Predictors of overweight and increased adiposity include early childhood **obesity**, elevated parental BMI, and increased fasting blood insulin (and associated decreased insulin sensitivity) and blood leptin levels (Tomoko 2011)²⁰.

Core stability exercises

Kibler et al defined core stability as "the pre-programmed integration of local, single joint muscles and multi-joint muscles (Kibler WB 2006)¹⁰." According to Pardis et al, 12-week core stability training helps in reducing weight in overweight people (Pardis 2012)⁷. Endurance exercises (bracing and holding) have been shown to prevent back injuries (Ron Jones 2007)⁸. Zambare et al found that Core stabilization exercises showed significant improvement in endurance of trunk extensors. Nicole reported that core stability exercises improve dynamic balance in young healthy adults (Nicole Kahle 2012)¹¹.

Core stability training results in improved flexibility. However, its effects on body composition, health status, and posture are more limited and may be difficult to establish (Neil A. Segal 2004)⁹. Sekendiz et al found that core stability exercises with Swiss ball improves strength, endurance, flexibility, and balance in sedentary women (Sekendiz 2010)¹².

PNF

Proprioceptive Neuromuscular Facilitation is a strengthening technique used in therapeutic exercise

that is based on human anatomy and neurophysiology. It is used to increase strength, flexibility, and ROM etc. According to Brent et al contract relax (PNF) and static stretches significantly improve flexibility. Ninety-seven subjects were selected for participation in this study. Subjects were randomly assigned to either a control group (no stretching), or one of two treatment groups (contract-relax proprioceptive neuromuscular facilitation stretch, or a static stretch). Result showed that flexibility scores for participants in each of the control and treatment groups significantly increased from pretest to posttest (J. Brent Feland 2001)¹⁴.

Further Chao-Chung Lee reported that PNF can improve balance and mobility performance in individual with chronic stroke. Sixteen outpatients with hemiparesis secondary to stroke participated in this study and were randomly assigned to either the experimental or the control group. Subjects in the experimental group received 30 min PNF treatment twice a week for a total of 12 sessions, while subjects in the control group received conventional treatment for the same amount of duration and frequency as in the experimental group. A significant improvement ($p < .05$) was found in the experimental group (Chao-Chung Lee 2001)¹⁹.

METHODOLOGY

Procedure

45 subjects who fulfilled the criteria were randomly selected and divided into three groups-

- Group A was given core stability exercises
- Group B was given PNF
- Group C was control group

All the subjects were analysed for flexibility with sit and reach test (SRT), for endurance curl up test (CUT) and Sorenson's Back Extension test (SBET), for balance Star Excursion Balance test (SEBT) in three directions for both lower limbs right anterior (RTA), right posteriolateral (RTPL), right posteromedial (RTPM), left anterior (LTA), left posteriolateral (LTPL), left posteromedial (LTPM). Pre readings from all the three tests were recorded.

Training Programs

The participants' height (in centimeters) and body mass (in kilograms) were used to calculate body mass index (in kilograms per square meter). The 2

experimental groups (Core stability exercise group and PNF group) participated in 4-week programs that aimed to develop flexibility, endurance, and balance. The progression of the groups was monitored by measuring lumbar sagittal mobility weekly for both groups. The training frequency for both groups was 5 times per week. All three groups performed standardized warm-up exercises (treadmill walking for 7–10 minutes and stretching exercises) and cool-down exercises as part of each training session for experimental groups. Before the main test, there was a demonstration of the movement by a physical therapist, and then 3 to 5 familiarization efforts were performed. The training session included 3 sets of 5 repetitions at first week, 3 sets of 10 repetitions at second week, 3 sets of 10 repetitions at third and fourth week. The rest intervals between repetitions and sets were 30 seconds and 60 seconds, respectively. All training sessions were supervised by the same physical therapist and had a total duration of 30 to 45 minutes.

Selection of Outcome Measures

The types of tests selected in this study were based on 2 factors: first, the tests should provide an adequate index of muscle performance (strength, endurance, and flexibility), and second, all subjects can perform the tests reliably and without difficulties. In particular, outcome measures included static trunk extension and flexion endurance (in seconds), flexibility (in centimetre) and balance (inches).

Results and data analysis

Related T Test was used to compare pre and post intervention values for statistical significance. One way ANOVA was used analyze data for statistical significance among the groups .Pair wise comparison was done by using Least Significant Difference(LSD).SPSS 11.0 Version Software was used for Data Analysis.

TABLE 1 Comparison of pre and post intervention values

Variables		Group 1			Group2			Goup3		
		Pre	post	T	pre	post	T	pre	post	T
SRT		28.38	32.15	1.67 ^{NS}	25.87	29.67	1.30 ^{NS}	25.27	28.92	1.40 ^{NS}
CUT		22.93	72.57	5.36 ^{**}	25.65	48.01	2.85 ^{**}	25.61	21.53	1.06 ^{NS}
SBET		32.51	59.65	2.98 ^{**}	41.85	58.81	2.22 [*]	41.52	34.55	1.31 ^{NS}
SEBT										
Right	A	31.55	34.98	3.078 ^{**}	32.81	35.19	2.35 [*]	31.91	32.30	0.40 ^{NS}
	PL	32.94	38.94	3.86 ^{**}	34.82	43.08	1.46 ^{NS}	33.04	32.02	0.49 ^{NS}
	PM	34.83	39.27	2.56 ^{**}	35.87	40.04	1.93 ^{NS}	36.32	32.13	2.21 [*]
Left	A	31.86	35.27	2.90 ^{**}	33.21	35.83	2.19 [*]	31.45	32.57	0.86 ^{NS}
	PL	33.69	38.75	3.28 ^{**}	35.57	38.53	1.23 ^{NS}	33.39	32.77	0.26 ^{NS}
	PM	35.07	39.83	3.48 ^{**}	37.24	40.67	1.77 ^{NS}	36.14	34.01	0.93 ^{NS}

This table shows comparison of the mean values calculated by unrelated T test of pre and post reading taken for different tests in Group A, B and C.

NOTE:-

*- If probability is less than 0.05 then T is significant

**- If probability is less than 0.01 then T is highly significant

NS- If probability is other than above then T is non-significant

ANOVA for comparison of mean change in sit and reach test among three groups was statistically insignificant. Pair wise comparison using LSD showed no statistically significant difference between all the groups.

ANOVA for comparison of mean change (post int. - pre int.) in curl up test scores among three groups was statistically significant. Pair wise comparisons

using LSD showed statistical significant difference between group 1 and 2, group 2 and 3 and group 1 and group 3.

ANOVA for comparison of mean change (post int. - pre int.) in Sorenson’s back extension test scores among three groups was statistically significant. Pair wise comparisons using LSD showed statistically significant difference between group 1 and 3 and

between group 2 and 3. However there was no statistically significant difference between group 1 and 2.

ANOVA for comparison of mean change (post int. - pre int.) in star excursion test scores in all three directions for both limbs among three groups were statistically significant.

Pair Wise comparisons using LSD between group 1 and 3 showed a statistically significant difference in SEBT scores of RTA, RTPL, LTA, LTPL AND LTPM, however there was no significant difference in RTPM SEBT scores between group 1 and 2.

Pair Wise comparisons using LSD between group 1 and 2 showed a statistically significant difference in SEBT scores of RTPL, RTPM, LTPL and LTPM, however there was no significant difference in RTA and LTA SEBT scores between group 1 and 2.

Pair Wise comparison using LSD between group 2 and 3 showed a statistically significant difference in SEBT scores of RTA and LTA, however there was no significant difference between both groups in SEBT scores of RTPM, RTPL, LTPM, and LTPL.

DISCUSSION

Results of Present study indicates that Core stabilization and PNF Technique (Rhythmic Stabilization and Combination of Isotonics) increases endurance in overweight females. There was significant improvement in group 1 as compared to group 2 in scores of curl up test, therefore it may be inferred that core stabilization is more effective in improving endurance than PNF technique of Rhythmic Stabilization and Combination of Isotonics. D. Zambare et al reported that core stability exercises improve trunk muscle extensor endurance. According to him core stabilization exercise links to the most effective abdominal training and increases ones strength and stamina. Core strengthening exercise program aims to improve stabilization and support to the spine providing the muscles of arms and legs. The muscles mainly involved in maintaining the trunk extensor stability are multifidus and transverse abdominus. This therefore helps in improving the endurance of trunk extensors (Gauri 2011)¹⁶.

Core Stabilization exercises and P.N.F. techniques used in present study also resulted in increase in balance but there was no significant improvement in flexibility in this study, however a study done by

Sekendiz et al in 2010 reported that core stability exercises can be used to provide improvement in balance, flexibility and endurance in sedentary women (Sekendiz 2010)¹².

According to a study by Nick, Kofotolis 2012, a two 4-week PNF programs improves balance, flexibility and endurance in women with chronic low back pain. This finding could be attributed to the fact that PNF involves muscle work at significant intensity levels that result in muscle strength and endurance. Further PNF stimulates the proprioceptors located between the muscle and joints which increases the sense of balance (HajarJahadian 2012)¹⁷. Houssein et al suggested that PNF exercise training programs designed to increase flexibility, strength and endurance (Houssein 2005)¹⁸. Observation that P.N.F. did not result in improvement in flexibility in the present study may be attributed to the PNF technique used in present study. Hold Relax and Contract relax added to the protocol of the present study may result in gains in flexibility.

CONCLUSION

Core Stabilization and P.N.F. techniques of Rhythmic stabilization and combination of isotonics improve endurance and balance. Core stabilization is more effective than P.N.F. techniques of Rhythmic stabilization and combination of isotonics in improving endurance and balance.

Core Stabilization and P.N.F. techniques of Rhythmic stabilization and combination of isotonics have no effect on flexibility.

ACKNOWLEDGEMENT

We thanks all the Participants who voluntarily participated in the study.

Conflict of Interest: None identified and/or declared.

Funding: This project was not funded from any Public or Private Body.

Ethical clearance: the study was approved by the ethical committee of the department.

REFERENCES

1. Aviva Must, The disease burden associated with overweight and obesity. *American Medical Association* 1999; 282(16): 1523-1529.
2. Obesity and overweight. *World Health*

- Organization 2003
3. Stephen P, Exercise and dietary weight loss in overweight and obese. *Journal of Arthritis & Rheumatism* 2004; 50(5): 1501–1510
 4. A N Jeffery, Parents' awareness of overweight in themselves and their children: cross sectional study within a cohort (Early Bird 21). *BMJ* 2005; 330:23–24
 5. Wi-Young So, Differences in physical fitness and cardiovascular function depend on BMI in Korean men. *Journal of Sports Science and Medicine* 2010; 9:239-244
 6. Jerrold, Core muscle activity during exercise on a mini stability ball compared with abdominal crunches on the floor and on a swiss ball. *The Journal of Applied Research* 2007; 7(3):255-272
 7. Pardis, The effect of abdominal resistance training and energy restricted diet on lateral abdominal muscles thickness of overweight and obese women. *European Journal of Clinical Nutrition* 2012; 66: 97-99
 8. Ron Jones, Functional Training #3: "CORE" Strength & Endurance. *High-Performance Health* 2007; 3: 4-6
 9. Neil A. Segal, The effects of pilates training on flexibility and body composition: *Arch Phys Med Rehabil* 2004;85:1977-81
 10. Kibler WB, The role of core stability in athletic function. *Journal of Sports Science and Medicine* 2006;36(3):189-98.
 11. Nicole Kahle, The Effects of Core Stability Training on Balance Testing in Young, Healthy Adults. *Journal of Strength & Conditioning Research* 2011; 25 (10): 2012-2030
 12. Sekendiz, Effects of Swiss-Ball Core Strength Training on Strength, Endurance, Flexibility, and Balance in Sedentary Women. *Journal of Strength & Conditioning Research*: 2010 ;24(11): 3032-3040
 13. K. Park, Park's text book of preventive and social medicine, 16th edition, 2000, 296.
 14. J. Brent Feland, Acute changes in hamstring exhibility: PNF versus staticstretch in senior athletes. *Physical Therapy in Sport* 2001; 2: 186-193
 15. Kamryn, Eating disorder pathology among overweight treatment-seeking youth: Clinical correlates and cross-sectional risk modeling. *Behavior research and therapy* 2007; 45(10): 2360-2371
 16. Gauri, Effect of Core Stabilization Exercise in Improving Trunk Endurance. *International Journal of Health Sciences & Research* 2011;1(1): 2-10
 17. HajarJahadian, The Effect of Eight Weeks Aquatic Balance Trainingand Core Stabilization Training on Dynamic Balance in Inactive Elder Males. *Journal of Scientific Research* 2012; 11 (3): 279-286
 18. Houssein, The effect of 10-sec of maximal voluntary isometric contraction and 10-sec of passive stretching on strength, endurance and flexibility of hamstring muscle. *Annals of Biological Research*, 2012; 3 (3):1480-148461.
 19. Chao-Chung Lee, Effect of PNF on balance and mobility performance of individual with chronic stroke. *Australian Journal of Physiotherapy* 2001; 47:29-38
 20. Tomoko, Relationship between core stability, functional movement and performance. *Journal of Strength and Conditioning Research* 2011; 25(1): 252–261