



Effects of Therapeutic Weight Loss Exercises on Obese Individuals with Lumbar Hyperlordosis (LHL) and Excessive Anterior Pelvic Tilt (EAPT)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Obesity, especially with upper and lower limbs, is a key cause in increased sensitivity to musculoskeletal diseases (MDs). Pelvic tilt is the pelvic alignment with the femur and the rest of the body. The correct posture and alignment of the pelvis to the femur relies upon its orientation, and the natural curvature of the lumbar and cervical spine regions is Lordosis. Our study aimed to investigate impacts on obese persons with lumbar hyperlordosis and excess intertidal pelvic tilt in the weight reduction activities. In a fitness facility, 50 overweight and obese men suffering lumbar and excessive anterior pelvic tilt, between 25 and 40 years, underwent the intervention studies. The conducted exercises were carried out on the basis of the therapeutic weight reduction. The findings before and after intervention revealed the provided therapy was substantial ($p < 0.005$). The serious lumbar hyperlordosis and excessive anterior pelvic tilt are directly related to an increase in BMI, sedentary lifestyles and physical inactiveness play an important etiological part for obesity in lumbar hyperlordosis and excessive anterior pelvic tilt development and progression. Essentially, early diagnosis and physical therapist-led intervention can rectify the deformity with little operational morbidity.

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1. INTRODUCTION

The alignment of the pelvis in respect to the femur and the rest of the body was termed as Pelvic tilt (PT) and the pelvis can tilt forwards, backwards, or lateral side of the body [1]. Alviso DJ [2] described that PT vary in different posture and position, PT is defined as the formation [3]. The normal range seems to be between 8° – 13° in males and may be higher in females [4]. Increase in the rotation of the pelvis anteriorly (forwards) is known as Excessive Anterior Pelvic Tilt (EAPT) [5]. Lordosis is the normal anterior curvature of cervical and lumbar regions of the human spine [6]. The curvature of the anteriorly convexed lumbar lordosis provides a much more efficient walking in humans [7]. Excessive extension of the lumbar spine is termed as Lumbar Hyperlordosis (LHL) [8], and is commonly called saddle back or hollow back [9]. EAPT is caused by the tightening hip flexors and lengthening of hip extensors [10], which leads to an increase in the lumbar lordosis [11]. Individuals who have a sedentary lifestyle lacking exercise [12] and those who often sit for a prolonged period have a very weak abdominal muscles, playing a major role in developing EAPT [13]. Corbel P et al reported that the increased storage of adipose tissue over the abdominal region in obesity, contributes to the increased lumbar lordosis [14], excessive APT and alters the normal center of gravity (COG), anteriorly [15]. Rectus femoris, Iliopsoas, Erector spinae, Multifoods and Quadratus labarum are the muscles which act like a couple of forces to maintain the pelvic alignment, tightness or weakness to this muscle may lead to the EAPT. Youdas JW analyzed the relationship between pelvic inclination angle and lumbar lordosis in standing position among 23 females and 8 males aged between 20 to 33 years and reported the association between the pelvic tilt and lumbar lordosis. Regarding the above literature, it has been stated that obesity and weakness of rectus abdominis are the predisposing factors in developing the LHL and EAPT. Cross sectional studies have shown that obesity is the major predisposing factor for lumbar lordosis and excessive anterior pelvic tilt. Exercise intervention studies has conducted to reduce the pain among different age groups and genders for pain relief. But none of the studies have shown conservative methods to repair LHL and EAPT

deformities in obese people. Thus, the benefits of therapeutic workouts on LHL and EAPT are reported as having a weakness, and this study aims at examining lumbar hyperlordosis and an excessive anterior pelvic inclination.

2. METHODOLOGY

The interventional investigation was performed in a gym in Chennai. There have been selected and included 50 overweight and obese guys aged 25-40 years. Participants with open injuries were eliminated from any significant current dermatological or inflammatory illness, recent fractures, congenital lower extremity abnormalities, breathing difficulties, cardiovascular, pulmonary, hepatic, renal, and hematological disorders. The study was outlined and its purpose, its risks and advantages were explained.

2.1 Materials

Standard measurement scale for height and weight by the skin folds was used to measure the adipose tissue in the subcutaneous. Caliper for pelvic inclination measurement, the Heart Rate (HR) pulse oximeter and sphygmomanometer have been used to control Blood Pressure (BP). The equipments (treadmill, stop cycle, stubble, barbels, resistance belt) were utilized. Fitness equipment was used.

3. METHODS

The people were evaluated in accordance with the recommendations of the American College of Sports Medicine (ACSM). The individual's height and weight were measured using a standard measurement. Wt/Ht (mt)² was computed for BMI. In the upright posture, subjects were identified using specific sites such as ASIS and PSIS, and the angle between ASIS and PSIS was measured using a standard caliper. The workouts were given and completed after fitness assessment and measurement of the pelvic angle. The people performed weight reduction activities for 6 months, correctly. Table 1 listed the exercises based on performance and improvement; the intensity of workouts was raised. Before and after the procedure, the parameters were recorded.

Table 1. Exercise schedule given for weight loss

Warm up exercises: Step kicks, free squats and joint mobilization 5-10 mins					
Stretching: Iliopsoas, Rectus Femoris, Erector Spinae and other major muscles					
Cardiovascular training: 30-40 mins/session, 3 – 4 session/week, 70%-80% of THR, 4 - 5.9METs,					
Core and abdominal exercises: Pelvic bridging, Plank.					
Strength training					
Exercises	Sets	Reps	Tempo	Rest	
Day 1 Chest and triceps	2-3	15,12,10	2:1:4	30-45(sec)	
Day 2 Thighs and legs	2-3	15,12,10	2:1:4	30-45(sec)	
Day 3 Upper and lower back	2-3	15,12,10	2:1:4	30-45(sec)	
Day 4 Latissimus dorsi and Biceps	2-3	15,12,10	2:1:4	30-45(sec)	
Day 5 Shoulders and neck	2-3	15,12,10	2:1:4	30-45(sec)	

4. RESULTS

SPSS software version 20 for windows 7 was used to observe the statistical analysis. The effectiveness of exercise intervention was observed using Paired *t* test. Significant Level for all the tests was fixed to $p < 0.005$. Descriptive statistics was used to calculate the mean and standard deviations (SD). The mean of participant's height was 173.61(3.81) cm, weight 90.61(23.7) Kg and BMI was 33.42(7.46) Kg/m².

The workouts in weight loss for obese people led to considerable weight loss and BMI decreases 4.26 (3.2) Kg/m² correspondingly). Also, as indicated in Table 2, the EAPT angle reported a significant decline of 3.11(1.8) degrees and a 95% CI.

5. DISCUSSION

The effects of obesity on LHL and EAPT, as seen in Fig. 1 & Fig. 2, are limited in this study, but only we concentrated upon the effects of weight reduction workouts on LHL and EAPT. The outcome of the investigation showed that the buildup of greater belly fat caused an increase in lumbar lordosis and EAPT are the major abnormal postures identified among obese individuals. Hence, the present study focused on weight reduction exercises, strengthening the Gluteal muscles and stretching the Iliopsoas, to reduce the LHL and EAPT among the participants.



Fig. 1. LHL and EAPT Before exercise intervention

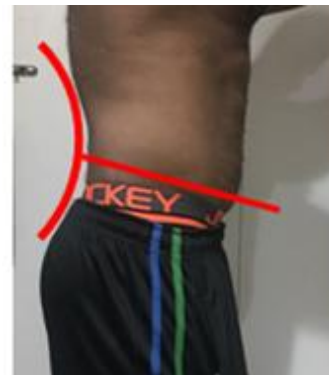


Fig. 2. LHL and EAPT After exercise intervention

Table 2. Pre and post intervention parameters with Statistical analysis

S. No	Parameters	Mean (SD)		t	p-value
		(Pre)	(Post)		
1	Weight (Kg)	90.61(23.7)	78.33(16.4)	12.76	<0.001
2	BMI (Kg/m ²)	33.42(7.46)	29.16(5.59)	13.37	<0.001
3	Anterior pelvic tilt (APT) (degrees)	19.73(3.3)	16.62(2.4)	11.77	<0.001

Sato T et al. performed posterior fixation, a surgical technique for a 20 years old patient with lumbar hyperlordosis deformity and analyzed that there was no prognosis in treating the deformity or the lumbago, the author also revealed that when the lumbar hyperlordosis is high or severe, the prognosis will be difficult. Comparing the study of Sato T et al with the present study, we have implemented a weight loss and strengthening exercises instead of surgical procedure for 50 participants. Ko K et al Studied the effects of lumbar stabilization using sling exercises for a duration of 12 weeks among 29 women with chronic low back pain and concluded that both sling exercises and lumbar stabilization exercise are the best approaches to relieve the chronic back pain. When comparing the present study with Ko K et al study, weight loss exercises and strengthening exercises were administered for the weakened muscles and stretches were applied for the tightened structures and the result showed a significant reduction of EAPT from $14.73(3.3)^{\circ}$ to $12.62(2.4)^{\circ}$.

EAPT is thought to be the result of muscular imbalance among obese individuals. The major function of the gluteal and abdominal muscles is to rotate the pelvis backward. Poor control and weakness of gluteal and abdominal muscles causes the pelvis to drop anteriorly. Tightness and poor flexibility in the hip flexor muscles among obese individuals contributes to the pelvis being held in an anteriorly tilted position. Sedentary lifestyle is the major predisposing factor for the development of obesity and EAPT, as most of the obese individuals spend a lot of time in flexed position (sitting posture); prolonged sitting posture causes the hip flexors to remain in a shortened position and the gluteal muscles are less active in sitting position than while standing or walking. Levine D and Whittle MW described that the anterior tilt of the pelvis is produced by couple-force of the muscles such as Erector Spinae, Rectus Femoris and Iliopsoas. Jang J et al stated that lumbar lordosis and anterior pelvic tilt play an important role in sagittal alignment and balance. The muscles supporting the pelvis are weakened, which includes Rectus Abdominis, External Abdominal Oblique, Gluteals and Hamstrings. Iliopsoas, Rectus Femoris, Tensor Fascia Latae and Erector Spine were the tightened muscles identified.

6. CONCLUSION

In this study, the results of workouts to reduce the severity of excessive anterior pelvic tilt and

lumbar hyperlordosis are found. Finally, significant aetiology of obesity, the formation and evolution of lumbar hyperlordosis and excessive anterior pelvic inclination are caused by sedentary lifestyle and physical inactivity. Regular diet-saving workouts diminish LHL and EAPT among fat persons and can avoid persistent low back pain and also may lower the need for surgical operations. Therefore, the main applied strategies were to extend tight hip flexors and strengthen weak hip extensors used to correct the EAPT. Early identification and procedure guided by the physical therapist that can essentially rectify deformity with little surgical morbidity. The decrease ($12.28(9.6)$ kg) in body weight and enhanced body muscles lowered the EAPT from 14.73° (3.3°) to 12.62° (2.4°). Tightness and poor flexibility in the hip flexor muscles among obese individuals contribute to the pelvis being held in an anteriorly tilted position.

CONSENT AND ETHICAL APPROVAL

The study received written consent from the participants and was endorsed by the Committee of Institutional Ethics (IEC).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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