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Original Research Paper

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EFFECT OF QUADRICEPS MUSCLE STRENGTHENING IN INDIVIDUAL WITH OSTEOARTHRITIS OF KNEE JOINT IN VARIOUS GRADES OF OBESITY

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ABSTRACT

Background: In OA knee joint lower extremity muscle weakness is important factor in knee pathology .strengthen exercise improve clinical finding in knee OA patient, such as pain and quality of life.
Although obese people have great absolute legs strength than there non obese counterpart, the opposite actually it's true when normalizing body mass. Muscle strength in obese people is off special patho mechanical interest because obesity independent affects the knee mechanically.
Objectives: Objectives of the study were to find out effect of quadriceps strengthing in Grade II OA of knee joint in GRADE I, II and III obese individuals
Material and methods: Pre and post test assessment was done with 1RM and MMT
Results: Statistical analysis of Quadriceps strengthening was found extremely significant in grade I obese individual with knee joint OA
Conclusion: The study concluded that there is marked increase in strength in grade 1 obesity as compared to grade II, and Grade III obesity.

KEYWORDS : Graded obesity, OA knee joint, quadriceps strengthening

INTRODUCTION :

The prevalence of childhood overweight and obesity has more than doubled in the past 25 year Gender discrepancy may be explained by the fact that female have a higher percentage of body weight that female fat content lower proportion mass that may increase the rate of quadriceps Obesity alter the process in case of tibia vara.

Most of these problems have considerable impacts on quality of life and some may reduce life expectancy.

Osteoarthritis (OA) is a chronic degenerative disorder of multiple causes associated with the loss of articular cartilage, hypertrophy of bone at the ends, subchondral sclerosis, and biochemical and morphological alterations in synovial membrane and joint capsule.[1]

Prevalence of osteoarthritis knee:

Marked joint space reduction, osteophyte formation & deformity.[12]

Change in the gait pattern due to fatigue will lead to altered knee kinematics at heel strike and consequently decreased shock absorption. Obesity is associated with musculoskeletal pain and osteoarthritis .the principal risk factors of osteoarthritis of the knee are: age, obesity and gender.

On the hand ,change in body configuration that may affects the physical activity may a role in the orthopedic disorder such as genu valgum and genu varum and caloric consumption and led to the development of obesity. Genu valgum is commonly referred to as "knock knees angle in and touch when the legs are straightened.

If the condition persist or worsens into late childhood and adulthood, corrective osteomy may be recommended to straighten the legs.

In addition to cosmetic concern, adult with uncorrected genu velgum are typically prone to injury and chronic knee problem such as chondromalacia and osteoarthritis.

Whereas obesity increase overall loading of the knee limb misalignment concentrates that loading on focal area, to the level at which cartilage damage may occur.

Consequently, while it is widely speculated that obesity cause increased loads on the knee leading to joint degeneration.

The quadriceps pulls the patella upward laterally and generates high power through a mechanical advantage from the patella.

The vastus medialis and lateralis provide both functional mobility and stability of knee joint and maintain balance between the two muscles, so the degree of activation and temporal coordination of these two muscles are key to providing safe movement of the knee joint Imbalance between the vastus medialis and lateralis of the quadriceps leads pain, as patella glide abnormally.

Genu velgum and genu varum are common knee mal-alignment problem that affect the cross-sectional area, onset, time and activation of the vastus medialis and lateralis.

Obesity is the risk factor for both the development (1-14) and progression (15-19) of knee osteoarthritis.

Hypotheses to explain the obesity-OA relationship fall into 2 categories, metabolic and mechanical The mechanical hypothesis has received less attention in epidemiologic investigation.

Varus mal-alignment intensifies the effects of excess body weight on the medial tibiofemoral compartment.

The direction of mal-alignment medial compartment load; valgus mal-alignment increase load lateral compartment load.

In the normally aligned, ambulating knee, load is transmitted to the medial compartment load is disproportionately transmitted to the medial compartment varus mal-alignment further increase the total load passing medially during gait.

The difference in the impacts of versus valgus mal-alignment on load distribution is well established. The direction of mal-alignment is likely to affect the potency of obesity as factor leading to progressive knee OA.

Knee alignment determines load distribution across the knee. During gait~70% of knee joint loading passes reaction through the medial compartment due to the ground reaction force passing medial to the knee joint.

Quadriceps strengthen exercise are commonly prescribed for patient with knee OA because they can reduce pain and improve function.

However, little is known about their effects on knee loading and disease progression, and it is unclear whether these effects are influence by the presence of mal-alignment.

It is also possible that greater quadriceps strength increases compressive forces across the knee joint, and that these effects may be accentuated with knee mal-alignment.

Increased knee joint loading has been associated with an increased risk of disease.

It is known that knee joint loads are increase by modifiable factors such as varus mal-alignment and obesity.

This notion is important because lower extremity muscle weakness is important factor in knee pathology .strengthen exercise improve clinical finding in knee OA patient, such as pain and quality of life.

Although obese people have great absolute legs strength than there non obese counterpart, the opposite actually it's true when normalizing body mass. Muscle strength in obese people is off special patho mechanical interest because obesity independent affects the knee mechanically.

MATERIAL AND METHODOLOGY

- Type of study: Experimental study
- Study design: randomized clinical trail
- Sampling method: simple random sampling
- sample size: 38
- Place of study: Physiotherapy OPD, Krishna College of physiotherapy, Karad.

MATERIALS:

- Towel
- Resistance band
- Plinth
- Weight cuffs

INCLUSION CRITERIA:

- Both male and female participants willing to participate in the study.
- Age group between 35-55 years
- Individuals with grade I, II and III obesity .
- Subjects diagnosed with grade OA by certified physiotherapist according to (kellgren and Lawrence scale)

EXCLUSION CRITERIA:

- History of trauma to knee
- Systemic illnesss
- Malignancy
- Polyarthritis ,spondylo arthropathies, rheumatic arthritis.

OUTCOME MEASURES

- **Manual Muscle Testing (MMT)**
- **1 Repetition Maximum (1RM)**

PROCEDURE

Ethical clearance was taken from institutional ethical committee. Study was carried out in Krishna institute of medical sciences, In this according to inclusive and exclusive criteria subjects was taken. They was told thoroughly about the project and intervention. They was also be told about its beneficial and side effects and consent will be taken. They were divided into 3 groups according to the grades of obesity. Group A were containing type 1 obesity subjects. Group B were containing type II obesity subjects. Group C were containing type III obesity subjects. And they were trained for the quadriceps strengthening for 7 days and pre and post assessment was taken for the muscle including MMT, 1 RM. And findings was noted down.

QUADRICEPS STRENGTHENING EXERCISES:

1. Quadriceps isometric exercises.
2. Straight leg raise.
3. Knee extension in high sitting.
4. Quadriceps isometrics with plantar flexion and dorsiflexion
5. Quadriceps table
6. Static cycling.

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

1) Gender distribution:

Table 7.1 : Gender distribution.

Male	Female	Total
23	22	45

45 subjects having OA age group above 35 years were taken. Out of 45 subjects, 23 included male and 22 included female.

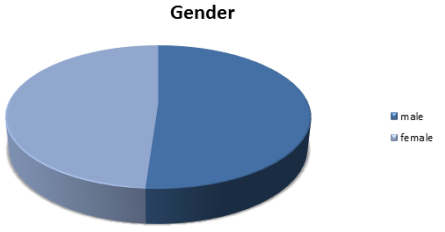

Fig : Gender distribution

2) Age distribution:

Table 7.2 : Mean Age of participants

Study group (n= 45)	MEAN + SD
Grade I	37.8+ 2.11
Grade II	38.33+ 2.225
Grade III	39.8 + 1.935

Age group of all participants was Above 35 years. The mean age of the participants is given above,

OUTCOME MEASURES

1 RM

Table 7.3: Comparison of 0 week and 7 days of 1 RM

Groups	0 weeks interventional Mean ± SD	1 week interventional Mean ± SD	p Value	T value	Inference
Grade I	43.33+5.876	58.33+5.563	<0.0001	7.685	Extremely significant
Grade II	39+9.10	46.33+5.16	0.0006	4.0363	Extremely significant
Grade III	43+8.61	43.33+6.98	0.670	0.4350	Not significant

The table also shows the comparison of mean and standard deviation at 0 week and 7 days between the grade wise obesity.

The table also shows the comparison of mean and standard

deviation at 0 weeks and 1week values of Grade I. II and III obesity.

In the Grade I, the mean of RM score at 0 week intervention was43.33+ 5.876 and at 1 week was 58.33+ 5.563 . The T Value was 7.685 . The P value was found to be 0.0001 which is extremely significant.

In the Grade II, the mean of RM score at 0 week intervention was 39+ 9.10 and at 1 week was 46.33+ 5.16 . The T Value was 4.06 . The P value was found to be 0.0001 which is extremely significant

In the Grade III, the mean of RM score at 0 week intervention was43+ 8.61 and at 1 week was 43.33+6.98 . The T Value was 0.4350 . The P value was found to be 0.678which is extremely significant

MMT

Table 7.4: Comparison of 0 week and 1 week of MMT within group

Groups	0 weeks interventional Mean ± SD	1 week interventional Mean ± SD	p Value	T value	Inference
Grade I	3+ 0.00	4.33+0.4880	<0.0001	10.583	Extremely significant
Grade II	3+0.414	4+0.845	0.0004	4.583	Extremely significant
Grade III	2.66+0.4880	3.33+0.4880	0.069	3.16	Very significant

The table also shows the comparison of mean and standard deviation of MMT at 0 week and 7 days between the grade wise obesity.

The table also shows the comparison of mean and standard deviation at 0 weeks and 1week values of Grade I. II and III obesity.

In the Grade I, the mean of MMT score at 0 week intervention was3+ 0.00 and at 1 week was 4.33+ 0.4880 . The T Value was 10.583 . The P value was found to be 0.0001 which is extremely significant.

In the Grade II, the mean of MMT score at 0 week intervention was 3+ 4.14 and at 1 week was 4+ 0.845 . The T Value was 4.583 . The P value was found to be 0.0004 which is extremely significant In the Grade III, the mean of MMT score at 0 week intervention wasTWO.66+ 0.488 and at 1 week was 3.33+0.488 . The T Value was 3.16 . The P value was found to be 0.69 which is VERY significant

DISCUSSION

OA of knee is one of the most common causes in older population and that leads to activity limitations and work. Prevalence of OA is highest in third decade of life. Thus, preventing and avoiding OA of knee joint progression is necessary to decrease the associated morbidities.

OA of the knee joint is one of the most common causes of activity and work limitations in older population. Prevalence of OA is highest in the third decade of life and thus, preventing and avoiding progression of OA of the knee joint is necessary to decrease the associated morbidities

Basically, Osteoarthritis can be described as degenerative changes , accompanied by painful limitation of movement and influenced by physical activities and posture .

Obesity is main disposing factor for the degenerative changes in weight bearing joint i.e, knee joint. Previous study conducted by R Lee, W Kean[24] on Obesity and Knee Osteoarthritis showed the relation between obesity and knee osteoarthritis. This study concluded that obesity is a primary risk factor for incidence of knee osteoarthritis due to biomedical and metabolic conditions. Therefore it was important to see the changes in various grades and to check the impact of exercises on various grades of obesity

In this study, 45 subjects who were clinically diagnosed with OA were taken and their obesity was classified according to the international classification of BMI. Of which, 23 (51.1%) were male and 22(48.9%) were females.

45 Subjects of the age between 35 to 55 years were included in this study.

Treatment in this study consists of 1 week protocol in which outcome assessment was done before the treatment started and 1 week after commencement of the treatment. In this study, 1 RM and MMT, was taken as the outcome measures.

The present study showed that after 1week, considerable changes were seen in the strength of the quadriceps muscle.

Using the outcome assessment of 1 RM, it was seen that subjects with grade I and grade II obesity showed more improvement after 1 week with a p value of 0.0001 (extremely significant) compared to subjects with grade III obesity which had a p value of 0.678 (not significant)

Using the outcome assessment of MMT, it was seen that subjects with grade I obesity showed the most improvement after 1 week with a p value of 0.0001 (extremely significant), followed by subjects with grade II obesity with a p value of 0.0004 (extremely significant). Subjects with grade III obesity had comparatively less improvement with a p value of 0.069 (very significant)

Thus, there was a significant increase in the subjects' quadriceps strength following the treatment administered in this study.

A study conducted by (citation) showed results similar to our study with significant changes in 1 RM and MMT of subjects after incorporating Quadriceps strengthening exercises for 1 week. They were more significant in Grade I Obesity followed by grade II and grade III obesity.

There are many studies which proved that there is effect of quadriceps strengthening on OA knee joint and there is beneficial effect of VMO strengthening. A study conducted by C Slemenda etall[26] on quadriceps weakness and Osteoarthritis of knee concluded that quadriceps weakness may be present in patients who have osteoarthritis but do not have knee pain or muscle atrophy ; this suggested that weakness may be due to muscle dysfunction.

Many studies showed that osteoarthritis of knee joint decreases quadriceps muscle strength, endurance as well as dynamic balance, hence the aim of rehabilitation of this study was to increase quadriceps muscle strength, endurance and dynamic balance with exercises.

A Previous study conducted by A Imoto,M Peccin,V Trivisani[25] on Quadricep strengthening exercises are effective in improving Pain, Function ,and quality of life in patients with osteoarthritis of the knee. This study concluded that Quadriceps strengthening exercises applied in randomized clinical trail was effective in improving Pain, Function and quality of life of patients with knee osteoarthritis.

This present study showed that after 1week, there were considerable changes in the outcome measures specially

which was more seen in grade I obesity which was followed be grade II and Grade III.

In this study, 1 RM and MMT, was taken as an outcome measure. A study showed the changes in 1 RM and MMT after incorporating Quadriceps strengthening exercises for 1 week was found to be significant more in Grade I Obesity followed by II and III grade obesity.

This study showed that there was extremely significant difference within 0 weeks and 1 weeks and within 0 week and 1 weeks of MMT had more significant changes . This study showed that there is a very significant difference in MMT that is exercises are more effective in Grade I Obesity with compared to grade II and III This study supported the result of the previous research within group, but there was significant difference in grade I, II and III obesity.

In this study the 1 RM was also taken as the one of the outcome measures and the their was significant effect seen in the Grade I And II obesity and their was no significant effect seen in the Grade III obesity which concluded that their was effect seen in improving power by strengthening protocol for quadriceps for 7 days in Grade 1 and II but no effect is seen in the Grade III in improving strength of the muscle but where as there is significant effect seen in improving power of the muscle by strengthening of the 7 days in individual.

Study conducted by D Sanghi etall[26] on The association of anthropometric measurement and osteoarthritis knee: a cross sectional study concluded that BMI and Anthropometric measurement have significant association with knee osteoarthritis. so there was extremely significant change in strength in grade 1 and grade 2 obesity as compared to grade 3 in current study.

According to the statistical analysis this study concluded that grade I obese individuals with grade II OA were showing more recovery and also had improved MMT Grade and 1 RM Which was followed by grade II obesity and grade III.

Thus more emphasis needs to be given on research in this area. Improvements such as an increase in the sample size, equal distribution of genders in the population can be made. More advanced treatment protocols as well as improved outcome assessment measures can be used. Also, an increase in the study duration would prove to be beneficial.

This study will help the further researchers in finding out the to find out an advancement in treatment strategy for knee osteoarthritis and improving the quality of life of obese subjects having osteoarthritis. This study will also help in finding out the stratergies in preventing osteoarthritis in obese subjects who are at risk of getting osteoarthritis of knee due to biomedical and metabolic conditions.

CONCLUSION

Results show extremely significant improvement in all three grades ($P<0.0001$) but grade I which showed the maximum improvement by reduced mean values of 1 RM and MMT Grade in subjects with knee osteoarthritis.

On the basis of this study, it was concluded that grade I obese individuals with grade II OA were showing more recovery and also had improved MMT Grade and 1 RM Which was followed by grade II obesity and grade III.

Thus, the alternative hypothesis is proved

REFERENCES

1. Onis m and M blossner,2000.prevalence and trends of overweight among preschool children in developing countries AJCN,72 (4):1032 1039
2. Patterson .R.L. frank, A.kristal,E.A white comprehensive examination of health condition associated with obesity in older adults. American J preventive Med.,27(5):385-390
3. Salenius Pvankka E the development of the tibiofemoral angle in children J Bone joint surg AM1975;57;259-261
4. Peltonen ,M.,A.K lindroos and J.S torgerson 2003.musculoskeletal pain in the obese; A comparison with general population and long- term change after conventional and surgical obesity treatment ,pain 104(3):549-557
5. Felson DT, Anderson JJ Naimark A walker AM , Meenan RF ovesity and knee osteoarithritis, the framinggham study, Ann intern Med 1988;109-24
6. Davis MA, ettinger WH Neuhaus JM . The role of metabolic factor and blood pressure in the association of obesity with osteoarithritis of the knee joint J Rheumatol 1988;15:1827-32
7. Vaan bar ME assendelft WJ,dekker J , Oostendrop RA Bijlsma JW.effectiveness of exercise therapy in patients with osteoarithritis of hip or knee: a systematic scoscopy and
8. Bischoff HA Roos Em Effctiveness and safety of strengthing,aerobic and coordination exercise for patient with osteoarithritis, curr opin Rheumatol 2003;15:141-4
9. Kettunen JA Harilaninen A,sandelin J, et al; knee arthroscopy and exercise varus exercise only for chronic patellofemoral paon syndrome; a randomized controlled trail. BMC Med 2007;5:38 dio 10.1186/1741-7015-5-38
10. Wong YM chan ST, tang KW et al :two modes of weight training programs and patellar stabilization J A thl Train 2009;44:264-71
11. K.R. baker,M.E. Nelson, D.T.Felson,J.E. layne,R.sarno,and Rroubenoff, " The efficacy of hone based progressive strength training in older adults with knee osteoarithritis; randomized controlled trail," Journal of Rheunatology, vol 28 no.7 pp.1655-1665,2001.
12. E Roddy,w Zhng,and M . Doherty,Effectiveness of home exercise for osteoarithritis of knee?A systmatric review ," Annals of the Rheumatic diseases,vol.64 no. 4 pp.544-548,2005
13. Guccione AA, Felson DT, Anderson JJ, Anthony JM, Zhang Y, Wilson PW, et al. The effects of specific medical conditions on the functional limitations of elders in the Framingham study. Am J Public Health 1994;84(3):351-8.
14. Lawrence RC, Helmick CG, Arnett FC, Deyo RA, Felson DT, Giannini EH, et al. Estimates of the prevalence of arthritis and selected musculoskeletal disorders in the United States. Arthritis Rheum 1998;41(5):778-99.
15. Carvalho NA, Bittar ST, Pinto FR, Ferreira M, Sitta RR. Manual for guided home exercises for osteoarthritis of the knee. Clinics (Sao Paulo) 2010;65(8):775-80.
16. Buckwalter JA, Lappin DR, The disproportionate impact of chronic arthralgia and arthritis among women, clinorthop. 2000 mar:159-168.
17. Deyle GD, Henderson NE, Matekel RL, Ryder MG, Garber MB, Allison SC. Effectiveness of manual physical therapy and exercise in Osteoarthritis of the Knee: a randomized, controlled trial. Ann Intern Med. 2000; 132:173-181.
18. Felson DT, Zhang Y, Hannan MT, Naimark A, Weissman B, Aliabadi P, Levy D. Risk factors for incident radiographic Knee Osteoarthritis in the elderly: the Framingham Study. Arthritis Rheum. 1997; 40:728 -733.
19. Lachance L, Sowers MF, Jamadar D, Hochberg M. The natural history of emergent Osteoarthritis of the Knee in women. Osteoarthritis Cartilage. 2002; 10:849-854.
20. McConnell S, Kolopack P, Davis AM. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC): a review of its utility and measurement properties. Arthritis Rheum 2001; 45:453-61.
21. Dr A C A Marijnissen -Joint distraction in the treatment of Knee Osteoarthritis: efficacy and underlying mechanisms.2012 July.
22. Liikavainio T, Lyytinen T, Tyrvainen E, Sipila S, Arokoski JP, Physical Function and properties of quadriceps femoris muscle in men with knee osteoarthtitis. Arch Phys Med Rehabil. 2008;89(11):2185-2194.
23. Maly MR, Costigan PA, Olney SJ, Contribution of psychosocial and mechanical variables to physical performance measures in knee osteoarthritis.Phys Ther.2005;85(12):1318-1328.9
24. R Lee, W Kean.Obesity and Knee Osteoarthritis.Inflammopharmacol (2012) 20:53-58
25. Imoto, M Peccin, V Trivisani, Quadricep strengthening exercises are effective in improving Pain, Function ,and quality of life in patients with osteoarthritis of the knee. Acta Ortop Bras. 2012; 20(3):174-179
26. D Sanghi etall .The association of anthropometric measurement and osteoarthritis knee in non-obese subjects: a cross sectional study,CLINICS 2011;66(2):275-279