



Physiotherapy

EFFECT OF BACK AND LEG STRENGTHENING ON CADENCE IN OBESE ADULTS.

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ABSTRACT

Aim: To study the effect of back and leg strengthening on cadence in obese adults. **Need of study:** Obesity causes gait problems such as reduced stride length & increased cadence, there is also reduced muscles strength which leads to reduction in the gait speed. Many studies have been done on the gait analysis and the walking improvement in obese who suffer from low back pain but no studies were done individually on the improvement of the cadence by increasing muscle strength hence the need of the study is to see the effect of back and leg strengthening on cadence in obese adults. **Design:** Randomized control trial. **Procedure:** Ethical approval had been taken & written consent had been taken from the subjects, subjects were randomly assigned into experimental & control group, the interventional group was given a 6 week strength training of 3 days/ week; and the control group performed AROM which was recorded through telephonic conversation, the cadence, back & leg MMT, functional gait assessment scoring (FGA) was assessed before and after 6 weeks for both the groups. **Result:** The strength training program improved the back extensor and leg strength relative to the control group (1.14 ± 0.57 , 0.92 ± 0.14 ; $p=0.002$) and the FGA score had no significant impact of strength training in the experimental group (2.64 ± 2.21 ; $p=0.341$) this did not reach significance, the interventional group showed a greater improvement in the cadence as compared to the control group (-7.9 ± -4.36 ; $p=0.021$). **Conclusion:** The use of strength training program produced modest improvements in patients walking speed that is; the cadence, back extensor strength and leg strength gain is an important contributing factor in improving walking in obese adults. Responders to resistance training had greater improvements than those who did not receive training. There was significant improvement in both groups MMT & FGA score, but there was greater improvement in the training group.

KEYWORDS : Obesity, strengthening, MMT, Cadence, Functional gait assessment scale.

INTRODUCTION

OBESITY is defined as abnormal accumulation of fat, usually 20% or more over an individual's ideal body weight and it is a heterogeneous disorder in which energy intake chronically exceeds energy expenditure^[1] It is also an abnormal growth of the adipose tissue due to the enlargement of fat cell size (hypertrophic obesity) or an increase in fat cell number (hyperplastic obesity) or a combination of both.

Extreme accumulation of fat in adults stimulates increased adipose cellularity because adipose size reaches an upper limit of about 1.0 μ g fat, beyond which no further hypertrophy occurs. The increase in number of cells at this point constitutes a failure of adipocyte regulation that unfortunately leads to further fat accumulation. It is useful to be able to distinguish between those at increased risk as a result of "abdominal fat distribution" or "android obesity" from those with the less serious "gynoid" fat distribution, in which fat is more evenly and peripherally distributed around the body.

Increase in body weight has been caused primarily by reduced level of physical activity, dietary habits and genetics.^[2] There is a ghrelin hormone which is a hunger hormone that increases the desire to eat. Obesity is expressed in terms of BMI. BMI is the ratio of body weight in kg's to the height in m².

UNDERWEIGHT	< 18.5
NORMAL	18.5 – 24.9
OVERWEIGHT	25 – 29.9
OBESE I	30 – 34.9
OBESE II	35 – 39.9
OBESE III	>40

Muscle strength is important for the maintenance of walking ability as a person ages. Weakness in the leg muscles compromises walking endurance, gait speed, crouch, stair climbing, and rising from a chair^[5] Obese individuals might adjust their gait characteristics in response to their heavy bodies to reduce the moment about the knee and the energy expenditure per unit time. Muscle may be impaired in obese persons, and this impairment may be consequence of both obesity and low physical fitness. Obese persons with low muscle strength have significantly lower walking speeds compared to the normal individuals.^[5]

The muscles that are mostly affected are the back muscles which help

in sustaining an upright posture and the leg muscles used for walking. The muscles that include are the superficial and deep erector spinae i.e. spinalis, longissimus, quadratus lumborum, multifidus. The muscles of the leg include hamstrings, quadriceps, soleus, gastrocnemius, tibialis anterior & posterior.^[4]

METHODOLOGY

- Population : overweight and Obese grade 1 and 2
- Sampling : Purposive
- Location : PCMC
- Study design : experimental
- Sample size: 30
- duration : 6 week

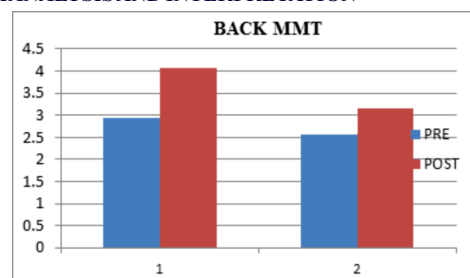
OUTCOME MEASURES

- Functional gait assessment scale
- Cadence
- MMT

PROCEDURE

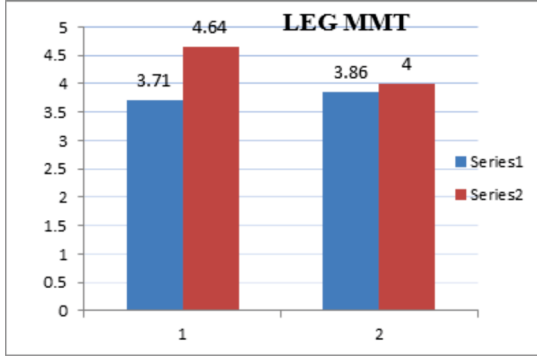
- Ethical approval had been taken by the ethical committee
- Informed consent had been taken from the subjects.
- The procedure was explained and the subjects were randomly assigned into experimental and control group.
- Strength training was given to the experimental group for 6 weeks, where as, the control group was given AROM and was recorded through telephonic conversation.
- Pre and post 6 weeks, Cadence, Back and leg Manual muscle testing, Functional gait assessment scale were measured.

DATA ANALYSIS AND INTERPRETATION



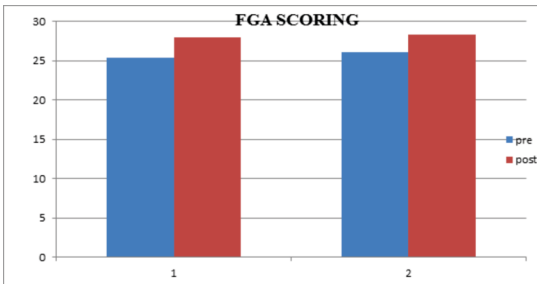
		N	MEAN	STDEV	Mean Diff	T val	P val
Interventional (1)	PRE	14	2.93	0.62	1.14	11.7	0.001
	POST	14	4.07	0.62			
Control (2)	PRE	14	2.57	0.51	0.57	4.16	0.001
	POST	14	3.14	0.36			

Graphical presentation 1: Paired T test used in group A & group B in pre and post test values of back MMT, showed increase in the interventional groups post values than the control group.



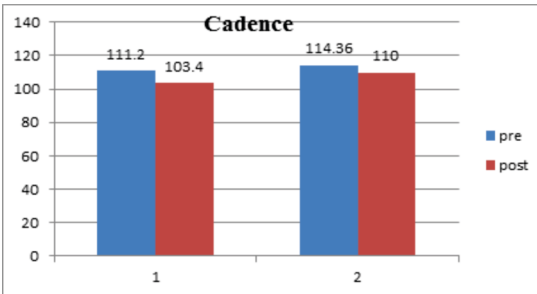
		N	MEAN	STDEV	MEAN DIF	T VAL	P VAL
Intervl(1)	Pre	14	3.71	0.46	0.93	13.00	0.001
	Post	14	4.64	0.49			
Control(2)	Pre	14	3.85	0.36	0.14	1.47	0.165
	post	14	4	0.39			

Graphical presentation 2: showed that Paired T test used in group A & group B in pre and post test values of leg MMT, showed increase in the interventional group than the control group



		N	MEAN	STDEV	MEAN DIF	T VAL	P VAL
Interventional (1)	Pre	14	25.36	1.82	2.64	11.74	0.001
	Post	14	28	1.46			
Control (2)	Pre	14	26.07	1.85	2.21	5.81	0.001
	post	14	28.29	1.42			

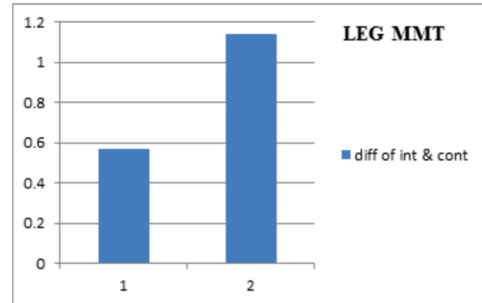
Graphical presentation 3: showed that Paired T test is used in group 1 & group 2 in pre and post test values of FGA SCALE SCORE, which showed that there is no significant difference between the values of the 2 group.



		N	MEAN	STDEV	MEAN DIF	T VAL	P VAL
Interventional (1)	Pre	14	111.2	11.3	-7.9	5.80	0.001
	Post	14	103.4	11.2			

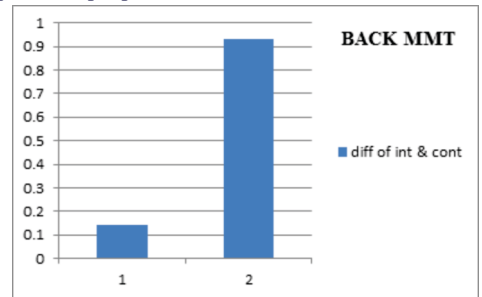
		N	MEAN	STDEV	Mean Diff	T value	P value
Control (2)	Pre	14	114.36	12.07	-4.36	6.68	0.001
	post	14	110	12.37			

Graphical presentation 3: showed that Paired T test is used in group 1 & group 2 in pre and post test values of CADENCE, showed increase in the cadence in the interventional group than the control group.



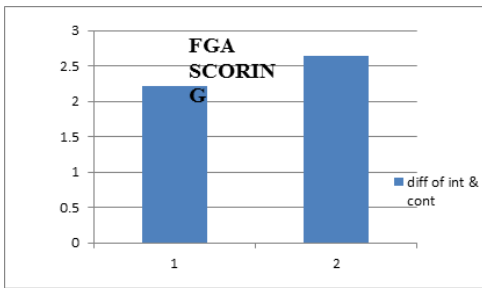
	N	MEAN	STDEV	Mean diff	T value	P value
Interventional	14	1.14	0.36	0.571	3.39	0.002
control	14	0.57	0.51			

Graphical presentation 5: Unpaired T test is used in group 1 & group 2 for the pre post diff of back MMT



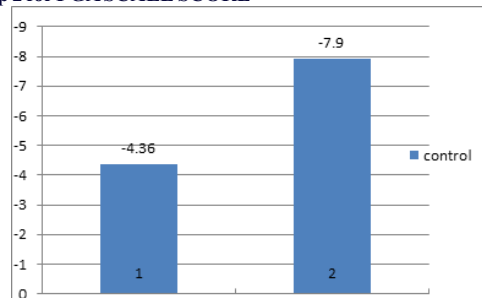
Graphical presentation 6: Unpaired T test used in group 1 & group 2 for leg MMT

	N	MEAN	STDEV	MEAN DIF	T value	P value
Interventional	14	0.92	0.26	0.785	6.52	0.001
Control	14	0.14	0.36			



	N	MEAN	STDEV	MEAN DIF	T value	P value
Interventional	14	2.64	0.84	0.428	0.96	0.341
control	14	2.21	1.42			

Graphical presentation 7: Unpaired T test is used for group 1 & group 2 for FGA SCALE SCORE



Graphical presentation 8: Unpaired T test is used for group 1 & group 2 for CADENCE

	N	MEAN	STDEV	MEAN diff	T value	P value
Interventional	14	-7.9	5.1	3.35	2.45	0.021
control	14	-4.36	0.30			

DISCUSSION

Obesity is a condition in which there is an abnormal accumulation of fat, it is also a type of malnutrition in which there is abnormal growth of the adipose tissue and this can occur due to an increase in size and number of fat cells.¹¹ Obesity is most commonly associated with reduced muscle strength and reduced functional mobility, which leads to slower walking speed and had a shorter stride length. They also spend more time on their stance phase.

During this study we found that the obese and overweight population had reduced back and leg muscle strength which leads to reduced gait speed and after the intervention the readings showed greater increase in back muscle and leg muscle strength in the interventional group than in the control group that increased the gait speed. The strength training leads to hypertrophy of the muscle which is an important adaptations that accounts for strength gains in the muscle. Hypertrophy of the skeletal muscle appears to be the result of an increase in protein synthesis and a decrease in protein degradation.⁶¹

The results also shows an increase in the scores of the FGA SCALE and CADENCE as the strength increases which in turn leads to improved gait. A study has proven that "lumbar extensor strength gain compared with leg strength gain is an important contributor to walking in obese adults"⁵¹. An article also stated that "improvement in back extensor strength is a significant factor in mobility improvement."⁷¹

The training session was carried out for 6 weeks for 3 days per week. The results showed significant improvement in both the groups but a greater improvement in the training group.

CONCLUSION

- The use of strength training program produced modest improvements in patients walking speed i.e the cadence and had significant improvement in their functional gait assesment scale scores and also increased back and leg muscles strength.
- Back muscle strength gain and leg muscle strength gain is an important contributing factor in improving walking in obese adults.
- There was significant improvement in both the groups, but a greater improvement in the training group.

LIMITATION

- smaller population
- longer duration study
- Availability of the sample size.
- Though the follow up was taken through a telephonic conversation, the reliability of the answers provided by the subjects could not be mentioned.
- Only cadence was assessed.

RECOMMENDATIONS

- larger population.
- Other gait parameters can be taken such as stride length, step length.
- Can be performed for a longer duration.
- Class III obese can be included

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