A PhD Research Study Establishing The Importance Of Physiotherapy and Body Composition Analysis for Independent And Healthy Geriatric Population

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ABSTRACT *A Summarized Abstract of the entire PhD Thesis " Doctor of Philosophy in Physiotherapy" awarded by Faculty of Physiotherapy- Maharaj Vinayak Global University – Jaipur - Rajasthan – India, in accordance with the provision of the UGC (Minimum Standards and procedure for the award of Ph.D. Degree) Regulation 2009, to Mr. Rohit Subhedar; (2ndBatch) 2013/2016, Reg No: MVGU13PB1PT10 – on the recommendations of Viva Voce Board held on 14th & 15th June 2018.*

Keywords: Geriatric, Physiotherapy, Body Composition, Physical activity, Aging, Pain

Introduction:

A perfect combination of physical activity in form of activities of daily living with specific emphasis on exercises and periodic evaluation of body composition parameters is essential in achieving physically fit and active geriatric lifestyle. Ageing is a continuous process and interventions in form of enhanced physical activity and self awareness towards evaluation of individualized body composition parameters shall help an elderly to cop up with effects of ageing and thereby improving the quality of life among elderly population.

Physiotherapy being an important allied branch of health sciences can bring enormous amount of change in the physical fitness statistics of the entire community and thereby reducing the medical burden on the community for maintaining good health. An optimal geriatric health and physically fit ageing completely depends upon the awareness among the individuals of the community regarding the importance of regular physical exercises and periodic self-assessment through body composition analysis under the supervision of a qualified Physical Therapist. It was also observed that physical exercises prescribed to the patients were not specific to the differences in body composition parameters. These lacunae resulted in generalized exercise prescription purely based upon the Musculo-skeletal deficits, whereas a significant role of parameters such as body fat, lean body mass, BMR, BMI and above all segmental fat distribution plays an important role in exercise prescription and thereby prognosis of the disease.

Today there is immense need of awareness for preventive medicine. The "Thought Process" of "Health is Wealth" among the elderly and young adults in our community is negligible. This apathy of the ailing community coming for physiotherapy treatment in my department provoked me to conduct a thorough research on the physical activity statistics and body composition parameters of individuals with different age groups. I sincerely hope that my research shall establish the importance of periodic body composition analysis and Physiotherapeutic exercise interventions among the entire community as a daily necessity.

Need of the study:

It is being observed in the community at a large that, the void of regular and periodic health check-ups are resulting in health hazards in form of obesity and various musculo-skeletal disorders, resulting in physically unfit community. To address this problem we thought that there is a need of research in the field of geriatric health, early ageing and importance of physical activity and body composition in creating physically fit community. It was observed in the clinical Physiotherapeutic practice that the individuals requiring Physiotherapeutic services were mainly those who are obese and physically inactive. These individuals presented with various Musculo-skeletal problems and on thoroughly examining them it was observed that they were unaware about the importance of physiotherapeutic exercise programs, hazards of excess body fat, inadequate total body water and improper distribution of fat. These presentations were specifically observed due to unhealthy dietary habits and sedentary lifestyle. Observing a continuing trend in the patients entering the physiotherapy department showing significant changes in body composition parameters and reduced physical exercise encouraged us; in fact provoked us to satisfy the need of this study.

Research Hypothesis:

1. **Hypothesis One** - States that increase in age shall be responsible for decrease in BMR, FFM and TBW whereas it shall result in increase in FM.
2. **Hypothesis Two** – States that decrease in Physical Activity level shall be responsible for Increase in Body Fat %.
3. **Hypothesis Three** – States that BMI shall not be the ideal indicator for Obesity as compared to Body Composition Analysis.
4. **Hypothesis Four** -States that differences in Segmental fat % distribution shall be an indicator for Musculo-skeletal Pain.

Aim and Objectives:

(1) To evaluate the body composition changes among healthy and active individuals of various age groups. Specifically Pre Geriatric and Geriatric age groups.
(2) To evaluate the impact of regular Physiotherapy in form of exercises in reducing effects of aging and age-related body composition changes among Geriatric Population of Indore district.
(3) To create awareness among Geriatric population regarding the importance of Physical Exercises for healthy and Independent living.
(4) To Establish Body Composition analysis as one of the easiest and accurate mode of evaluating Musculo-skeletal Pain and Fitness.
(5) To Establish the Importance of Body Composition analysis in Prescribing effective Physiotherapeutic Exercises for Healthy and Pain free Geriatric Life.

Procedure:

At the onset of the study we decided to Evaluate body composition and physical activity parameters of individuals from the Central India. To execute this, enormous amount of logistic work was required, so finally we restricted the data collection of the participants purely to the Indore - District of the Madhya Pradesh region of India. The ethnicity was mainly limited to Asian individuals with Indian origin. The participants were both males and females with no specific age limit; Data was obtained from Randomized individuals participating in Full Body Executive check-up at Bombay Hospital Indore- India. Parameters for the study were obtained through the Body Composition Analysis reports, Pain scale reports and Physical activity scores. Each individual assigned for body composition analysis among all other full body executive check-up tests had to report to the Physiotherapy Department. After reporting to the Physiotherapy Department they were initially evaluated for their physical characteristics mainly the height followed by verbal questionnaire, which included parameters such as physical activity involvement per day /per individual. Based upon the answers physical activity was marked from the scale of 1 to 5. Followed by which the individuals were made to stand on the body composition analyzer unit for evaluating their body composition parameters. After obtaining the body composition parameter report based upon the segmental fat distribution and body fat each individuals were asked questions pertaining to Musculo-skeletal pain, daily water intake and other Musculo-skeletal problems. Based upon the data collected a master chart was made which divided the parameters into total 20 parameters viz. 5 parameters of physical characteristics, 10 parameters of body composition, 4 parameters of pain and 1 parameter of physical activity. After obtaining parameters of each individual, the reports of all the 4000 subjects were further subdivided for inter and intra group observational quantitative statistical analysis.

Instruments:

1. Fat Chart
2. BMI Chart
3. Height Chart
4. Tanita Body Composition Analyzer BC-418 MA
5. VAS Scale
6. Customized Physical Activity Scale (CPA Scale)

Data Analysis:

My study is a quantitative observational cross-sectional study. In my study I divided the data obtained into various age groups and then inter and intra group data was further analysed. The comparative analysis was carried out for the entire data which had all the clinical parameters for each of the 4000 candidates, obtained after evaluating their body composition analysis and personalized questionnaire from each of them. The data was initially captured in the customized Performa and then transferred it to Microsoft Excel

for analysis. Online statistical software was used for calculating the P values. Comparison of mean between the two groups was done using Unpaired' T test, comparison of mean between more than two groups was done using One-Way ANOVA, followed by post-hoc Tukey test, association between two non-parametric variables was done using Pearson Chi-square test, Correlation between two parametric variables was done using Pearson Coefficient of Correlation 'r'. A p value of < 0.05 was taken as statistically significant. The final data was presented in the form of tables.

Results:

The results of our study have finally provided a broad base significance towards the importance of regular physical exercises and body composition analysis for Healthy, Happy and Independent Geriatric Population. The statistical data resulted in proving that exercises or activities in form of various activities of daily living are the best means of maintaining ideal combinations of body composition parameters, which are essential for independent geriatric living. The results of our study have succeeded in emphasizing the importance of the awareness among the geriatric community regarding the periodic body composition analysis and exercises interventions. The results were subdivided for easier statistical inference. The division was based upon age, sex, BMI and Body Fat of different age group individuals. All the 20 parameters were compared with each other for the individuals of different decade. Based upon the result obtained we can elaborate the results as under:

Comparison of all parameters with age: When all the parameters such as BMR, FFM, TBW, FM or Fat %, BMI, RLF%, LLF%, RAF%, LAF%, TRF%, Pain Parameters (RLP, LLP, RAP and LAP) and PA were distributed according to age and analyzed, results showed that:

➢ There is a decreasing trend seen in **BMR, FFM and TBW** in relation to the increasing age. There was a statistically significant association seen between age and TBW/Wt (%) cut-off (50%), showing that the distribution of patients in <=50% and >50% TBW is dependent on the age of the patients (P<0.05).

➢ **BMI and Fat with age:** There is increasing trend in **BMI and FM or Fat %** in relation to age till 6th decade, and then FM or Fat % tends to decrease. . There was no statistically significant difference in the pairs 31-40 years to >60 years and 41-50 years to 51-60 years (P>0.05), while it was statistically significant in all the other pairs i.e. <=30 years to 31-40 years; <=30 years to 41-50 years; <=30 years to 51-60 years; <=30 years to >60 years; 31-40 years to 41-50 years; 31-40 years to 51-60 years41-50 years to >60 years and 51-60 years to >60 years (P<0.05).

➢ **Segmental fat % parameters with age**: It was observed that, all the segmental fat parameters (RLF%. LLF%, RAF%, LAF% and TRF%) reached the peak in the age group 41-50 years and then started falling till the age >60 years. While RAF (%) reached the peak in the age group 51-60 years and then started falling i.e. highest RAF (%) was seen in the age group 51-60 years. Trunk Fat % when compared, it was found that TRF showed increasing trend with age.

➢ **Pain parameters (RLP, LLP, RAP and LAP) with age**: The highest RLP was seen in the age group 41-50 years, but when compared among different age groups there was no statistically significant difference seen in any of the pairs (P>0.05). The highest LLP was seen in the age group >60 years i.e. left Lower Limb Pain showed increasing trend with age. There was decrease in the LAP after the age of 50 years i.e. the individuals having left arm pain were more among the age group 41-50 years. Statistically significant difference was seen among the individuals of 4th and above 6th; 5th and 6th; 5th and above 6th, 6th and above 6th (P<0.05). When RAP was compared, it was seen that individuals with age group more than 60 years suffered more than other age individuals. RAP in individuals of 5th and 6th decade showed significant difference with age group above 60 years (P<0.05).

Correlation of FM, FFM and BMI classification: After evaluating the correlation analysis of FM and FFM with BMI classification groups {i.e. underweight (<18.5), normal (18.5–24.9), overweight (≥25), or obese (≥30)}, statistically significant & positive correlation was found. The highest FM was seen in the obese, followed by overweight, than normal and the lowest in the underweight, at the same time the highest FFM was also seen in the obese, followed by overweight, than normal and the lowest in the underweight. Both FM and FFM showed increasing trend with increase in BMI.

Comparison of all parameters Between various BMI: When comparison of all parameters among various BMIs was done the results obtained were:

➢ **BMR, segmental fat parameters** i.e. RLF, LLF, RAF, LAF and trunk fat % showed increasing trend with BMI, whereas **Physical Activity scores** had decreasing trend with BMI. When comparison was made among different pairs of BMI groups, it was found to be statistically significant in all the pairs

(P<0.05) for BMR, PA and segmental fat % parameters and there was a statistically significant association seen between the leg/arm pain and BMI.

➢ **Pain parameters among BMIs:** RLP and LAP showed increasing trend with BMI while LLP showed Decreasing trend. When comparison of RLP was done between the pairs Underweight to Normal; Underweight to Overweight; Underweight to Obese; Normal to Overweight; Normal to Obese and Overweight to Obese, significant difference was seen among normal and overweight; normal and obese; overweight and obese (P<0.05), while no significant difference was seen between the underweight individuals and other group i.e. normal, overweight and obese (P>0.05). LLP showed significant difference (P<0.05) between all the pairs except for comparison among underweight and normal (P>0.05) and LAP showed significant difference (P<0.05) among all pairs except for 'underweight to normal' and 'overweight to obese' (P>0.05).

Comparison of all parameters among various Fat Classifications: All the parameters when compared among various fat % i.e., under fat, Normal, over fat and obese groups, same trend was found to have as with BMI groups, i.e.

➢ BMR, FFM, segmental fat % parameters, RLP and LAP tend to increase with Fat % while PA and LLP tend to decrease with Fat %.

Comparison of Physical activity and Body fat percent parameters: The results of statistical analysis showed that the highest Fat % was seen in the PA Group 1, followed by PA Group 2, then PA Group 3 and the lowest was seen in the PA Group 4. As the PA is increasing the Fat % is showing a decreasing trend.

Comparison of different parameters among various PA Group: Different parameters when compared among physical activity groups (PA Group 1 to PA Group 2; PA Group 1 to PA Group 3; PA Group 1 to PA Group 4; PA Group 2 to PA Group 3; PA Group 2 to PA Group 4 and PA Group 3 to PA Group 4, it was found that BMR and segmental fat % parameters followed decreasing trend with PA groups and there was a statistically significant difference seen in all the pairs (P<0.05). RLP and LLP showed decreasing trend with Physical Activity.

➢ When Comparative analysis of **FFM and PA group** was done, it was observed that the highest FFM was seen in the PA Group 1 because FM also showed increasing trend as the physical activity decreases, thus there was overall increase in the weight for all those individuals showing sedentary lifestyle as specified in PA Group 1.

➢ **Pain parameters:** When compared with Physical Activity, it was found that PA group 4 had lowest pain compared to other groups and highest was seen in PA group 3. When comparative analysis was observed between the groups there was no statistically significant difference seen in the pairs PA Group 1 to PA Group 3 and PA Group 2 to PA Group 3 (P>0.05), while it was statistically significant in all the other pairs (P<0.05), i.e. increase in arm pain from PA group 1 to 3 and 2 to 3 was not significant but decrease in arm pain from 1 to 4, 2 to 4 and 3 to 4 was significant. FFM showed a significant decrease, on comparing between the individuals of PA group 1 to 4 or 1 to 2 or 2 to 4, but the decrease was not significant between the individuals of PA group 2 - 3 and 3 – 4. To explain this more precisely we can infer that Physical Activity should progress in gradual manner to preserve the FFM while simultaneously reducing the FM.

Correlation of all parameters with TBW/Wt (%): When the comparison of all parameter values in relation to the cut off of TBW/Wt (%) at 50% was done, it was found that lower BMI patients were more in the >50% group, while patients with higher BMI were more in the <=50% group and Healthy / normal patients, over fat patients were more in >50% group while obese were more in the <=50% group, whereas PA and FFM was found higher in >=50% group (P<0.05). The association of Leg/arm Fat (%) and leg/arm pain in relation to the TBW/Wt (%) cut-off (50%) showed statistically significant association. The distribution of patients in <=50% and >50% is dependent on the Leg/arm Fat (%) of the patients and leg pain (P<0.05). More number of left leg fat (%) and left leg pain were in the >50% group, while more number of right leg fat (%) and right leg pain were in the <=50% group, whereas Left arm fat (%) and left arm pain was more prominent in the <=50% group, while right arm fat (%) and right arm pain was more prominent in the >50% group, showing statistically significant association (P<0.05)

Correlation between segmental fat % parameters and Pain parameters: It was found that segmental fat percentage parameters i.e. RLF, LLF, RAF and LAF showed statistically significant correlation with pain parameters i.e. RLP, LLP, RAP and LAP (P value 0.000). Correlation was positive between all the fat and pain parameters except for LLF and LLP. The above results of statistical analysis say that, as the difference in the fat percentage of right and left quadrant increases intensity of pain also shows increasing trend.

Comparison of different parameters between genders: When Comparison of variables between the two genders was done, the results showed that, BMI (Body Mass Index), Body Fat (%) or FM, RLF (%) (Right Leg

Fat Mass), LLF (%) (Left Leg Fat Mass), RAF (%) (Right Arm Fat Mass), LAF% (Left Arm Fat Mass), LAP and TRF (Trunk Fat) was higher in females in comparison to the males, whereas FFM, PA and BMR (Basal Metabolic Rate) was higher in males which was statistically significant (P<0.05). RLP was comparable in both the males and females (P>0.05), which was statistically not significant.

Conclusion:

I conclude that individuals of age group from; 4th and 5th decades possessed, significant pain due to unbalanced fat deposition, central obesity and reduced level of physical activity. It is possible to evaluate the pain by the simple method of identifying the level of more fat deposition on the body segments and questions based on the same. This method of identifying physical problems through the means of Body composition analysis is a revolution in providing diagnostic skill to the physical therapist in his physical therapy practice. This finding also concludes that these group adults, were more sedentary, had unbalanced fat distribution, were under- hydrated or dehydrated and were completely unaware about the importance of Body composition parameters in healthy living. I finally conclude that the study accomplished its aim; by making more and more elderly and pre geriatric individuals aware about the importance of periodic Body composition analysis and indispensable role of physical activity in healthy geriatric lifestyle. The study concludes that majority of individuals were unaware about the role of various body composition parameters. The study brought enormous amount of awareness among elderly individuals regarding the importance of Physical activity for reducing body fat and increasing fat free mass. They were also ignorant about the difference between BMI and Body fat. They were made aware about the basic principle of "BODY FAT- NOT –WEIGHT" is the ideal parameter of fitness. All the elderly actively accepted the advice and promised to under-take physical exercises as a daily routine program for healthy living. They realized that exercises based on the body composition parameters should prove to be of more scientific importance; rather than just simple mobility programs or activities of daily living. Thus, I finally conclude that my aim of making "AWARE" the majority of individuals in my community and specifically those coming to my department is fulfilled. I conclude by saying that "Prevention is better than cure"; is well imbibed in all my patients and shall prove to be imbibed in all the future patients, as a fruit of this extensive study. May god bless all the senior citizens of my country and the world; so that they understand that physical activities are of core importance in keeping them independent, healthy, happy and functional active till their last breath in their journey to this beautiful planet earth!!! God bless one and all always!!!!! Thanks

LIST OF ABBREVIATIONS:

1. FM – Fat Mass
2. FFM – Fat Free Mass
3. LBM – Lean Body Mass
4. BF – Body Fat
5. BF% - Body Fat Percentage
6. TBW – Total Body Water
7. BCA – Body Composition Analysis
8. BIA – Bioelectrical Impedance Analysis
9. BMI – Body Mass Index
10. BMR – Basal Metabolic Rate
11. PA – Physical Activity
12. RLF% - Right Leg Fat Percentage
13. LLF% - Left Leg Fat Percentage
14. RAF% - Right Arm Fat Percentage
15. LAF% - Left Arm Fat Percentage
16. TRF% - Trunk Fat Percentage
17. RLP – Right Lower limb Pain
18. LLP – Left Lower Limb Pain
19. RUP – Right Upper Limb Pain
20. LUP – Left Upper Limb Pain