ORIGINAL RESEARCH

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A STUDY ESTABLISHING THE IMPORTANCE OF INDIVIDUALIZED EXERCISE PRESCRIPTION IN PHYSIOTHERAPY FOR ACHIEVING PHYSICAL FITNESS BY COMPARATIVE ANALYSIS OF BODY COMPOSITION, PHYSICAL CHARACTERISTICS AND PHYSICAL ACTIVITY

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ABSTRACT

Background: This study deals with the evaluation of body composition and fitness of individuals who differ in their physical characteristics viz. weight, height, Age, Sex, Body Frame and physical activity levels viz. Heavy, Moderate, Light, and thereby identify the ideal combination of physical characteristics and physical activity required in Prescribing Exercises for attaining "THE PERFECT BODY COMPOSITION".

Method: Assessments of physical characteristics, physical activity and body composition was done for 88 subjects of age group between 20-40 years. Body composition analyzer used was Futrex-5000/XL based on near infrared inheritance light technology. Total data was divided into 5 test groups according to their BMI.

Results: Results showed that overweight individuals were classified into individuals having risky health status due to excess amounts of fat mass (28.45), higher BMI and lower physical activity. The study also showed greater body frame size in overweight individuals when compared to underweight or normal weight individuals. Whereas Lean individuals possessed very low percent body fat and high levels of physical activity. LBM% showed alarming increase among abnormally underweight males (94%) and females (91.3%) due to abnormal decrease in fat% making them physically unfit.

Conclusion: It is concluded that, physical fitness of an individual depends upon his/her physical characteristics and also upon the level of physical activity performed. Body composition can be considered as an ideal parameter for evaluating physical fitness with special emphasis on physical characteristics and Individualized Prescription of physical activity and Physical exercises in Physiotherapy.

Key words: Body composition, Physical characteristics, Physical activity, Body fat, Lean Body mass, BMI

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INTRODUCTION

This study deals with the body composition and fitness analysis of individuals who differ in their physical characteristics viz. weight, height, Age, Sex, Body Frame and physical activity levels viz. (1) Heavy (2) Moderate (3) Light. These individual differences change the body composition and physical fitness levels among various individuals. The present study was conducted to evaluate those changes and thereby identify the ideal combination of physical characteristics and physical activity required for attaining "THE PERFECT BODY COMPOSITION". It is said that "BODY FAT, NOT WEIGHT" IS THE MEASURE OF PERFECT HEALTH AND FITNESS, thus body composition assessment should be an integral part of each individuals physical fitness profile regardless of body weight, NIH'S Health Implication of Obesity.

Importance of Body composition and its analysis: Body composition is a key component of an individual's health and physical fitness profile, Wilmore JH & Behnke AR 1968. Body composition is considered as an ideal parameter for fitness analysis and is gaining much more importance in analyzing fitness levels among individuals in sports and those willing to maintain excellent physical fitness. The evaluation of body composition permits the quantification of major structural components of the body, Muscle, bone and fat, Brozek 1951. As a sports physiotherapist, it is important to realize that the athlete who is willing to maintain optimum level of physical fitness may be "over fat" even though they do not appear to be "overweight". This may happen due to lack of physical activity and individual differences in physical characteristics. Sports physical therapy can help in maintaining excellent physical fitness and enhance performance capabilities of an athlete, by considering body composition analysis as an ideal evaluating tool. Body composition studies are also very important in medicine, as it is an established fact that excessive amounts of fat are associated with many diseases and disabilities. It is known that curvilinear relationship exists between fatness and health risk, Simopoulos 1987. The specific health risks of obesity include impaired cardiac function as a result of increased mechanical work, Alexander et al 1986, Several types of cancer, Simopoulos 1987; menstrual irregularities, National Institute of Health 1985; enormous psychological burden, Bray 1986; smoking, elevated blood lipids and hypertension, Hubert et al 1983 have also been demonstrated. Importance of Physical Characteristics and Physical Activity in Body Composition and Fitness Analysis: Physical characteristics of a person have played key role in the overall development, psychology and general outlook of a person. The physical parameters have over the ages standardized to particular norms of perfection. Physical characteristics have in recent times, helped the individual not only in enhancing his body image for more pristine outlook but also substantially helped in attaining professional excellence. On the other hand, physical activity plays a major role in maintaining those components of physical characteristics that make a man look and feel more physical fir and healthy, Abe et al 1996. A perfect combination of physical characteristics viz. height, weight, age, sex, body frame and physical activity levels viz. heavy, moderate and light in an individual gives him/her "The perfect body composition", useful for achieving an excellent physical fitness. A high percent fat hinders performance in many physical activities, because fat does not contribute to force production capabilities for the musculoskeletal system, Choing et al 1990. Generally for most activities lower the percent body fat, greater the physical performance potential of the individual, especially for activities requiring strength, muscular endurance, and power, Wilmore JH & Behnke AR 1970. Thus the main aim of the study is to find out which are the most significant parameters of body composition, physical characteristics and physical activity that make an individual physically fir or unfit. Different objectives of the study also include: To determine the values for various body composition parameters among overweight, underweight, normal weight, slightly overweight and abnormally underweight males and females.

Review of Literature:

1. Brown and Jones 1977 studied the distribution of body fat in relation to habitual activity in 42 female subjects aged 19-24 years and found no significant differences in the fat distribution. However, they found a higher body density in the very active subjects, which was explained due to the variation in the composition of fat free mass as a result of the differing levels of habitual activity. Obese females showed reduce levels of physical activity whereas high level of physical activity was established among normal and lean females.
2. Siervogel et al. (1980) studied the subcutaneous fat distribution in males and females from 1-39 years of age and found relatively low intersite communalities during the prepubertal years suggesting a tendency in each sex for considerable site-to-site variation during this period. Immediately before puberty and

throughout adolescence, high communalities indicate that the thickness of subcutaneous fat at any site is highly related to thickness at all other sites. This higher degree of variation continues into middle age only in women, implying that more changes occur in their subcutaneous fat that differently affect various parts of the body`

3. Conway et al. (1984) investigated on an approach for the estimation of body composition infrared interactance. The original research using Near-IR technology to perform body composition analysis is described in this paper. This research, which was done using a $100,000 computerized spectrophotometer, identified the wavelengths and mathematics for accomplishing accurate measurements of body composition.
4. Forbes and Brown (1987) studied the energy need for weight maintenance in human beings, effect of body size and composition. Energy requirement was estimated, by determining the amount of food needed to maintain body weight in a controlled environment. It was found that the energy required for weight maintenance was directly proportional to body weight (r=0.92). The increased energy requirement of the obese is due to their greater burden of body fat, together this account for 8% of the variance.
5. Rookus et al. (1984) studied the impact of frame-size categories in weight -height tables was studied by comparing the efficiency of the body-mass index and weight adjusted for body-height and a body-diameter, W/(H2DP), in predicting body fatness. Body-weight, body height, six body-diameters and four-skin fold thickness were measured in 95 men and 70 women, aged between 23 and 35 years. The inclusion of body diameter increased variation of body fatness. The study showed that women possessed greater body fat than males irrespective of body mass index.
6. Rosenthal (1986) observed the characteristics of non-destructive near-infrared instrumentation. He describes the basic concepts of using near-infrared technology to perform quantitative measurements using the food industry as an example. This paper is a basic reference document for those interested in knowing more about near-infrared quantitative analysis.
7. Carole Stroub (1988) conducted investigation for a new method of determining body composition near infrared interactance. Fifty-five volunteers were tested using NIR, skin fold and densiometry. The study revealed that NIR is comparable to skin fold in determining percent body fat. The FUTREX-5000 was the NIR instrument used in the study. A reliability test yielded a correlation coefficient of 0.97, concluding that the FUTREX-5000 XL estimates percent body fat with the same accuracy as the skin fold method. The FUTREX-5000 XL appears to be safe, reliable noninvasive, accurate measurement of body fat.
8. Glauber et al. (1988) studied body weight versus body fat distribution and showed adiposity and frame size as predictors of bone density. Weight, height, hip-waist ratio, elbow breadth, adiposity and BMD were measured in 6705 older women participating in the study of Osteoporotic Fractures. Adiposity was measured by bioelectric impedance and BMD by single-photon and dual energy X-ray absorptiometry. Adiposity explained a substantial fraction of the effect of weight on BMD, particularly at weight bearing sites (36-62%). On the other hand, weight explained virtually all the variability of adiposity on BMD at weight bearing sites. All the overweight individuals are not over fat, thus over weight and over fat are not same thing. They also concluded that overweight males and females showed large frame size than their lean counterparts.

Abbreviations used: BF%- Body Fat Percent, LBM- Lean Body Mass, TBW- Total Body Water, DCI- Daily calorie Intake

METHODOLOGY

Study Design: Observational comparative experimental study.

Sampling:

Population- Total 88 subjects of age group between 20-40 years were taken for study.

Sample Size- Total data is divided into 5 test groups. Group 1, 2 and 3 are having 20 subjects, and group 4 and 5 are having 14 subjects each.

Sampling Criteria-

Group 1- 20 subjects classified as overweight (O.W.) individuals (10 males and 10 females)

Group 2- 20 subjects classified as underweight (U.W.) (10 males and 10 Females)

Group 3- 20 subjects classified as normal weight (N.W.) (10 males and 10 Females)

Group 4- 14 subjects classified as slightly overweight (7 males and 7 Females)

Group 5- 14 subjects classified as abnormally underweight (AUW) (7 males and 7 Females)

Materials:

1. Futrex-5000/XL Body composition and Fitness analyzer, based on the principle of near infrared interactance light technology. The

technique is based on the principle of light absorption and reflection using Near Infrared Spectroscopy.
2. A computer with color printer attached with a powerful chip and a special operating software, which provides "fitness analysis".
3. Electronically designed automatic weighing machine.
4. Anthropometric Rod, designed for easier height measurements.
5. Physical activity questionnaire chart for self-assessment.
6. Height and weight table- for grading individuals according to weight differences.
7. Body frame chart- for grading individuals for their respective frame size
8. National Institute of Health (NIH) Reference data- for grading an individual physically for or unfit in five different rating groups viz. 1) very risky 2) Good 3) Excellent 4) Fair 5) Risky

Procedure: The study consist of following parts-

1. Assessment of physical characteristics: The most important physical characteristic includes Age, sex, and Height, Weight and Body frame. These parameters divided the individuals in to different weight categories for specific body composition analysis. The data chart was employed for more than 200 subjects for this purpose.
2. Assessment of Physical Activity Levels: To analyze physical activity levels a pre-structured questionnaire was employed on each individual.

Physical Activity level assessment chart--

Exercise Frequency- How often the exercise is performed.
[5] Daily or almost daily (6-7 times/week)
[4] 3-4 times per month
[3] 1-2 times per month
[2] Few times per month
[1] Rarely once per month
Exercise intensity- how much energy expenditure
[5] Aerobic activity that results in sustained heavy breathing and perspiration (e.g. High impact aerobics, running, speed swimming, distance cycling etc.)
[4] Aerobic activity that results in sustained heavy breathing with less perspiration and activity little less to extremes
[3] Activities that results in intermediate and less heavy breathing or less tiring activities (moderate activity)
[2] Activity of daily living with efficiency (e.g. walking, jogging etc)
[1] Very Less activity, due to sedentary life style.

Exercise Time- how many minutes the exercise is performed
[5] Exercise over one hour
[4] Over 30 minutes
[3] 20-30 minutes
[2] 10-20 minutes
[1] Under 10 minutes
Individual's physical activity levels were graded as light, moderate and heavy, by the computer software program, which calculated the fit value
Fit value = Ex. Frequency x Ex. Intensity x Ex. Time

3. Assessment of Body Composition: Body composition of the subjects was assessed with the help of Futrex-5000. The measurement was taken at the mid-point of the dominant bicep.

Outcome parameters: Body Mass Index (BMI), Basal Metabolic Rate (BMR), Body Fat%, Fat Free Mass, Height, Weight, Total Body water (TBW)
Inclusion Criteria:
1. Age group between 20-40 years
2. Near infrared interactance light technology was used for body composition analysis
3. Physical activity parameters used for assessment were exercise intensity, exercise frequency and exercise time.
4. Physical characteristics parameters used were age, sex, height, weight and body frame.
5. Healthy individuals were included in the study

Exclusion Criteria:
1. Other methods of body composition analysis were excluded
2. Individuals with Age below 20 and above 40 were excluded
3. Individuals with any illness or disease were also excluded for study.
4. Individuals of other population were also excluded.

STATISTICAL ANALYSIS

Mean standard deviation, error and percentile were used to prepare summary statistics. Student's 't' test was used to compare different variables among various test groups. The corresponding level of confidence was determined by noting the 'p' values at 0.05, 0.01 and 0.001 level of confidence for statistical analysis.

RESULTS

Table 5.1 shows t-values for various parameters obtained by comparing combinations of G1 (O.W.) individuals with individuals of other groups. Among all the combinations statistically highly significant differences ($p < 0.001$) have been observed between (G1 vs. G5) for weight ($t = 14.68$), fat% ($t = 23.45$), fat kg ($t = 12.65$), LBM% ($t = 22.71$), TBW% ($t = 5.95$), TBW Lt ($t = 6.57$), BMI ($t =$

10.9) and exercise intensity (t= 21.3), highly significant differences ($p<0.001$) have been observed between (G1 vs. G3) for exercise frequency (t= 4.87), and exercise time (t= 16.65), and highly significant ($p<0.001$) between (G1 vs. G2) for DCI (t= 6.39), whereas significant differences ($p<0.05$) have been observed for height (t= 3.28), and LBM kg (t= 2.59) between (G1 vs. G5) **Table 5.2** shows t-values for various parameters obtained by comparing combinations of G2 (U.W.) individuals with individuals of other groups. Among all the combinations statistically highly significant differences ($p<0.001$) have been observed for height (t= 5.45), LBM% (t= 11.97), TBW Lt (t= 11.14), DCI (t= 9.08), Ex. Frequency (t= 8.9), exercise intensity (t= 12.38) and Ex. time (t= 10.79) between (G2M vs. G1F), weight (t= 8.99) and BMI (t= 8.2 between (G2M vs. G1M)), BMR (t= 6.52) between (G2M vs. G5F), fat% (t= 12.36), and fat kg (t= 13.28) between (G2M vs. G5M), TBW% (t= 5.13), and LBM kg (t= 5.35) between (G2M vs. G3M) **Table 5.3** shows t-values for various parameters obtained by comparing combinations of G3 (N.W.) individuals with individuals of other groups. Among all the combinations statistically highly significant differences ($p<0.001$) have been observed for height (t= 9.42), LBM kg (t= 4.33), TBW (t= 6.15), fat kg (t= 26.36) and BMI (t= 18.83) between (G3 vs. G5), fat % (t= 14.67), LBM% (t= 14.48), TBW Lt (t= 5.87), DCI (t= 4.72), Ex. Frequency (t= 14.87), exercise intensity (t= 15.92) and Ex. time (t= 16.05) between (G3 vs. G1). Significant differences ($p<0.05$) have also been observed for BMR (t= 2.7) between (G3 vs. G5) and for height (t= 2.28) between (G3 vs. G1). **Table 5.4** shows t-values for various parameters obtained by comparing combinations of G4 (slightly overweight) individuals with individuals of other groups. Among all the combinations statistically highly significant differences ($p<0.01$) have been observed for weight (t= 15.05), fat% (t= 20.35), fat kg (t= 29.61), LBM% (t= 19.82), LBM kg (t= 4.8, TBW% (t= 7.22), and BMR (t= 4.03) and BMI (t= 25.07) between (G4 vs. G5); TBW Lt (t= 4.91), DCI (t= 4.82), Ex. Frequency (t= 8.87), exercise intensity (t= 13.73) and Ex. time (t= 13.7) between (G4 vs. G1). Significant differences ($p<0.05$) have also been observed for height (t= 2.37) between (G4 vs. G1). **Table 5.5** shows t-values for various parameters obtained by comparing combinations of G5 (AUW) individuals with individuals of other groups. Among all the combinations statistically highly significant differences ($p<0.001$) have been observed between (G5 vs. G4) for weight (t= 15.05), fat kg (t= 29.61), LBM kg (t= 4.8), TBW% (t= 7.22) and BMI (t= 25.07); fat% (t= 23.45), LBM% (t= 22.71), TBW Lt (t= 6.57), exercise frequency (t= 14.19), exercise intensity (t= 21.3) and exercise time (t= 14.65) between (G5 vs. G1). Significant differences ($p<0.05$) have been observed for age (t= 2.42) between (G4 vs. G1), BMR (t= 2.7) between (G5 vs. G3) and ($p<0.01$) significant level for height (t= 3.28) between (G5 vs. G1) **Table 5.1 to 5.5** shows t-values for various parameters obtained by comparing combinations of males and females of same group. Among all the combinations statistically highly significant differences ($p<0.001$) have been observed between (G5M vs. G5F) for fat% (t= 10.18), fat kg (t= 6.13), LBM% (t= 10.28), DCI (t= 4.64). Highly significant differences ($p<0.001$) have been observed between (G3M vs. G3F) for height (t= 3.95), weight (t= 7.99), LBM kg (t= 7.84), BMI (t= 2.45; $p<0.01$) and BMR (t= 3.95); highly significant differences between (G4M vs. G4F) have been observed for TBW% (t= 5.96) and for TBW kg (t= 8.890 between (G2M vs. G2F) also showed highly significant differences ($p<0.001$).

Table 5.1 Comparison of overweight individuals with individuals of other group

S. No	Parameters	T- values			
		Combinations of overweight individuals with individuals of other groups			
		G1 vs. G2	G1 vs. G3	G1 vs. G4	G1 vs. G5
1	AGE	1.67	1.73	1.32	2.42*
2	HEIGHT (cm)	3.17**	2.28*	2.37*	3.28***
3	WEIGHT (kg)	9.39***	6.09***	4.44***	14.63***
4	FAT (%)	12.12***	14.67***	10,23***	23.45***
5	FAT (kg)	8.92***	9.33***	6.67***	12.65***
6	LBM %	11.83***	14.48***	10.4***	22.71***
7	LBM kg	2.33**	1.74	1.44	2.59*
8	BMR kcal/day	0.31	0.8	1.63	2.05*
9	DCI cal	6.39***	4.72***	4.82***	3.4**
10	TBW (%)	4.13***	0.91	1.18	5.95***
11	TBW (lit)	3.69***	5.87***	4.91***	6.57***
12	BMI	8.64***	6.38***	5.12***	10.9***
13	EX. FREQUENCY	12.45***	14.87***	8.87***	14.19***
14	EX. INTENSITY	15.09***	15.92***	13.73***	21.3***
15	EX. TIME	14.41***	16.65***	13.7***	14.65***
*Indicates $p<0.05$, **Indicates $p<0.01$, ***Indicates $p<0.001$.					

Table 5.2 Comparison of underweight individuals with individuals of other group

S. No	Parameters	T- values			
		Combinations of underweight individuals with individuals of other groups			
		G2 vs. G3	G2 vs. G4	G2 vs. G5	G2 vs. G1
1	AGE	0.05	0.33	0.75	1.67
2	HEIGHT (cm)	0.85	0.86	0.02	3.17**
3	WEIGHT (kg)	3.37**	6.86***	5.05***	9.39***
4	FAT (%)	3.11**	3.14**	14.69***	12.12***
5	FAT (kg)	1.73	8.74***	20.23***	8.92***
6	LBM %	2.68**	2.92**	13.87***	11.83***
7	LBM kg	3.83***	3.89***	0.4	2.33**
8	BMR kcal/day	1.11	2.04*	1.81	0.31
9	DCI cal	1.9	2.88**	2.96**	6.39***
10	TBW (%)	4.6***	5.23***	0.91	4.13***
11	TBW (lit)	4.01***	2.34*	5.88***	3.69***
12	BMI	7.24***	11.08***	5.66***	8.64***
13	EX. FREQUENCY	1.33	4.77***	1.26	12.45***
14	EX. INTENSITY	0.66	2.71**	2.78**	15.09***
15	EX. TIME	0.66	2.78**	1.85	14.41***
*Indicates $p<0.05$, **Indicates $p<0.01$, ***Indicates $p<0.001$.					

Table 5.3 Comparison of Normal weight individuals with individuals of other group

S. No	Parameters	T- values			
		Combinations of Normal weight individuals with individuals of other groups			
		G3 vs. G4	G3 vs. G5	G3 vs. G1	G3 vs. G2
1	AGE	0.31	0.87	1.73	0.05
2	HEIGHT (cm)	0.71	0.89	2.28*	0.85
3	WEIGHT (kg)	2.57*	9.42***	6.09***	3.37**
4	FAT (%)	6.61***	11.62***	14.67***	3.11**
5	FAT (kg)	10`89***	26.36***	9.33***	1.73
6	LBM %	6.39***	12.88***	14.48***	2.68**
7	LBM kg	0.55	4.33***	1.74	3.83***
8	BMR kcal/day	0.63	2.7**	0.8	1.11
9	DCI cal	0.8	1.15	4.72***	1.9
10	TBW (%)	0.16	6.15***	0.91	4.6***
11	TBW (lit)	2.23*	0.05	5.87***	4.01***
12	BMI	5.56***	18.83***	6.38***	7.24***
13	EX. FREQUENCY	6.95***	0	14.87***	1.33
14	EX. INTENSITY	3.44**	2.04*	15.92***	0.66
15	EX. TIME	3.77***	1.26	16.65***	0.66
*Indicates p < 0.05, **Indicates p < 0.01, ***Indicates p < 0.001.					

Table 5.4 Comparison of Slightly Overweight individuals with individuals of other group

S. No	Parameters	T- values			
		Combinations of Slightly Overweight individuals with individuals of other groups			
		G4 vs. G5	G4 vs. G1	G4 vs. G2	G4 vs. G3
1	AGE	1.08	1.32	0.33	0.31
2	HEIGHT (cm)	0.91	2.37*	0.86	0.71
3	WEIGHT (kg)	15.05***	4.44***	6.86***	2.57*
4	FAT (%)	20.35***	10,23***	3.14**	6.61***
5	FAT (kg)	29.61***	6.67***	8.74***	10`89***
6	LBM %	19.82***	10.4***	2.92**	6.39***
7	LBM kg	4.8***	1.44	3.89***	0.55
8	BMR kcal/day	4.03***	1.63	2.04*	0.63
9	DCI cal	0.55	4.82***	2.88**	0.8
10	TBW (%)	7.22***	1.18	5.23***	0.16
11	TBW (lit)	3.36**	4.91***	2.34*	2.23*
12	BMI	25.07***	5.12***	11.08***	5.56***
13	EX. FREQUENCY	6.48***	8.87***	4.77***	6.95***
14	EX. INTENSITY	6.18***	13.73***	2.71**	3.44**
15	EX. TIME	5.4***	13.7***	2.78**	3.77***
*Indicates p < 0.05, **Indicates p < 0.01, ***Indicates p < 0.001.					

Table 5.5 Comparison of Abnormally Underweight individuals with individuals of other group

S. No	Parameters	T- values			
		Combinations of Abnormally underweight individuals with other groups			
		G5 vs. G1	G5 vs. G2	G5 vs. G3	G5 vs. G4
1	AGE	2.42*	0.75	0.87	1.08
2	HEIGHT (cm)	3.28***	0.02	0.89	0.91
3	WEIGHT (kg)	14.63***	5.05***	9.42***	15.05***
4	FAT (%)	23.45***	14.69***	11.62***	20.35***
5	FAT (kg)	12.65***	20.23***	26.36***	29.61***
6	LBM %	22.71***	13.87***	12.88***	19.82***
7	LBM kg	2.59*	0.4	4.33***	4.8***
8	BMR kcal/day	2.05*	1.81	2.7**	4.03***
9	DCI cal	3.4**	2.96**	1.15	0.55
10	TBW (%)	5.95***	0.91	6.15***	7.22***
11	TBW (lit)	6.57***	5.88***	0.05	3.36**
12	BMI	10.9***	5.66***	18.83***	25.07***
13	EX. FREQUENCY	14.19***	1.26	0	6.48***
14	EX. INTENSITY	21.3***	2.78**	2.04*	6.18***
15	EX. TIME	14.65***	1.85	1.26	5.4***
*Indicates $p < 0.05$, **Indicates $p < 0.01$, ***Indicates $p < 0.001$.					

DISCUSSION

An accurate appraisal of body composition provides an important basis for formulating an intelligent program of total fitness. The frequently used standard age, height, weight tables re of limited value in evaluating physique (Behnke & Wilmore JH et al., 1969,1968) for it is now well established that overweight and over fat are not same thing (Glauber, 1988). The present study on body composition of individuals with differences in physical characteristics and physical activity compared the body composition of individuals differing in body weight and activity levels. It was found that overweight individuals were classified into individuals having risky health status due to excess amounts of fat mass (28.45), higher BMI and lower physical activity. (Rabkin et al., 1997) stated that it is the excessive amount of fat component of the body, which is primarily associated with the multiple atherogenic traits and contributes to an increased risk of disease. Though daily calorie intake (DCI) showed low levels among group 1 overweight individual, due to lack of physical activity and higher BMR they showed excessive amounts of fat deposits. Obese individuals may have low level of calorie intake, yet due to higher BMR and sedentary lifestyle they may store extra fat deposits (Alban et al., 1989), (Shinkai et al., 1994). Whereas, group 5 abnormally underweight individuals showed alarming decrease in body fat% (7.63; $p < 0.001$), statistically high significance was established on comparing them with overweight and normal weight males and females. Lean individuals possessed very low percent body fat whereas exhibited high levels of physical activity (Fogelholm et al., 1996), exercise training enhances fat free mass (Ballor et al., 1994). It is well known that some amount of fat is essential because it serves as an insulator to converse body heat, a metabolic fuel for the production of energy (ATP) and padding for protection, fat% below certain levels can cause severe health hazards (Glauber 1988). Such variations were also found in the study among underweight and abnormally underweight individuals grading them as physically unfit individuals. The study also showed that females possessed excess amounts of fat then males among all the test groups' highly significant differences ($p < 0.001$) were seen for fat% between group5, group4, group3 and group2 males and females. Women possessed greater body fat than males irrespective of body mass index (Rookus et al., 1984). The study also showed greater body frame size in overweight individuals when compared to underweight or normal weight individuals. Obese males and females show large frame size then their lean counterparts (Glauber 1988). LBM% showed alarming increase among abnormally underweight males (94%) and females (91.3%) due to abnormal decrease in fat% making

them physically unfit. The physical activity level among abnormally underweight individuals was found to be very high. Highly significant differences ($p < 0.001$) were established on comparing group1 (OW) individuals with group5 (AUW) individuals ($t = 41.19$) for exercise frequency, ($t = 21.3$) for exercise intensity, ($t = 14.65$) for exercise time. Such high level of physical activity with low levels of fat among AUW individuals made them physically unfit. Lean women exhibited high levels of physical activity (Fogelholm et al., 1996). Individuals having mean age 31.8 with normal height and weight combinations showed all the components of body composition quite similar to the standard reference tables showing ideal body composition parameters for individuals with differences in physical characteristics. They were graded as physically fit individuals having mean height 166cm, weight 60.65kg, fat% 16.77, fat kg 9.88, LBM% 82.6, LBM kg 50.7, BMR 1444 kcal/day, DCI 2381 calorie, TBW% 30.04, TBW lit 62.40, BMI 21.92 with high levels of physical activity in form of exercise frequency 4.6, exercise intensity 4.5 and exercise time 4.35. High statistical significance ($p < 0.01$) was seen on comparing activity levels among overweight and normal weight individuals ($t = 14.87, 15.92, 16.65$ respectively). Thus it is clear that people with a physically active lifestyle or those involved in endurance exercise program maintain a desirable level of body composition (Bijorntrop, 1982). In the light of this observation and discussion it can be concluded that the physical characteristics viz. Age, Sex, Height, Weight and Body frame can modify the normal body composition of an individual. These basic components of physical characteristics can decide whether an individual is fit or unfit. Similarly physical activity also contributes in maintaining ideal body composition. Exercise intensity, frequency and time when incorporated in greater amounts (more than his/her physical characteristics permits) may cause undue stress on the physique of an individual and may make him physically unfit. Similarly all the three components of physical activity when incorporated in lesser amounts may make an individual completely sedentary and alter his physical fitness levels. Thus it can be concluded that to maintain ideal body composition one should get involved into regular physical activity taking care of his or her physical capabilities and characteristics. Putting up Prescribed vigorous physical activity may benefit overweight individuals, whereas underweight Individuals need low intensity exercise, which should be an Individualized Exercises prescription in Physiotherapy.

CONCLUSION

In the light of observation and discussions it is concluded that, physical fitness of an individual depends upon his/her physical characteristics and also upon the level of physical activity performed. Body composition can be considered as an ideal parameter for evaluating physical fitness with special emphasis on physical characteristics and physical activity. Body composition and fitness analysis graded the individuals into 5 different groups: individuals having very risky health status (overweight)[unfit], individuals having risky health status (abnormally underweight)[unfit], individuals having good health status (underweight)[unfit], individuals having fair health status (slightly overweight)[unfit], and individuals having excellent health status (Normal weight)[Fit]. Maintaining ideal physical fitness completely depends upon the way in which an individual balances his physical characteristics, physical activity and body composition. The perfect body combination of all the three as seen among normal weight individuals can be an ideal guideline for achieving "The perfect body composition and ideal physical fitness for an individual". Thus, it is rightly said, "Anything in excess or too less can be harmful". It is only the perfect and proportionate combination of physical characteristics and physical activity, which may provide an individual, willing to maintain ideal body composition, with his desired excellent physical fitness. Definitely more studies are required to still clearly identify the ideal parameters essential for achieving "The perfect physical fitness", yet in the light of present findings it may be stated "to achieve excellent physical fitness ideal combinations of body composition, physical characteristics and physical activity are indispensable" along with Individualized Exercise Prescription as an Prerequisite for appropriate Physiotherapy management.

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