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RESEARCH ARTICLE

ASSESSMENT OF PHYSICAL FITNESS IN FEMALE ADULTS USING TREADMILL IN REALATION TO BASAL METABOLIC RATE

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Abstract

The energy needed for our body to function at rest, while doing nothing, is called basal metabolic rate or BMR. It is the energy needed for our heart, brain, kidneys and other organs to operate and keep us alive. Basal metabolic rate depends on our sex, age, weight and height. The present study was conducted in 30female adult subjects to explore relation between physical fitness using treadmill in relation to basal metabolic rate and the results revealed that no significant correlation and regression observed between load test and BMR, significant correlation was found in between BMR and total energy expenditure, Hb level and highly significant correlation was found in between BMI and BMR.

INTRODUCTION

Physical fitness is a general state of health and well-being, specifically the ability to perform aspects of sports or occupations. Physical fitness is generally achieved through correct nutrition, (Tremblay, 2010) moderatevigorous physical activity, (De groot, 2010) exercise and rest, (Malina, 2010). It is a set of attributes or characteristics seen in people and which relate to the ability to perform a given set of physical activities.

Basal metabolic rate (BMR) represents the largest component of total energy expenditure and is a major contributor to energy balance. Therefore, accurately estimating BMR is critical for rigorous obesity prevention and control strategies. Over the past several decades, numerous BMR formulas have been developed for different population groups. A comprehensive literature search revealed 248 BMR estimation equations developed using diverse ranges of age, gender, race, fat-free mass, fat mass, height, waist-to-hip ratio, body mass index and weight. A subset of 47 studies included enough detail to allow for development of meta-regression equations. Utilizing these studies, meta-equations were developed targeted to 20 specific population groups. A review provides a comprehensive summary of available BMR equations and an estimate of their accuracy. An accompanying online BMR prediction tool was developed to automatically estimate BMR based on the most appropriate equation after user-entry of individual age, race, gender and weight. (Sabounchi et al., 2013).

Alexandra et al., (2005) conducted a cross sectional study of 150 white adults from northeast Scotland, United Kingdom. The results revealed that only 2% of the observed variability in BMR was attributable to within-subject effects, of which 0.5% was analytic error of the remaining variance, which reflected between-subject effects, 63% was explained by FFM, 6% by FM, and 2% by age. The effects of sex and bone mineral content were not

significant (P > 0.05). Twenty-six percent of the variance remained unexplained. This variation was not associated with concentrations of circulating leptin or T3. T4 was not significant in women but explained 25% of the residual variance in men.

In the presnt study assessed the physical fitness in female adults using threadmill in relation to basic metabolic rate.

METHODOLOGY:

In the present study 30 female postgraduate and Ph.D students selected from Acharya N.G.Ranga Agricultural University. And all the subjects were in the age group of 20 to 30years. The body composition such as total body fat(BF), lean body mass(LBM), and total body water(BW), and Basal Metabolic Rate (BMR)were measured using body composition measuring equipment "Bioelectrical Equipment" named as "Body Stat". The heart rates were monitored on a online polar heart rate monitor throughout the exercise period and recovery time. Physical fitness was tested in lab conditions with the help of Graded maximal exercise test (GXT) under laboratory conditions using standard Bruce protocol on the treadmill.

RESULTS AND DISCUSSION:

The results of the study are presented below by using treadmill test and assessed the physical fitness in relation to Basic metabolic rate in female adults.

Family particulars of the subjects:

All the subjects were from nuclear family (100 per cent) and majority had four (33 per cent) or five (30 per cent) members in family with maximum two male (40 per cent) and two female (37 per cent) members. Most of the subjects were unmarried (87 per cent) and doing post graduation (87 per cent). Family income of subjects ranged mostly (30 per cent) between one and half to two lakhs. This was followed by one to one and half lakh (20 per cent). The major reasons could be due to regular, private or government jobs of earning members in the respondent families.

Number of subjects as per BMR in Treadmill Test

The details pertaining to subjects grouping basing BMR were presented in table 1

Table 1: Number of Subjects as per BMR

BMR ranges :	No	Per cent	Mean ±SD
1000-1250	7	23	1170.4 ± 62.5
1251-1500	21	70	1332.9 ± 58.3
1501-1750	2	7	1525.5 ± 12.5

The subjects were grouped depending on the status with regard to BMR and results indicate that Majority (70 per cent) of the subjects had BMR 1251 to 1500 followed by 1000 to 1250 (7 per cent) and 1501 to 1750 (7 per cent).

Changes in parameters of subjects during treadmill test, basing on BMR

Changes in various parameters basing on BMR in subjects during Treadmill test was assessed and is presented in table 2. Initially, heart rate during rest period among all the ranges of BMR was almost same (79 to 82 bpm). But on load test in higher range (1501-1750), higher increase in (196 bpm) heart rate was observed that increased form 82 to 196 bpm. In middle range (1251-1500) increase was slightly lower initially but finally with L6 work load the increase was similar (196 bpm) to that of higher range group. In the lower range (1000-1250) group, the increase in heart rate was close to middle range upto L4 load. But on L5 load, the increase in mean heart rate was very low (179 bpm). Significant correlation and regression was not observed between load test and BMR

Table 2 : Changes in parameters of subjects during Treadmill test, basing on BMR

Parameters	Basal Metabolic Rate Ranges			Correlation	Regression
	1501- 1750 (2)	1251 – 1500 (21)	1000-1250 (7)		
Heart Rates During Work Loads (bpm) :					
Rest	81 ± 0.25	79 ± 6.76	82 ± 8.36	0.0932	-0.678
L1	126 ± 13	121 ± 14.04	124 ± 13.59	-0.3161	1.198

L2	140 ± 9.00	130 ± 9.42	133 ± 16.53	0.0867	-1.95
L3	161 ± 8.50	148 ± 8.08	152 ± 17.36	0.3274	0.736
L4	182 ± 9.5	175 ± 7.95	175 ± 11.10	-0.0422	-0.028
L5	196 ± 8.5	188 ± 6.92	179 ± 5.00	0.223	-0.393
L6	196	196 ± 0.47	–	0.3509	1.402
AT	16 ± 1.00	12.6 ± 1.54	11.8 ± 1.53	0.3852*	-
TEE	106 ± 9.5	73 ± 15.98	66 ± 14.85	0.4182*	-0.174
Heart Rate (bpm) Recovery Time (mt) :					
15	-	108 ± 6.99	98 ± 3.55	-0.4456*	0.505
20	112 ± 0 .00	109 ± 8.89	-	0.3788*	0.565
25	109 ± 0.00	105 ± 0.00	-	0.2086	0.455
B.P Systolic (mm Hg) :					
Before	112 ± 3.00	109 ± 6.87	100 ± 3.13	0.4054*	0.869
After	130 ± 7.00	129 ± 9.58	123 ± 7.82	0.3262	-0.908
B.P Diastolic (mm Hg) :					
Before	81 ± 11.0	71 ± 5.00	69 ± 15.1	0.3147	0.776
After	83 ± 9.00	75 ± 7.09	69 ± 7.26	0.321	0.386
Pulse Rate (bpm) :					
Before	76 ± 8.5	82 ± 8.72	96 ± 13.78	0.0819	0.12
After	147 ± 0.50	125 ± 11.6	125 ± 18.89	0.4613*	0.84
Bmi	23 ± 0.50	22 ± 3.30	20 ± 1.83	0.5032**	-
Body Composition (Per cent) :					
Fat	23 ± 1.20	29 ± 4.85	31 ± 2.93	-0.1363	-
Lbm	77 ± 1.22	71 ± 11.04	69 ± 2.95	-0.0423	-
Body Water	53 ± 0.10	52 ± 3.94	54 ± 3.45	-0.4302*	-
Hb (g/dl)	13 ± 1.25	11 ± 1.58	10 ± 2.38	0.4429*	-
F = 0.92614 NS					

NS: Not significant ** Significance at 1% * Significance at 5%	L1 to L6 are work loads with 3 mt increase (mt) TEE : Total Energy expenditure (K.cal / AT) AT : Activity time	- Negative correlation & regression #Values in parenthesis indicate number of subjects

AT revealed higher time (16 mt) for higher BMR group, followed by middle BMR group (12.6 mt) and least time for lower range (11.8 mt). But the lower range group withdrew at L5 load only.

The total energy expenditure showed a definite trend i.e. with increase in BMR, the energy expenditure proportionately increased (106 K.Cal / AT) in higher range group. In lower range group the total energy expenditure was very low (66 K.Cal / AT). In the middle range, the total energy expenditure (73K.Cal / AT) was between lower and higher BMR ranges. The maximum number of subjects (21) fell into middle range group and followed by lower (7) and higher (2) range. The total energy expenditure significantly correlated to BMR at 5 per cent level.

Heart rate recovery time revealed a decrease in heart rate after 20 to 25 mt, rest in the higher range group. While in the middle range group, heart rates recovered in 15 to 25 mt. The lower range group took only 15 mt to recover. Among all the groups, the lowest heart rate was 98 bpm (Lower range group). A significant correlation at 5 per cent level was observed for 15 mt and 20 mt rest time and BMR.

The systolic B.P was not similar initially, but increased in similar way after load test and the increase was between 18 and 23. Before the exercise, the systolic B.P significantly correlated to BMR, at 5 per cent level. The diastolic B.P revealed a similar trend that of systolic B.P. Following load test in treadmill, a slight increase in diastolic B.P was noticed that ranged between zero (Lower range) and four (Middle range).

The pulse rate showed a contradicting trend to that of systolic and diastolic B.P. Initially and following exercise load, increase was observed in reverse order that is the higher range which had pulse rate initially 76 bpm increased to 147 bpm while the lower range group who had pulse rate initially 96 bpm increased to 125 bpm. In the middle range group, the pulse rate increased from 82 to 125 bpm. The pulse rate after load exercise significantly correlated to BMR, at 5 per cent level.

BMI showed a higher index (1501 – 1750) in higher range group, lower BMI (20) lower BMR (1000-1250) group and middle BMI (22) in middle BMR (1501-1500) group. Highly significant correlation was observed at (1 per cent) level between BMI BMR.

Fat per cent was less (23 per cent) in higher range group while higher (31 per cent) in lower range group.. The LBM was higher (77 per cent) in higher range BMR group followed by middle group (71 per cent) while other groups had 69 per cent LBM. Body water was in similar range (52 – 54 per cent) among all the groups and negatively correlated significantly correlated at 5 per cent level.

The haemoglobin levels showed a very good trend with increase in BMR. Haemoglobin levels ranged from 10 to 13 g/dl in a different BMR groups. The subjects in lower range group were anaemic. A significant (5 per cent) correlation was observed between BMR and Hb level

CONCLUSION:

Among all the factors, TEE, B.P, recovery time, BMI, body water and Hb level positively correlated to BMR but the F value was not significant for BMR.

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