

Co-Relation of Timed Forearm Plank Test with Basal Metabolic Rate in Sedentary Urban Females of Age Group 25 to 55 Years

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Abstract-The basal metabolic rate (BMR), defined as the energy required for performing vital body functions at rest, is the largest contributor to energy expenditure and is a major contributor to energy balance. Therefore, accurately estimating BMR is critical for developing rigorous obesity prevention and control strategies. The Timed Forearm Plank Test, also known as the Prone Bridge Test, is a simple and cost effective fitness test of core muscle strength which can be easily self-administered. It is also an excellent technique for strengthening the core muscles. Very few studies have studied the relationship of Basal Metabolic Rate and isometric muscle endurance which is known to be less in the female population. Therefore the need to establish whether there is a significant relationship between the BMR and isometric core muscle endurance in adult females.

Key Words: Basal Metabolic Rate (BMR), isometric muscle endurance, plank test, females, core muscles, obesity.

1. INTRODUCTION

The basal metabolic rate (BMR), defined as the energy required for performing vital body functions at rest, is the largest contributor to energy expenditure and is a major contributor to energy balance. Therefore, accurately estimating BMR is critical for developing rigorous obesity prevention and control strategies.¹ Low BMR plays an important role in the pathogenesis of the obesity and age related chronic disease in old age. There is a clear sex effect on average daily metabolic rate in the general population, with average daily metabolic rate in females being 11% lower than in males of the same age and body size²

The size of the change in energy expenditure associated with physical activity is generally higher than the energy cost of the training intervention. Obesity as measured by increased BMI and body fat percentage is associated with decreased back and core muscular endurance in the general population^{3,4}. Various studies have proven that there is a direct relationship between BMR with Fat Free Mass (FFM) and Obesity. Training might delay the age-induced impairment of personal mobility associated with a reduction in physical activity⁵

Decreased strength of the core muscles is a common finding in obese individuals⁶. The Timed Forearm Plank Test, also known as the Prone Bridge Test, is a simple and cost effective fitness test of core muscle strength which can be easily self-administered. It is also an excellent technique for strengthening the core muscles^{7,8}. Very few studies have studied the relationship of Basal Metabolic Rate and isometric muscle endurance which is known to be less in the female population. Therefore the need to establish whether there is a significant relationship between the BMR and isometric core muscle endurance in adult females.

1.1 Aim

Co-relation of Timed Forearm Plank Test with Basal Metabolic Rate in Sedentary urban females of age group 25 to 55.

1.2 Objectives of the study

1. To score sample population on the performed Timed Forearm plank test.

2. To study the Basal Metabolic Rate (BMR) in the sample population.
3. To study their co-relation with each other.

2. Review of literature

Klaas R. Westerterp & P. Meijer² et al (2001) in their study 'Physical activity and parameters of ageing – A Physiological perspective' established that increasing age is associated with declining physical activities & with changes in a number of physiological parameters.

Sarah. L. Strand, John Hjelm⁷ et al. (2014) in their study 'Norms for an Isometric Muscle Endurance Test' observed that physical activity and athletic status were significantly related to the Prone Timed Forearm Plank test time.

K A Chase, C E Brigham⁸ (2019) in their study 'Fitness Norms for the Plank Exercise' established the normative fitness measurements of core musculature endurance using Plank Exercises.

Oh SK, Son DH¹⁴ et al in their study, 'Association between Basal Metabolic Rate and Handgrip Strength in Older Koreans', stated that the study established a relationship between the BMR and the muscle strength itself in old population, which strongly suggest that increasing muscle strength besides muscle mass should be considered to improve their BMR in older people.

3. Methods and Study design

3.1 Design

Co-relational study

3.2 Inclusion criteria

50 middle aged sedentary women belonging to the urban setup of age group 25 to 55.

3.3 Exclusion criteria

1. Pregnancy
2. Spinal surgery
3. Acute low back pain
4. Any significant medical history
5. Any other musculoskeletal problems

3.4 Materials

1. Validated patient consent form and screening questionnaire
2. Stedometer
3. Stopwatch
4. Tanita Body Composition Monitor (Model: BC-541N)

3.5 Methodology

Written consent was obtained from the sample population. Vital parameters like pulse rate, respiratory rate and blood pressure were noted. Evaluation proforma was administered. Basal Metabolic Rate measured. Timed Forearm Plank Test was administered after prior demonstration. Hold time noted of the core abdominal muscles was noted.

3.6 Statistical Analysis

2-way ANOVA

4. Results

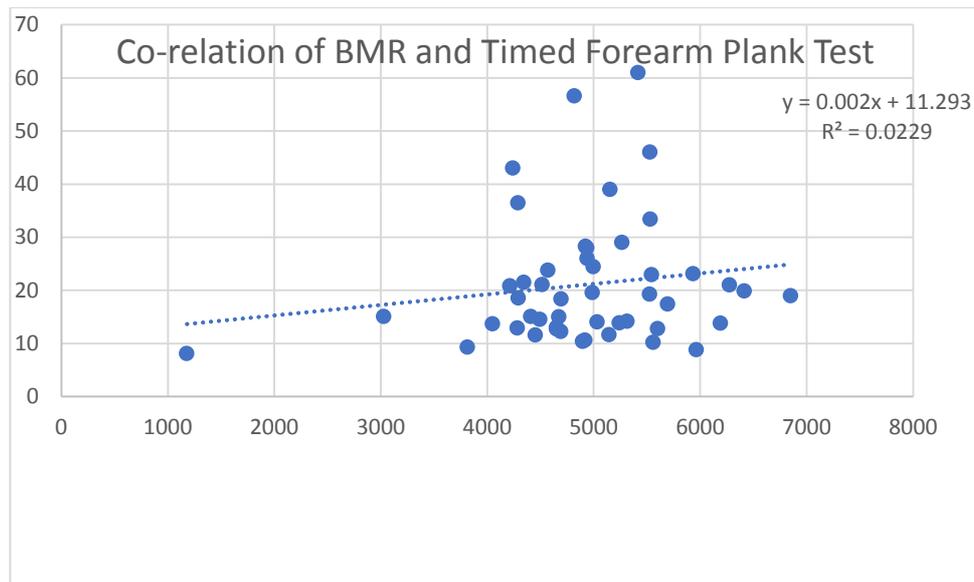


Chart -1: Co-relation between Basal Metabolic Rate and Time Forearm Plank Test

Inference: Basal Metabolic rate has a weak positive co-relation with Timed Forearm Plant Test ($p=0.151$, $r=0.1513$, $r^2=0.0229$)

4. Discussion

This study intended to find out relation of Basal Metabolic Rate (BMR) with the Timed Forearm Plank Test. A weak positive co-relation was observed between the two variables ($r=0.1513$). The above study supports the hypothesis active women who participate in habitual physical activity can maintain lower body fat and a higher BMR than sedentary controls with similar body mass and Fat free mass³ A substantial proportion of total energy expenditure is accounted for by BMR, which is determined principally by body mass and body composition both of which vary with age and sex. Females generally have a lower BMR as compared to males. Also a lower BMR is said to have a negative effect on physical activity, though Fat Free Mass is said to be more of an accurate predictor for the same. Various studies suggest that the resting metabolic rate of trained muscle is around 55kJ per kilogram, per day. Even a substantial increase in muscle mass, say 5 kg, would make only a minor impact on BMR.^{10,11} Hence there is a definite co-relation of BMR with physical activity and training. Factors such as thyroid hormones, catecholamines, genetics, as well as menstrual phase and menstrual dysfunction are additional determinants. Energy balance is an extrinsic factor known to influence metabolic rate^{12,13}. Multiple other factors like age, body, temperature of the environment and diet also are said to influence metabolic activity at rest¹⁴. A strong co-relation therefore cannot be established using a single variable. Although the Timed Forearm Plank Test is an excellent indicator of Isometric Muscular endurance of the core muscles it is an insufficient indicator of the Basal Metabolic Rate. The fat free mass and other extrinsic variables should be taken into account to when studying physical fitness and activity levels.

4.1 Conclusion

There is a weak positive co-relation between the Basal Metabolic Rate and the Timed Forearm Plank Test in sedentary urban females aged 25-55 years.

4.2 Limitations

1. Extrinsic factors affecting the BMR were not considered
2. Limited sample size

4.3 Clinical Implications

The Basal Metabolic Rate (BMR) when combined with Fat Free Mass is a better indicator for physical activity levels and should be considered during evaluation and monitoring of patients.

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