Abstract

The present study was conducted to see the effect of physical activity and nutrition on physical fitness of adult population of 50 to 75 years. For this 200 subjects were selected from the city of Mumbai and were divided into two age groups, 50 to less than 60 years and 60 to less than 75 years. Data was collected on physical activity and dietary intake of the subjects. The calorie, protein, calcium and iron intake of the subjects was determined through a two day food diary and physical fitness was determined using 6 minute walk test. Statistical analysis was done using t-test and ANOVA. The results showed that physical fitness was significantly associated with physical activity (p<0.01). Physical fitness was also found to reduce significantly with increase in age (p=0.00). In terms of nutrition, significant correlation was found only in case of iron intake and physical activity. Thus to conclude, physical fitness reduces with age but is greatly influenced by physical activity of the individuals and to some extent by their nutritional intake.

1. Introduction

Old age comprises of the later part of life. Lately, there has been a sharp increase in the number of older persons worldwide. According to the Demographic Profile of Elderly, 15% of world’s elderly population lives in India. With a decline in fertility and mortality rate and increased life expectancy due to betterment in medical facilities there is a progressive rise in the number of elderly persons. In recent years there has been an increasing international awareness of health issues relating to aging populations. Aging results in significant decline in muscle power and exercise capacity. Therefore, elderly often function at the limit of their capacity in order to fulfil activities of daily living. Determination of physical fitness is important in clinical decision making. Many
Physical fitness denotes the ability to carry out daily tasks with vigour and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits [2]. Physical fitness is generally achieved through physical activity, correct nutrition, and rest. Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure [2]. Physical inactivity has been identified as the fourth leading risk factor for global mortality causing an estimated 3.2 million deaths globally. Regular moderate intensity physical activity – such as walking, cycling, or participating in sports – has significant benefits for health such as reduction in the risk of cardiovascular diseases, diabetes, colon and breast cancer, and depression. Moreover adequate levels of physical activity will decrease the risk of a hip or vertebral fracture and help control weight.

Optimal nutrition and physical activity make a significant contribution to the physical fitness and the overall quality of life at any age and especially for older adults. Improper nutrition can lead to several problems such as under-nutrition, over-nutrition, iron deficiency leading to anaemia, decreased physical ability, impaired body temperature regulation, lowered resistance to infection, and alterations in behaviour and intellectual performance. Similarly, calcium deficiency can cause bone problems and alteration in strength [3].

A lot of studies have been done on the relation between physical fitness and physical activity for children, adolescents and young adults. But there is a paucity of research in the field of physical fitness for older adults. Thus this study was planned to observe the effect of physical activity and dietary intake of older adults on their physical fitness.

2. Methodology

A sample size of 200 subjects was selected from the age group of 50 to 75 years. The population was divided into 2 groups: 50 to less than 60 years (N=111) and 60 to less than 75 years (N=89). Both the groups included males as well as females. The subjects recruited for the study included those:

i. Who did not have any problem in walking or standing,
ii. Who have not suffered from any acute illness in the past 3 months
iii. Who were not suffering from severe arthritis, severe osteoporosis, and peripheral neuropathy or have undergone any bone related as well as cardiovascular surgery in the past.

A consent letter was signed by the participating subjects before recording their data. The study proposal was approved by Inter System Biomedical Ethics Committee, Mumbai.

2.1 Tools for data collection

2.1.1 General questionnaire: The General Questionnaire had three sections (a) Basic information such as name, age, medical history, number of family members, family income etc, (b) Anthropometric data consisted of height and weight of the subjects, from which BMI of the subjects was derived, (c) Record of type of Physical activity with its duration and frequency. From this information, each subject was allotted a physical activity score based on physical activity index developed on the basis of PAR (Physical Activity Ratio) values for each activity. The formula is given as follows:

$$\text{Physical Activity Index} = (\text{Intensity Factor}) \times (\text{Duration}) \times (\text{Frequency})$$
2.1.2 **Two day food diary**: This was used to determine dietary pattern of the subjects. The food diary included the time of meal, the name of food item, the ingredients used for each food item and their respective quantity in household measures. The data collected was then analyzed for subjects’ intake of calories, protein, calcium and iron and to compare it with their RDA. Also the nutrient consumption helped in determining if there was any correlation between physical fitness and nutrition.

2.1.3 **Physical fitness test**: To test the physical i.e. cardio-respiratory fitness of the subjects, a 6 minute walk test was conducted. It is a sub-maximal test for measuring aerobic capacity. The test requires a long and even path where the subjects can walk, a stop watch, a blood pressure measuring machine. The instruments were calibrated for both validity and reliability. The blood pressure and heart rate of the subjects is monitored before the test, i.e., in relaxed state. Once the subjects are ready, they are asked to walk continuously for 6 minutes. The aim is to cover maximum distance in 6 minutes without breaking into a run. After completion of 6 minutes, the blood pressure and the heart rate of the person are monitored again. The results obtained were analyzed statistically. The closer the post-test blood pressure and heart rate is to the pre-test blood pressure and heart rate, the greater the fitness level of the subject. Also as per the findings given by Jones and Rikli (2002), the lesser the difference between pre-test BP/heart rate and after 6 min rest BP/heart rate, the greater the fitness levels [4].

Statistical analysis of the data was done using frequency, mean, t-test, ANOVA and correlations. The mean values were determined for physical activity index, distance covered in 6MWT, BP and heart rate and the individual nutrient consumptions for both the age groups. Also correlations were determined among physical activity index, physical fitness test results and nutrient consumption.

### 3. Results And Discussion

The mean height, weight, and BMI values were found to be 162 cm ± 8.51, 71.1 kg ± 11.29 and 27.2 kg/m² ± 4.74 respectively. On categorizing the sample population based on their BMI, it was found that 39% of the people were obese, 48.5% were overweight and only 12.5% were normal.

#### 3.1 Physical Activity Index

Data collected showed that one quarter of the sample population did not indulge in any physical activity. Out of the 75% who did indulge in some physical activity, majority indulged in walking. The sample population was classified into 5 group based on their physical activity index: no activity (PAI: 0), very low activity (PAI: 1 to 30), low activity (PAI: 31 to 60), moderate activity (PAI: 61 to 90) and high activity (PAI: above 90). The following table shows the count and percentage of people falling in each category:

<table>
<thead>
<tr>
<th>Physical Activity Index</th>
<th>Category</th>
<th>Number of subjects</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No activity</td>
<td>50</td>
<td>25%</td>
</tr>
<tr>
<td>1 to 30</td>
<td>Low activity</td>
<td>74</td>
<td>37%</td>
</tr>
<tr>
<td>31 to 60</td>
<td>Moderate activity</td>
<td>55</td>
<td>27.5%</td>
</tr>
<tr>
<td>61 to 90</td>
<td>High activity</td>
<td>18</td>
<td>9%</td>
</tr>
<tr>
<td>Above 90</td>
<td>Very high activity</td>
<td>3</td>
<td>1.5%</td>
</tr>
</tbody>
</table>
The mean value of physical activity index was 27.34 ± 22.97 for the age group 50 to 60 years and 32.78 ± 30.83 for the age group 60 to 75 years. No significant association was found between age and physical activity.

3.2 Two Day Food Diary

The 2 day food diary was analyzed for consumptions of calories, proteins, calcium and iron. The consumption values were compared with the RDA. The following results were found:

**Figure 1: Percentage consumption of calories**

- More than 100% of RDA, 14.0%, 14%
- below 33% of RDA, 1.0%, 1%
- 33% to 66% of RDA, 34.5%, 35%
- 66% to 100% of RDA, 50.5%, 51%

**Figure 2: Percentage consumption of proteins**

- More than 100% of RDA, 24.0%, 24%
- 33% to 66% of RDA, 21.0%, 21%
- 66% to 100% of RDA, 54.5%, 55%
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Figure 3: Percentage Consumption of Calcium

Figure 4: Percentage consumption of iron
The mean values for consumption of various nutrients in the two age groups are given in Table 2 below. A significant decrease was found between the age groups for consumption of only iron consumption (p=0.024).

Table 2: Mean consumption of nutrients in different age groups

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>50 to less than 60 yrs</th>
<th>60 to less than 75 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average calorie consumption (kcal)</td>
<td>1470.87 ± 388.23</td>
<td>1497.19 ± 328.73</td>
</tr>
<tr>
<td>Average protein consumption (g)</td>
<td>46.48 ± 12.93</td>
<td>48.23 ± 11.16</td>
</tr>
<tr>
<td>Average calcium consumption (mg)</td>
<td>775.51 ± 360.73</td>
<td>773.60 ± 289.39</td>
</tr>
<tr>
<td>Average iron consumption (mg)</td>
<td>13.02 ± 5.61</td>
<td>11.48 ± 3.38</td>
</tr>
</tbody>
</table>

3.3 Six Minute Walk Test
The mean values for distance covered in six minutes were 308.80 meter ± 105.78 for the age group 50 to 60 years and 244.03 meter ± 119.31 for the age group 60 to 75 years. A t-test showed that the distance covered by age group 50 to 60 years was significantly higher than the distance covered by age group 60 to 75 years (p=0.000). The same findings are reported in the studies done by Teresa, et al. (2002), Steffen and Hacker (2002) and later on by Mahajan & Mistry. All of these researchers have confirmed that there is a progressive decline in the 6 minute walk distance with increasing age [1, 6, and 7].

On analyzing the BP and pulse of the subjects, a significant rise was found in both systolic and diastolic blood pressure as well as the pulse after the test (p=0.000). On comparing the data between the two age groups, the rise was found to be significant in both the age groups (p<0.01). The mean values have been mentioned in the table below.

Table 3: Mean values of BP and pulse in different age groups

<table>
<thead>
<tr>
<th>Parameter</th>
<th>50 to less than 60 yrs</th>
<th>60 to less than 75 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP before test: systolic (mm Hg)</td>
<td>133.44 ± 16.217</td>
<td>139.26 ± 19.289</td>
</tr>
<tr>
<td>BP after test: systolic (mm Hg)</td>
<td>142.96 ± 16.820</td>
<td>148.28 ± 19.587</td>
</tr>
<tr>
<td>BP before test: diastolic (mm Hg)</td>
<td>82.90 ± 10.534</td>
<td>80.82 ± 9.379</td>
</tr>
<tr>
<td>BP after test: systolic (mm Hg)</td>
<td>84.57 ± 11.031</td>
<td>84.35 ± 11.608</td>
</tr>
<tr>
<td>Pulse before test (beats/min)</td>
<td>79.33 ± 11.207</td>
<td>72.84 ± 10.770</td>
</tr>
<tr>
<td>Pulse after test (beats/min)</td>
<td>86.56 ± 12.202</td>
<td>81.12 ± 21.908</td>
</tr>
</tbody>
</table>

To find out the association between physical fitness, physical activity and nutrition, the results of physical activity index, 6 minute walk test and two day food diary were correlated with each other through Pearson’s correlation.

3.4 Physical Fitness And Physical Activity
The results of physical activity index were correlated with distance covered in 6MWT and the rise in BP and pulse post the 6MWT. From the results, we found out that people with higher physical activity index covered more distance in the 6MWT. The results were significant for both the age groups (p<0.01). The results are in accordance with those established in the study conducted by Milanovic et al in 2013. This study showed that physical fitness declined due to a decline in the physical activity [8]. When the results of the rise in BP and pulse of our study population were correlated to the physical activity index, there was no correlation found between these parameters.
3.5 Physical Fitness And Nutrition

So far as nutrition was concerned there was no major effects seen of energy and protein consumption of the population on their physical fitness. Even though about 71% of the population consumed calcium more than the RDA, no correlation was found between the consumption of calcium and physical fitness of the people. However, a significant correlation was found between the consumption of iron and the distance covered in 6MWT for both the age groups (p<0.05). This means that people with lower iron intake are able to cover lesser distance in 6 minutes. This is because iron plays a major role in transport of oxygen through formation of haemoglobin. When iron levels are low, haemoglobin levels will also be low which in turn will reduce the oxygen transport to exercise muscles. Hence the aerobic capacity of a person is affected and his performance in exercise reduces [9, 10].

4. Conclusion

In the present study population, physical fitness was found to be reducing with advancing age. Overall more physical activity was seen in males than in females. Through this study we could also establish that an association exists between physical activity and physical fitness. The statistical significance was only seen in case of distance covered in 6 minute walk test but not in terms of BP and pulse. As can be logically explained, those who are physically more fit are engaged into more physical activities.

We also observed significant association between iron consumption and physical fitness but the association was not significant between calcium intake and physical fitness. This could be because of many confounding factors like bioavailability of calcium sources, poor calcium absorption in this age and less vitamin D intake etc.

5. References