Research article

Association of health literacy and physical activity with physical fitness level among adults

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ABSTRACT

Introduction and Aim: ‘Health is wealth’ is the best quote heard but the importance of it is realized only when health is lost. This study aims to assess the knowledge of health information, physical activity level among the adults and correlate this with their physical fitness.

Methods: Healthy adults were recruited from the general population through simple random sampling. Physical activity, health literacy, muscle strength, endurance and flexibility were assessed using International Physical Activity Questionnaire (IPAQ), Health Literacy Survey European Questionnaire 16, hand grip test, curl up test, sit and reach test respectively. Data analysis was performed using Primer of Biostatistics (Version 7) statistical software.

Results: A total of 51 participants (36 females) with an average age of 34 years and BMI of 24.2 kg/m² were recruited in the study. Health literacy (HL) score was found to be inadequate in 15% and limited in 37% of the studied population. Majority (62%) had low levels of physical activity. We found a strong association of health literacy, with physical activity and muscle strength, muscle endurance, flexibility and physical fitness index (p = 0.000 for all).

Conclusion: The health literacy was good, though the physical activity scores indicated more inactive people. Majority had normal muscle strength and average to above average level of flexibility, but muscle endurance was greatly affected owing to an unacceptable physical fitness index. The study demonstrates significant association between health literacy, physical activity, and physical fitness level among adults. Adequate health literacy is necessary to comprehend and utilize health information.

Keywords: Endurance; flexibility; muscle strength.

INTRODUCTION

Health is wealth’ is the best quote heard but the importance of it is realized only when health is lost. The benefits of physical activities and exercises have been known from ages, but the present-day lifestyle has resulted in a decrease in physical fitness level and an increase in the non–communicable diseases (1,2). Numerous efforts have been taken by the government and health institutions to promote good health and prevent diseases. Health literacy (HL) has been found to be an important intervention in health promotion.

Health literacy (HL) as defined by World Health Organization (WHO) is “cognitive and social skill which determine the motivation and ability of individuals to gain access to, understand and use information in ways that promote and maintain good health” (3). Study on physical activity (PA) and inactivity pattern in India has shown a staggering figure of inactive individuals who are at risk of developing non-communicable diseases (4). It has also been seen that HL in patients of chronic diseases is associated with preventive behaviour and compliance to pharmacological management (5). Studies have also shown that there is a strong relationship between HL and self-assessed health (6).

Research related to HL is still limited to reading and pronunciation and studies related to higher skills and practices to utilize information are few (7). There is research with contradicting views on association of HL with physical fitness levels (8). and studies done on HL and physical fitness in the Indian scenario are few. Lack of HL (because of inadequate knowledge) can make the general population suffer. This study offers the opportunity to explore the different domains of HL and physical fitness levels in populations with different strata of education and delve into the relationship between health information and fitness levels. Here, we test the hypothesis that individuals with good health literacy have good physical activity and physical fitness level.

The current study aimed to estimate the health literacy, physical activity, fitness levels (muscular strength, endurance, flexibility, and cardiovascular fitness) among the adults and to determine whether health literacy correlates with physical activity and physical fitness level.
MATERIALS AND METHODS

This exploratory cross-sectional study was designed to recruit 51 adults from the general population. The sample size was calculated using WinPepi software and assuming 69% of likely sufficient literacy with a 13.8% error at a confidence level of 95%. Sample size estimated to 44 individuals but considering probable dropouts we aimed to recruit 50 participants. The study was conducted after obtaining ethical clearance from the Institutional ethical committee and an informed written consent was obtained from each participant.

Participants were recruited from different Housing societies in Pimpri-Chinchwad municipal area. Chairman of these societies were asked to inform the society members to gather at the club house of the society. The study procedure was addressed to the people gathered. Detailed participant information was taken of the subjects willing to take part in the study. Participants were screened further based on the predefined inclusion and exclusion criteria. Each of these subjects were further selected based on simple random sampling.

We included those with the age range of 25-50 years and of either gender. Participants with any acute/chronic illness like cardiovascular, respiratory, orthopedic diseases, neurological disorders, etc., those who were on any medications and who were having any kind of addictions were excluded.

Anthropometric and blood pressure measurements

Height was measured using a calibrated portable stadiometer; weight was measured using a digital weighing scale. Blood pressure (BP) was measured using Omron digital BP apparatus respectively.

Physical activity and health literacy measurement

Short form International Physical Activity Questionnaire (IPAQ) was given to assess their physical activity level following which health literacy survey European Questionnaire 16 (HLS-EU-Q 16) was given to the individuals to assess their knowledge on health information.

Physical activity categories

a. Scoring a HIGH on the IPAQ: 1500-3000 MET minutes a week.
   b. Scoring a MODERATE on the IPAQ: 600 MET minutes a week.
   c. Scoring a LOW on the IPAQ: none of the criteria for either MODERATE or HIGH levels of physical activity is met (9).

HLS-EU-Q16 scoring was done through Likert scale and results are analyzed as scores between 0 and 16, categorized as inadequate (<9), limited (9–12) or sufficient (13–16) health literacy (10).

Physical fitness measurements

After answering both the self-administered questionnaires, the individuals were tested for muscle strength, muscle endurance, flexibility, and cardiovascular fitness. Study was conducted between 6 pm - 8 pm. The above fitness components were assessed using the tests given below:

Muscle strength by using handgrip dynamometer

Camry electronic hand grip dynamometer instrument was used. The dominant upper limb was tested. It is a static isometric test where the subject was asked to sit on the chair, with elbows flexed at 90° and forearm kept in neutral position (semi-pronated). Subject should squeeze the handgrip dynamometer as hard as possible. Highest of 3 recordings was taken. Based on their performance they were categorized as weak, normal and strong (11).

Muscle endurance by curl up test

Subject was made to lie supine on a mat with legs flexed at a 90-degree angle, arms prone lying by the body’s side just touching the tape strip perpendicular to the trunk. Another tape strip is kept lying 12 cm away from the first. Movement of the trunk should be at the rate of 1 repetition in 2-3 secs. Timing was set with the metronome MT -10 meter tuner at the rate of 25/minute. Procedure was terminated when the person was unable to reach the other strip or unable to produce other repetition. Based on the number of repetitions done, they were categorized as below average, average and above average (12).

Flexibility was tested using sit and reach test

A measuring tape was placed on the floor and tape placed at a right angle to the 15-inch mark. Subject sat with measuring tape between the legs and legs extended at right angles to the taped line on the floor. Heels of the feet touched the edge of the taped line and was about 10-12 inches apart. Subject moved forward as far as possible and was asked to hold in position for 2 seconds. Best of the two trials were taken. Based on the highest value, they were categorized as below average, average and above average (12).

Cardiovascular fitness by Harvard step test

In this test, male and female subjects stepped up and down on an 18 inch and 17-inch-high bench 30 times per minute for five minutes respectively. Rate was fixed with the help of the metronome. Subjects were asked to step up and down by adjusting the rate with the metronome. If the subject gets exhausted earlier, duration for which the subject was able to perform was noted. At the end of the task the subject was asked to sit immediately. Pulse was counted at 1-½ minute, 2-½ minute and 3-3½ minutes. Physical fitness index was calculated with the formula:

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Duration of exercise in seconds × 100
2 x (sum of pulse counts during recovery)

Based on the scores obtained from the physical fitness index, subjects were classified with <65 as unacceptable, 65-79 as marginally acceptable and >79 as acceptable physical fitness level (13).

Data was entered in excel and analyzed using Primer of Biostatistics (Version 7.0) by Chi square test. Quantitative data was summarized using Mean and Standard Deviation (SD).

RESULTS
A total of 51 participants were recruited from the general population. Of the recruited participants, 15 (29.42%) were males and 36 (70.58%) were females. They had mean age of 33.82±4.43 years, average height of 161.66±7.17, weight of 63.59±12.38 and BMI of 24.29±4.35. [3(5.88%) was underweight, 21(41.18%) were normal and 27(52.94%) were overweight]. Forty seven percent of them were employed and 53% were homemakers.

Based on the HL scores, 8 (15.09%) showed inadequate, 19 (37.25%) limited and 24 (47.06%) sufficient health literacy. The PA scoring showed 32 (62.74%) participants had low, 13 (25.49%) moderate and 6 (11.76%) had high levels of physical activity. Categories of different parameters are retitled in the result section for easier understanding (Inadequate, limited, sufficient of HL, weak, normal, strong of muscle strength, below average, average, and above average of muscle endurance and flexibility, unacceptable, marginally acceptable, and acceptable are retitled as low, moderate and high respectively). Distribution of study participants in various physical fitness parameters is given in Table 1.

<table>
<thead>
<tr>
<th>Performance categories</th>
<th>Muscle strength n (%)</th>
<th>Muscle endurance n (%)</th>
<th>Flexibility n (%)</th>
<th>Physical Fitness Index n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>7(13.73%)</td>
<td>44(86.27%)</td>
<td>18(35.29%)</td>
<td>51(100%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>44(88.27%)</td>
<td>7(13.73%)</td>
<td>18(35.29%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>High</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>15(29.42%)</td>
<td>0(0%)</td>
</tr>
</tbody>
</table>

Data presented as n (%)

Table 2: Association of health literacy with physical activity and muscle strength

<table>
<thead>
<tr>
<th>Performance categories</th>
<th>HLS n (%)</th>
<th>PAS n (%)</th>
<th>MS n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>8(15.69%)</td>
<td>32(62.74%)</td>
<td>7(13.73%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>19(37.25%)</td>
<td>13(25.49%)</td>
<td>44(88.27%)</td>
</tr>
<tr>
<td>High</td>
<td>24(47.06%)</td>
<td>6(11.76%)</td>
<td>0(0%)</td>
</tr>
</tbody>
</table>

(HLS= Health Literacy Score, PAS= Physical Activity Score, MS= Muscle Strength, n= number of subjects, Chi-square = 78.117 with 4 degrees of freedom; P*= 0.000)

Table 3: Association of health literacy with physical activity and muscle endurance

<table>
<thead>
<tr>
<th>Performance categories</th>
<th>HLS n (%)</th>
<th>PAS n (%)</th>
<th>ME n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>8(15.69%)</td>
<td>32(62.74%)</td>
<td>44(86.27%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>19(37.25%)</td>
<td>13(25.49%)</td>
<td>7(13.73%)</td>
</tr>
<tr>
<td>High</td>
<td>24(47.06%)</td>
<td>6(11.76%)</td>
<td>0(0%)</td>
</tr>
</tbody>
</table>

(HLS=Health Literacy Score, PAS= Physical Activity Score, ME= Muscle Endurance, n = number of subjects, Chi-square = 60.738 with 4 degrees of freedom; P*=0.000.)

Table 4: Association of health literacy with physical activity and flexibility

<table>
<thead>
<tr>
<th>Performance categories</th>
<th>HLS n (%)</th>
<th>PAS n (%)</th>
<th>F n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>8(15.69%)</td>
<td>32(62.74%)</td>
<td>18(35.29%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>19(37.25%)</td>
<td>13(25.49%)</td>
<td>18(35.29%)</td>
</tr>
<tr>
<td>High</td>
<td>24(47.06%)</td>
<td>6(11.76%)</td>
<td>15(29.42%)</td>
</tr>
</tbody>
</table>

(HLS= Health Literacy Score, PAS= Physical Activity Score, F=Flexibility n= number of subjects; Chi-square = 27.074 with 4 degrees of freedom; P*=0.000.)

Table 5: Association of health literacy with physical activity and physical fitness index

<table>
<thead>
<tr>
<th>Performance categories</th>
<th>HLS n (%)</th>
<th>PAS n (%)</th>
<th>PFI n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>8(15.69%)</td>
<td>32(62.74%)</td>
<td>51(100%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>19(37.25%)</td>
<td>13(25.49%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>High</td>
<td>24(47.06%)</td>
<td>6(11.76%)</td>
<td>0(0%)</td>
</tr>
</tbody>
</table>

(HLS= Health Literacy Score, PAS= Physical Activity Score, PFI= Physical Fitness Index, n = number of subjects, Chi-square = 79.503 with 4 degrees of freedom; P*= 0.000)
Health literacy is highly associated and statistically significant with physical activity and muscle strength, muscle endurance, flexibility and fitness index as given in Table 2, 3, 4 and 5 respectively.

**DISCUSSION**

General literacy may not always indicate health literacy (7). Few studies showed association of HL with health-related knowledge, improved self-efficacy and self-management behavior which were either done in a clinical setting or were disease specific (14). The tools utilized for HL commonly dealt with word recognition and pronunciation, not assessing its different domains (7). The HLS-EU-Q measures three domains of health and expresses them in terms of accessing, understanding, appraising and applying information to manage risks, disease and health (3). Study done by D’souza et al., in 2013 suggests that the usage of HLS-EU-Q 16 would be helpful to capture and assess various components of health literacy in the Indian context (15).

In the present study, using the HLS-EU-Q 16, we found that 47.06% showed sufficient HL, 37.25% had limited HL and 15.09% had inadequate HL, the results are in line with the study done by Zamir et al., (16). The reason for similar results could be the educational status and frequent interaction with family physicians contributing to improved health literacy. In a study done by Rathnakar et al., majority of the subjects had low health literacy, and this difference could be due to the different tool of HL used which minimally covers the domains of HL, giving dissimilar results (7).

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure (17). Physical inactivity is found to be one of the leading risk factors for various non-communicable diseases and global mortality. There are various subjective and objective tools used to assess PA. Physical activity questionnaire is commonly used (18). Few studies have shown that the total physical activity measured with IPAQ-SF correlates with objective standards (19).

In our study, the PA score assessed using IPAQ-SF showed 62.74% participants with low levels of physical activity. Similar results of insufficient physical activity, common in adults living in urban area, homemakers, retired people, and unemployed were seen in various studies (4,20).

Subjects living in urban areas may have less physically demanding occupations and better work resources and transport facilities. In our study, the number of females were greater, the majority of whom were homemakers. As shown in previous studies, homemakers could be involved in household chores not having sufficient time for leisure activities. Padmapiya et al., in their study, showed an increased prevalence of high to moderate levels of physical activity among the study participants. Disparity in results could be due to differences in the age groups studied (9).

Physical fitness is defined as “the ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies”. Physical Fitness has various components like cardiorespiratory fitness, muscular strength, endurance, and flexibility (13). Very few studies dealing with various components of fitness in adults are available in literature (21). Amongst the physical fitness parameters in our study, 88.27% of the subjects had normal muscle strength and BMI of majority of these subjects ranged between normal to overweight, which was like the study done by Lad et al., With increasing BMI, there is increase in handgrip strength in all the BMI ranges. The BMI is an indicator of body mass. But in our study, it is unfit to comment that the effect is due to an alteration in the muscle mass or body fat percentage (22). Our study showed disparity with the results conveyed by Bimali et al., and Bandyopadhyay, presumably due to differences in age groups and physical characteristics of the subjects (23,24). In the muscle endurance category, 86.27% subjects were below average, and 13.73% average. Similar studies have been done using different procedures (21,25).

In the flexibility category, 35.29% participants were below average, 35.29% average, and 29.42% were above average. Durain et al., showed about 62.7% male subjects and 69.81% female subjects were in good grade, 33.33% male subjects and 11.32% female subjects were average and 1.96% male subjects, and 18.86% female subjects were excellent and 1.96% male subjects were in fair grade in their sit and reach flexibility test (26). Mak et al., in their study showed a gender difference in sit and reach tests where girls performed better than boys, overweight subjects performed better than normal and overweight/obese individuals (25). More female subjects in the present study with difference in viscoelastic properties of the muscle and difference in pelvic anatomy compared to males would help corroborate the results with the previous studies.

In our study, the physical fitness index parameter, all participants were in an unacceptable category, which was like the study done by Hattiwale et al., (27). Possible reason could be that the Harvard step test turned strenuous, as workload could not be adjusted for individual subject and also by virtue of difference in their physical characteristics. Contradictory results were found in the PFI score done by Dharmesh Parmar et al due to difference in methodology and the age group of the subjects involved (28).

As per Table 2-5, our study showed that with an increasing level of health literacy, physical activity improved in addition to all the physical fitness parameters like muscle strength, muscle endurance,
flexibility, and physical fitness index. Our study supports the study done by Dominick et al., which shows health literacy improved the physical activity self-efficacy (14) and study done by MacAuley that showed relationship between physical activity and physical fitness (6). Our results diverge from the study done by Hartman et al., and Sayah et al., owing to differences in methodology performed (8,29).

The small sample size in the current study limits the generalizability of the data. Information on participant sociodemographic characteristics and highest level of education attained was lacking. Since it was a field survey, a study was conducted which was feasible in terms of space and equipment. Use of advanced technology would have given more accurate results. Objectively measured physical activity would be much preferred over questionnaires which could force on recall bias.

CONCLUSION

From the above study, we conclude that the health literacy in the study population was good. Physical activity scores indicated more people were inactive. In the majority of the individuals, muscle strength was normal, but muscle endurance was greatly affected. Maximum participants had average to above average level of flexibility. Physical fitness index of all the candidates was unacceptable. Results in the present study demonstrate significant association between health literacy, physical activity, and physical fitness level among adults. Adequate health literacy is necessary to comprehend and utilize health information. To identify exercise and physical activity as beneficial is not sufficient but to take advantage of its benefits in everyday life is paramount, which is estimated by a person’s fitness level.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

REFERENCES


