Evaluation of Methodologies of Physical Activity: Self Reported International Physical Activity Questionnaires (IPAQ) Categories and Accelerometer Registration, as an E-health Tool

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Abstract

The aim of the study is to assess moderate level physical activity in male and female population, analyze the intra individual physical activities, compare for any significant variations in self reported, International Physical Activity Questionnaires (IPAQ) categories and Accelerometer registration, as an e-health tool. Reliability, precision and validity of both methodologies are also studied. Discusses the importance of Physical activity in minimizing the risk factors of various non communicable diseases, and impact on mortality and morbidity. Both the methodologies were studied in N = 38 participants, Further statistical analysis is performed by SPSS (Version 17.0) software. The analysis indicated that the self reported scores are less reliable and exaggerated, and in the moderate level physical activity there is no significant difference in male and female of population.

Keywords: Physical Activity, Accelerometer, IPAQ, E-health.

1. Introduction

The Physical inactivity is the fourth leading risk factor for global mortality (6%) according to World Health Organization [WHO] Statistics 2004 followed by blood pressure (13%), tobacco use (9%), and high blood glucose (6) [1].

The increasing global physical inactivity has impact on population’s general health and increased the prevalence of Non communicable Diseases, (such as cardiovascular disease, diabetes, cancer) and their risk factors like High blood pressure, high blood sugar and obesity [2].

Physical activity is defined as any bodily movement produced by skeletal muscles producing an increase in energy expenditure above resting metabolic rate [2].

The advantage associated with regular physical activity is in reduction of risk factors of non communicable diseases. Higher levels of physical fitness result in delay of mortality, primarily due to lowered rates of cardiovascular disease and cancer [3]. Physical activity is the key determinant in Energy expenditure and aids in limiting obesity and energy balance [2].

The aim of global recommendations on physical activity for health is guidance on physical activity, its associated health benefits and the dose response (the frequency, duration, intensity, type and total amount of physical activity needed for health enhancement and prevention of non communicable diseases) [4].

Promoting physical activity is a cost effective measure and sustainable public health intervention, reduces the health care expenditure in managing non communicable diseases associated with physical inactivity [5]. The various social benefits associated with regular physical activity, include work place productivity, fewer absentees, and better performing schools [5]. The recommendations is for at
least 30 minutes of moderate intensity of physical activity, 5
days/week, reduces the risk of non communicable diseases,
(Cardio vascular diseases, stroke, type II diabetes, colon
cancer) [5].

2. Materials and Methods

In epidemiological studies the physical activity is assessed
for physical activity behavior and energy expenditure. The
physical activity behavior either measured by indirect
methods like questionnaires, or direct methods like motion
detector, physical activity records, direct observation, and
HR monitoring. The energy expenditure is assessed by
Calorimetry, double labeled water, oxygen consumption,
heart rate, body temperature, and ventilation. The ques-
tionnaire method is low on precision and reliability, in
comparison to other laboratory methods [6].

This study involved 38 participants (14 females and 21
males, data for there samples were considered invalid, for
technical issues and less registration time). Over a period
of 7 days and the cut off period is 5 days, (activity of first
and last day inclusive), The filter for missing data is 20 min-
utes of zero counts per minute. The Metabolic Equivalent
(MET/EE) Critical value is 1952 counts.

3. Methodology

The instructions for both form of measurements were give
in writing and explained in detail on how to wear the accel-
erometer, duration of wearing time, handling instruction
[not to be worn when under shower or during water sports
activities, as it is not water proof and to wear the sensor all
the time except when sleeping].

3.1 Actigraph Accelerometer

Measures body moments in terms of acceleration which
estimates the intensity of physical activity over the time,
(only the vertical moments are noted) the data in form
of counts records intraday variations of physical activity,
intensity of physical activity in the internal memory and
downloaded to the computer [7].

3.2 IPAQ Questionnaire

The Questionnaire was handed to all the participants to
record the individual physical activity details, it catego-
rizes the physical activity into three categories based on
MET values [8, 9]. The results are categorized-Category 1,
Category 2, Category 3 [10, 11]. The questionnaire gathers
data for general details like age, gender, and time spent for
each activity, exceeding 10 minutes, like moderate, vigor-
oun, inactive, sedentary or walking over week days [11].

3.3 Software for Processing Accelerometer

Recordings

MAH UFFE.

3.4 Software for Statistical Analysis

SPSS (Version 17) Mann Whitney U Test, Chi-square test
were performed.

4. Results

The intra individual variations were as noted as follows,
the self reported individual Accelerometer recordings for
10 days, since few days after day 4 the Accelerometer was
not worn and was continued later on and a total activity for
10 days is accounted. As per the cutoff days mentioned in
the instructions only 7 days observations were noted. My

Table 1. IPAQ Categories and Accelerometer
categories

<table>
<thead>
<tr>
<th>IPAQ Category/ Accelerometer Category</th>
<th>Met Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>&lt;600</td>
</tr>
<tr>
<td>Category 2</td>
<td>1500–3000</td>
</tr>
<tr>
<td>Category 3</td>
<td>&gt;3000</td>
</tr>
</tbody>
</table>

Table 2. Female study groups with accelerometer
measured average minutes per day at different activity
level

<table>
<thead>
<tr>
<th>Light activity</th>
<th>Moderate activity</th>
<th>Vigorous activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>182</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>235</td>
<td>94</td>
<td>0</td>
</tr>
<tr>
<td>183</td>
<td>66</td>
<td>1</td>
</tr>
<tr>
<td>96</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>197</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>138</td>
<td>26</td>
<td>6</td>
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<tr>
<td>250</td>
<td>32</td>
<td>5</td>
</tr>
<tr>
<td>206</td>
<td>39</td>
<td>0</td>
</tr>
<tr>
<td>95</td>
<td>47</td>
<td>0</td>
</tr>
<tr>
<td>104</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>157</td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>178</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>179</td>
<td>33</td>
<td>1</td>
</tr>
<tr>
<td>187</td>
<td>36</td>
<td>1</td>
</tr>
</tbody>
</table>
peak count activity was found to be more on Thursdays (6500, 6600) followed by Wednesday (6600), Friday (5400) and least on one of the Wednesday (4600). The times of maximum peak activity was noted at 9am and 6PM. Graph 1. My average moderate activity per week is 406 minutes/week which exceeds the recommended limit of 150 minutes of activity a week [5], and my average vigorous minutes per week is 49 minutes/week which is less than the recommended level of 75/week [5].

The histogram for moderate level physical activity was plotted in the both the groups to detect the distribution pattern and it showed a skewed pattern (1985 in females and 0.65 in males) Table 4, therefore to interpret the results a non parametric independent two variable test (Mann Whitney U Test) is performed according to null hypothesis both the female and male groups will have same moderate physical activity, and the alternate hypothesis states there is significant difference in the moderate physical activity of both the groups the confidence interval of 95% and significance level 0.05 (alpha). The values from the test Z = −0.52, P = 0.60 Table 4, as p>0.05, Therefore we conclude that the data does not provide statistically significant evidence of a difference between male and female moderate activity so we accept the null hypothesis and alternate hypothesis is rejected. There is no difference in male and female moderate activity.

From chi-square test the results are Pearson’s chi-square value 0.68, and fishers exact test value 1 Table 5. Both the values are greater than .05 so null hypotheses is rejected. There exists no relation between self reported physical activities and actual recorded categories.

The IPAQ categories for various observations can be summarized as follows.

5. Discussion

The direct method of physical activity observation, Accelerometer recordings has several advantages as well as effective over the self-report method (IPAQ). The advantages include ease of data collection, detailed information
instance the alternate hypothesis suggests that there is significant difference in the physical activity. Upon analysis of the data results using Mann Whitney U test the results approves the Null hypothesis that there is no difference between the male and female moderate physical activity. Since the variation in data collection with regards to total number of days and total number of continuous days when the accelerometer was worn were considered, there were found discrepancies in data collection as some participants wore for more than 7 days, one participants data is discarded since his registrations are less than 5 days, and also data from 3 samples were discarded due to technical reasons. The results are likely to be less reliable due to small sample size and less relatively varied ratio of male, female population size.

For establishing relation between self reported and recorded categories, the percentage of count of cells less than 5 is greater than 20% and the sample size is low, fishers exact test value is considered and it is found to be greater than 0.05 Hence the null hypothesis (if the observed significance level is less than 0.05 then there exists a significant relationship between the reported and recorded categories) is rejected and there exists no significance relationship between Self reported category and Actual recorded category, also the Accelerometer category has no corresponding value for category 3 of IPAQ. Therefore the IPAQ categories can be considered less reliable.

6. Conclusion

The study indicates a linear association with physical activity and health benefits also indicates that there is no significant difference between male and female moderate level physical activity and the self reported category values are less reliable and less significantly related to the accelerometer readings and accelerometer recordings can be used with convenience as a e-health tool to record physical activity.

7. References

7. The ActiGraph GT1M:GT1M specifications, Available from: www.theactigraph.com
9. Guidelines for the data processing and analysis of the International Physical Activity Questionnaire, Available from: www.ipaq.ki.se