Introduction

Various studies have highlighted the benefits of physical activity (PA) performance in older adults on physical, cognitive, and functional levels. For this reason, one of the main health strategies aimed at this group is the promotion of PA. For this purpose, it is fundamental to ascertain efficient resources in order to pinpoint the level of PA that has been reached after a period of time. This would allow experts to determine the baseline from which an adequate prescription of PA performance could be established, as well as to identify the effects of the interventions with this objective in mind. In this regard, PA recall performance questionnaires are considered the most effective tool given their low-cost, ease of administration, and capacity for simultaneous assessment in larger samples.

In spite of this, research is still scarce regarding the psychometric properties of the Spanish versions of questionnaires that are specifically tailored for the assessment of PA performance in older adults. For this reason, one of the main health strategies aimed at this group is the promotion of PA. For this purpose, it is fundamental to ascertain efficient resources in order to pinpoint the level of PA that has been reached after a period of time. This would allow experts to determine the baseline from which an adequate prescription of PA performance could be established, as well as to identify the effects of the interventions with this objective in mind. In this regard, PA recall performance questionnaires are considered the most effective tool given their low-cost, ease of administration, and capacity for simultaneous assessment in larger samples.

The results imply that the Spanish version of CHAMPS shows construct validity to estimate the amount of physical activity performed by institutionalized older adults without cognitive impairment.

Methods

Participants in this study were recruited through a collaboration agreement signed between the University of “Vigo” and “Fundación San Rosendo”, a company that specializes in geriatric center management. The inclusion criteria were the following: (a) being over 65 years’ old; (b) residing in a geriatric center; and (c) presenting mobility autonomy, in other words, being able to move freely without the help of another person. Individuals who presented any type of pathology that could prevent them from carrying out the tests included in the study, or otherwise expressed their desire not to take part either personally or through a family member or caretaker, were also excluded. All participants and their families were informed of the aims and characteristics of the research and their informed consent was obtained. Research approval was granted by the Ethics Committee of the University of “X”.

Abstract — This study investigates the construct validity of the Spanish version of the CHAMPS questionnaire with institutionalized older adults between the ages of 74 and 90. Seven days of accelerometer data were collected from 52 participants (mean age 82.40 ± 8.26 years), followed by the administration of CHAMPS. The Barthel Index and the Chair Stand Test were used to assess functional independence and fitness levels. The four scores yielded by CHAMPS showed a low-to-moderate agreement with the data derived from the accelerometer (r=0.253–0.385) and with the Barthel Index (r=0.313–0.519), but no association was established with fitness levels. Additionally, no significant correlations were observed between CHAMPS and the accelerometer when cognitive impairment was considered. The results imply that the Spanish version of CHAMPS shows construct validity to estimate the amount of physical activity performed by institutionalized older adults without cognitive impairment.

Keywords: validity, physical activity, questionnaire, older adults, institutional care.
Assessment

Sociodemographic and cultural characteristics. Age, gender, and educational level of participants were obtained from the medical histories provided by the appropriate geriatric centers.

Cognitive functionality. The presence of cognitive deterioration was determined through an analysis of the results obtained from a Spanish language adaptation of the Mini-Cog Test (MCT) and Pfeiffer’s questionnaire, which were recorded in each patient’s medical history.

CHAMPS questionnaire. The present study employed the Puerto Rican version of CHAMPS that originally included 41 items. With the purpose of adapting questionnaire entries to the characteristics of institutionalized persons, a number of items were discarded, such as related activities that were not attested in the environment of the geriatric centers where the study was conducted. These activities included playing golf or tennis, skating, going to meeting places, carrying heavy bags, etc. The resulting version included 31 items involving the frequency (times per week) and duration of physical activities (classified using six categories: less than 1 h · wk⁻¹; 1–2.5 h · wk⁻¹; 3–4.5 h · wk⁻¹; 5–6.5 h · wk⁻¹; 7–8.5 h · wk⁻¹; and 9 or more h · wk⁻¹).

Activities that were featured in the final modified version included walking leisurely (fast or briskly), cycling, light gardening, light housekeeping, jogging, swimming, light exercises to maintain physical condition (stretching, Tai-Chi), taking part in physical therapy or exercise fitness programs, doing aerobics, engaging in muscular strength training (free-weights, calisthenics, machines), dancing, playing a musical instrument, reading, and playing cards.

The CHAMPS questionnaire yields four separate scores: (1) total caloric energy expenditure per week based upon “all” activities that would likely impact health; (2) caloric energy expenditure per week based upon moderate-to-vigorous intensity activity; (3) frequency per week (in minutes) of engagement in total meaningful activities; and (4) frequency per week (in minutes) of engagement in moderate-to-vigorous intensity physical activities.

To estimate energy expenditure, metabolic equivalents (METS) were used according to the compendium of activities that were originally designed in conjunction with the questionnaire, and later modified and completed by Hekler et al. In this regard, a value of 3 METS or higher was given to moderate-to-vigorous intensity physical activities.

The criterion validity of the CHAMPS questionnaire to estimate the amount of PA performed was contrasted with the construct validity of the questionnaire, participants were asked to carry the accelerometer with them for one week. The device remained attached to their right thigh above the iliac crest while in standing position, or around their dominant wrist while in sitting position. It was expressed that they were to use the device from early in the morning until they went to bed at night, putting it aside only if they wished to have a bath or a shower, or needed to perform any kind of water-based activity. In addition, both the caretakers’ and health personnel’s collaboration was requested to guarantee that the indications stipulated at the beginning of the experiment were observed. The day after their weekly activity monitoring, health personnel at each geriatric center administered the CHAMPS questionnaire to the participants individually in an interview format.

Statistical analysis

A descriptive statistical analysis was conducted to summarize the main variables that were examined. For continuous variables, central tendency measures were used (mean, standard deviation, median, minimum, and maximum), while categorical variables were studied using percentages. This descriptive analysis was performed globally by stratifying the sample depending upon the presence or absence of cognitive deterioration. To contrast the normality of the data set, and take the size of the sample into account, the Shapiro-Wilk test was employed. The results indicated that all dependent variables presented a normal distribution, both when the sample was considered in groups and in stratified form, depending upon the level of cognitive deterioration (p>0.05). Student’s t-test for independent data was applied to identify statistically significant differences in the continuous variables depending upon the presence or absence of cognitive deterioration. A Pearson correlational analysis was performed to identify the degree of association between the CHAMPS questionnaire, the GT3X accelerometers, the Barthel Index, and the Chair Stand Test. The data set was studied using the SPSS Statistics software (Armonk, NY: IBM Corp.) version 22.0 for Windows with a significance level of p<0.05.
Results

A total of 52 institutionalized older adults (average age 82.40±8.26 years; 70% women) completed the tests. Individual characteristics as well as the mean values obtained in general and relative to the presence or absence of cognitive deterioration, are shown in Table 1. According to the results observed in the adapted version of MCT and Pfeiffer’s questionnaire, it was evident that 69.2% of the sample presented with cognitive deterioration.

Table 1 Characteristics and mean values obtained from the sample relative to the presence or absence of cognitive deterioration.

<table>
<thead>
<tr>
<th></th>
<th>Total sample n = 52</th>
<th>Absence of cognitive deterioration n = 16</th>
<th>Presence of cognitive deterioration n = 36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (% female)</td>
<td>72.20%</td>
<td>-</td>
<td>69.40%</td>
</tr>
<tr>
<td>Age in years</td>
<td>82.40±8.26</td>
<td>78.67±9.17</td>
<td>86.13±7.68</td>
</tr>
<tr>
<td>Educational level (% primary)</td>
<td>95.38%</td>
<td>96.32%</td>
<td>94.44%</td>
</tr>
<tr>
<td>MCT score</td>
<td>18.30±8.50</td>
<td>25.58±6.33</td>
<td>11.02±8.65</td>
</tr>
<tr>
<td>Pfeiffer Test</td>
<td>4.25±13.55</td>
<td>1.17±2.29</td>
<td>7.32±15.63</td>
</tr>
<tr>
<td>Barthel Index</td>
<td>51.28±29.40</td>
<td>63.33±29.64</td>
<td>39.23±21.63</td>
</tr>
<tr>
<td>Five chair stands (s)</td>
<td>18.03±6.23</td>
<td>15.44±4.78</td>
<td>20.62±6.44</td>
</tr>
</tbody>
</table>

CHAMPS Questionnaire

<table>
<thead>
<tr>
<th>Moderate and greater intensity measures. Caloric expenditure per week in at least moderate intensity physical activities (MET ≥ 3.0)</th>
<th>Total sample n = 52</th>
<th>Absence of cognitive deterioration n = 16</th>
<th>Presence of cognitive deterioration n = 36</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,375.72 (789.23)</td>
<td>1,633.90 (933.83)</td>
<td>1,188.45 (686.53)</td>
<td></td>
</tr>
<tr>
<td>Minutes per week in at least moderate intensity physical activities (MET ≥ 3.0)</td>
<td>425.00 ±244.12</td>
<td>498.75 (287.12)</td>
<td>353.50 ±216.21</td>
</tr>
<tr>
<td>All activities measure. Caloric expenditure per week in all listed physical activities</td>
<td>3,624.26 (2141.95)</td>
<td>4,508.91 (2981.78)</td>
<td>2,741.88* (1,599.83)</td>
</tr>
<tr>
<td>Minutes per week in all listed physical activities</td>
<td>1,849.50 (975.33)</td>
<td>2,321.67 (1,241.76)</td>
<td>1,378.33* (749.87)</td>
</tr>
</tbody>
</table>

Note. **p<0.001; *p<0.05

The total estimated amount of PA performed provided by the CHAMPS questionnaire was 3,624.26±2,141.95 kcal/week for the sample as a whole, with statistically significant differences found depending upon the absence or presence of cognitive deterioration (4,500 vs. 2,740 kcal/week, respectively).

For the entire sample, a significant statistical correlation was observed between the four scores of the CHAMPS questionnaire and the amount of PA performed according to the data derived from the accelerometer (r=0.253–0.385). These four scores also showed statistically significant associations with the degree of independence determined using the BI (r=0.313–0.519), but not with the results of the Chair Stand Test. Similar findings were attested in institutionalized participants without cognitive deterioration even though the degree of association between the CHAMPS questionnaire and the accelerometry, and the degree of association between
the CHAMPS questionnaire and the BI, led to higher values in general ($r=0.203–0.630$ and $r=0.334–0.494$, respectively). The sub-sample of institutionalized individuals with cognitive deterioration also showed statistically significant associations, but only between the CHAMPS questionnaire and the BI ($r=0.279–0.368$).

Table 2 Correlations established between the variables under study.

<table>
<thead>
<tr>
<th></th>
<th>Total sample n = 52</th>
<th>Abundance of cognitive deterioration n = 16</th>
<th>Presence of cognitive deterioration n = 36</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GT3X accelerometer Counts</td>
<td>Barthel Index</td>
<td>Five chair stands</td>
</tr>
<tr>
<td>Moderate and greater intensity measures. Caloric expenditure per week in at least moderate intensity physical activities (MET $\geq 3.0$)</td>
<td>Pearson’s Correlation</td>
<td>.253*</td>
<td>.383*</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>.046</td>
<td>.012</td>
</tr>
<tr>
<td>Minutes per week in at least moderate intensity physical activities (MET $\geq 3.0$)</td>
<td>Pearson’s Correlation</td>
<td>.258*</td>
<td>.313*</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>.049</td>
<td>.045</td>
</tr>
<tr>
<td>All activities measures. Caloric expenditure per week in all listed physical activities</td>
<td>Pearson’s Correlation</td>
<td>.287*</td>
<td>.498**</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>.045</td>
<td>.002</td>
</tr>
<tr>
<td>Minutes per week in all listed physical activities</td>
<td>Pearson’s Correlation</td>
<td>.385*</td>
<td>.519**</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>.023</td>
<td>.001</td>
</tr>
</tbody>
</table>

Note. **$p < 0.001$; *$p < 0.05$**

**Discussion**

This study provides information about the construct validity of the CHAMPS questionnaire when administered to institutionalized Spanish older adults between the ages of 74 and 90. The results could prove useful for professionals in the field of gerontology and physical exercise in search of an effective tool to estimate the amount of PA performed by this particular population.

The CHAMPS questionnaire includes two primary measures, minutes per week spent performing PA and calories per week expended in all physical activities, which make it possible to estimate the total amount of PA performed by the population surveyed. In this regard, the degree of validity shown by the CHAMPS questionnaire for the entire sample could be described as moderate, which is in agreement with previous findings. Particularly, Colbert, Matthews, Havighurst, Kim, and Schoeller indicated the existence of a degree of correlation of 0.52 between caloric expenditure, as estimated by this questionnaire, and counts per minute measured by the ActiGraph, while Hekler et al. reported that CHAMPS total activity scores were moderately associated with accelerometry minutes of corresponding intensity ($\rho = 0.34$). Likewise, Giles and Marshall reflected a similar level of agreement ($r=0.38$) even though they employed a pedometer as a measure of objective assessment.

CHAMPS was developed to assess the potential outcomes of PA intervention and designed to be administered to populations of community-dwelling older adults. For this reason, the CHAMPS questionnaire seems to be the best choice to rank individuals with respect to their levels of physical energy expenditure. Nevertheless, little is known about the behavior of its psychometric properties among institutionalized persons and the same applies to its usefulness in populations with cognitive...
deterioration. The originality of the present study resides not only in assessing CHAMPS validity for Spanish populations, but also in putting forward data concerning its validity in institutionalized populations with and without cognitive deterioration. In this sense, CHAMPS attested a satisfactory degree of construct validity among institutionalized persons without cognitive deterioration, which opposes the observations of Harada, Chiu, King, Stewart who could not find any type of significant statistical association between the total estimated amount of PA performed according to the questionnaire and the data obtained from the accelerometry for this population.

These somewhat contradictory findings could have been due to methodological divergences between the studies. Indeed, the present research asked participants to wear the accelerometer during the week before answering the questionnaire, which could have facilitated their recall of the activities they had performed. Moreover, in Harada et al. (ibid.) participants completed the questionnaire themselves, while the present study preferred a face-to-face method of administration, which favors validity. It should also be added that taking Harada, Chiu, King, Stewart’s (ibid.) caloric expenditure as reference, this factor could be qualified as sedentary, and it has been claimed that CHAMPS is not the most appropriate resource to assess sedentary behavior, or even to estimate the amount of PA performed in populations where low-intensity activity is predominant. However, the CHAMPS questionnaire proved to be an invalid tool to estimate the amount of PA performed in institutionalized populations with cognitive deterioration in this study.

In light of the fact that the energy expenditure levels reported by participants with cognitive deterioration was significantly lower than those of participants without cognitive deterioration, it could be concluded that leading a sedentary life might be the reason behind the lack of correlation between CHAMPS scores and accelerometer results. Nevertheless, despite levels of energy expenditure among participants with cognitive deterioration being lower than those reported in previous research studies carried out with cognitively healthy institutionalized persons using the same questionnaire, according to Stewart, Mills, King, Haskell, Gillis, Ritter those participants could be qualified as somewhat active. In fact, the levels of energy expenditure that were reported in their case were considerably higher than those obtained from the CHAMPS questionnaire in non-institutionalized populations with possible cognitive deterioration. For this reason, the lack of validity of the CHAMPS questionnaire in this particular sub-sample might be related to the fact that remembering the activities performed throughout the week could be challenging for this group. Indeed, the only PA recall questionnaire that has proven its validity to date in populations with cognitive deterioration is the One-day Recall. In this regard, it is important to highlight that even though it has been suggested that administering CHAMPS to populations with cognitive deterioration might lead to missing data, complications have not been reported from its administration to older adult populations with subjective and objective mild cognitive impairment.

The present study confirmed a significant degree of association between the CHAMPS questionnaire and the participants’ level of functional independence. Similarly, other studies have reported the existence of significant correlations between the estimated total amount of PA obtained from the questionnaire and the results gathered from performance-based physical function tests and self-reported physical functioning. However, no correlation was found with the level of fitness when the Chair Stand Test was employed, which contradicts previous observations in institutionalized populations.

This lack of correlation could be due to the characteristics of the sample, and judging by the mean values obtained from both groups (with and without cognitive deterioration) in the Chair Stand Test, the level of muscular endurance of the sample population could be judged as very low. In this regard, it has been stated that poor muscular fitness is an aspect that affects the validity of the PA recall questionnaire. Further discussion on the subject has been limited as research experiments that have analyzed the degree of correlation between the CHAMPS questionnaire and the Chair Stand Test have not provided information about the mean values that resulted from the test, and only one reported on the correlation coefficient obtained specifically from this test.

In spite of the originality of the results presented here, it is necessary to acknowledge certain methodological weaknesses that may limit the generalization of results. Specifically, the ability to determine the validity of the CHAMPS questionnaire in institutionalized populations was affected by the reduced number of participants in the study sub-sample without cognitive deterioration and the lack of an aerobic fitness assessment test. In this respect, future studies should focus upon larger samples and include a more complete fitness level assessment to confirm these findings.

Conclusion

The CHAMPS questionnaire has shown adequate construct validity at the time of determining the amount of PA performed by institutionalized older adults. However, its use is discouraged for people with cognitive deterioration.

Acknowledgments

We thank Fundación San Rosendo and all the professionals in the centers that participated in the study.

References


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Manuscript received on August 03, 2016
Manuscript accepted on August 24, 2016