THE EFFECTS OF EXERCISE ON PHYSICAL FITNESS IN DAILY LIFE ACTIVITIES, AUTONOMY AND SATISFACTION WITH LIFE AMONG THE ELDERLY IN INSTITUTIONS

EFEITOS DE UM PROGRAMA DE EXERCÍCIOS DE FORÇA NA APTIDÃO FÍSICA RELACIONADA COM AS ATIVIDADES DA VIDA DIÁRIA, AUTONOMIA E SATISFAÇÃO COM A VIDA EM IDOSOS INSTITUCIONALIZADOS

EFECTOS DE UN PROGRAMA DE EJERCICIO DE FUERZA EN LA APTITUD FÍSICA EN RELACIÓN CON LAS ACTIVIDADES DE LA VIDA DIARIA, AUTONOMÍA Y SATISFACCIÓN DE VIDA EN ANCIANOS INSTITUCIONALIZADA

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ABSTRACT

This study is aimed at examining the effects of a muscle-strength condition exercise (MSE) program (MSE) on a battery of physical fitness tests battery related to daily living activities (Pf-Adl) and life satisfaction among elderly men's. The sample consisted of male participants from two elderly care institutions. The participants were randomized into an experimental group (EG; n = 27; age = 78.2 ± 4.1 years) and control group (CG; N= 24; age 77.9 ± 3.7 years). The EIG participated in carry out a MSE program during for 12-weeks, two times per week. The CG, did not underwent a MSE program. To measure the psychological dimension, the Satisfaction with Life Scale (SWLS) was used. The Pf-Adl was analysed through the LAGED motor tasks protocol (LP). The paired-t statistics revealed significant reductions in the execution time of all the tests of the LP protocol which indicated possible benefits that come from EIG, being promoted by the mediation of the through exercise. As for the SWL dimension there were significant differences in the SWL dimension with the magnitude of the effect size suggesting that these changes were possibly beneficial. In the CGC there were no changes were found. The present study demonstrates that a 12-weeks MSE can improve Pf-Adl and SWL perception in older men, pointing to evidence of possible benefits to physical and psychological health that may be associated infor these participants.

Keywords: physical fitness, activities of daily living, muscle strength, elderly.

RESUMO

Este estudo tem como objetivo analisar os efeitos de um programa de exercícios de força (MSE) na aptidão física relacionada com as atividades da vida diária (Pf-Adl) e na satisfação com a vida (SWL) em idosos. A amostra foi constituída por participantes do sexo masculino em regime de institucionalização (lares). Os participantes foram divididos em dois grupos de forma aleatória: grupo experimental (EG; n =
27; idade = 78.2±4.1 anos) e grupo de controlo (CG; N= 24; idade 77.9±3.7 anos). O programa MSE teve a duração de 12 semanas, com frequência bissemanal. Os participantes do não GC realizaram a passagem pelo MSE. Para avaliar a dimensão psicológica, foi aplicada a versão brasileira da escala de satisfação com a vida. A Pf-Adl foi avaliada através do protocolo LAGED de tarefas motoras (LP). A análise comparativa (t-paired test) revelou uma diminuição no tempo de execução do LP, o que indica ‘possíveis benefícios’ deste tipo de intervenção, sendo promovidas pela mediação do exercício. Foram encontradas percepções mais elevadas na SWL. Já no GC não foi verificada nenhuma alteração nestas dimensões. Os resultados demonstraram que um MSE com duração de 12 semanas demonstrou ser eficaz para melhoria da percepção SWL e na Pf-Adl em idosos do sexo masculino e que estas melhorias podem estar mutuamente associadas.

**Palavras-chave:** aptidão física, atividades da vida diária, homens idosos, treinamento de força.

**RESUMEN**

Este estudio tiene como objetivo analizar los efectos de un programa de entrenamiento de fuerza (MSE) sobre la condición física relacionada con las actividades de la vida diaria (Pf-Adl) y la satisfacción con la vida (SWL) en los ancianos. La muestra estuvo conformada por participantes masculinos en la institucionalización de régimen (viviendas). Los sujetos fueron divididos en dos grupos al azar: grupo experimental (GE, n = 27; edad = 78,2 ± 4,1 años) y grupo control (GC, n = 24; edad de 77,9 ± 3,7 años). El programa MSE tenía una de 12 semanas, con una frecuencia quincenal. Los participantes de la no-GC hicieron el paso a través de la BMV. Para evaluar la dimensión psicológica se aplicó la versión brasileña de la escala de satisfacción con la vida, El Pf-Adl se evaluó mediante tareas motoras protocolo LAGED (LP). El análisis comparativo (prueba t pareada) mostró una disminución en el tiempo de ejecución LP, que indica “beneficios potenciales” de este tipo de intervención, siendo promovido por la mediación del año. Percepciones más altas se encontraron en la LOC. Usted GC hubo cambios en estas dimensiones verificados. Los resultados mostraron que un período de 12 semanas con SEM demostró ser eficaz para mejorar la percepción y SWL Pf-Adl en varones de edad avanzada y estas mejoras se puede asociar mutuamente.

**Palabras clave:** aptitud física, actividades de la vida diaria, los hombres de edad avanzada, el entrenamiento de fuerza.
INTRODUCTION

We can consider aging, according to many specialists in this area, as a phase of a continuum that is life that begins with conception and ends with death (Fried et al., 2001). This process is characterized by a progressive loss that occurs gradually, by universal and irreversible loss in cognitive and functional abilities (Bowen, 2012); by changes in body composition (Pernambuco et al., 2013); by increased body fat mass (BMI) profile (Cavuoto & Nussbaum, 2014); and by low psychological wellbeing (PWB) adjustments such as stress, anxiety, depression and satisfaction with life feelings (Colon-Emeric, 2013). Many of these factors listed above are related to low functional autonomy (Nascimento et al., 2012), understood as a decreased ability to perform daily life activities related to physical fitness (Pf-adl) regardless of form, including displacements, self-care activity (Boissy, Briere, Tousignant, & Rousseau, 2007), adequate sleep and participation in recreational or sports activities (National Research Council, 2013).

Poor functional autonomy of action, in general, is associated with activity constraint, isolation, low levels of physical activity, increased risk of fall and negative feelings (Albert et al., 2014; Siqueira Rodrigues, Ali Cader, Bento Torres, Oliveira, & Martin Dantas, 2010). In this sense, the evidence that sustaining a satisfactory state of functional independence seems to be directly related to an acceptable physical fitness condition is acceptable (Fraga, Cader, Ferreira, Giani, & Dantas, 2011; Matta Mello Portugal et al., 2013; Pernambuco et al., 2013).

The aging process is associated with an increased prevalence and number of both mental and physical health concerns and disabilities (Blazer, Burchett, Service, & George, 1991; Ko & Coons, 2005; Mroczek & Spiro, 2005). Poor mental health is an important consideration for the older adult population, because it appears to be a substantial component of perceived quality of life (Kahn, Hessling, & Russell, 2003), can affect physical health domains (Diefenbach, Leventhal, Leventhal, & Miller, 1996), and is likely to obstruct engagement in positive health behaviors (Cohen-Mansfield, Marx, & Guralnik, 2003). Given the high and rising cost of health care and prescription medications, it is important to consider relationships between modifiable behaviors and lifestyles that might affect mental health (Albert et al., 2014).

The investigation into the association between exercise and SWL is not new, but questions remain as to what frequency, intensity, and duration of physical exercises programs is most feasible and effective for affecting mental health (Parker, Strath, & Swartz, 2008). Small gains in strength or in aerobic condition, can make a significant difference in older adults’ quality of life, by preserving their ability to execute Pf-adl (Chou, Hwang, & Wu, 2012; Patel, Newstead, & Ferrer, 2012). The American College of Sports Science (ACSM) makes clear in its guidelines that older people get benefits related to SCE, in general, it is recommended to practice ranging from between 30-60 minutes of exercise/day; frequency twice a week and 8-10 exercises involving the major muscle groups (Nelson et al., 2007). The main objective is to mitigate the effects of senescence such as loss of muscle mass and prevention of sarcopenia by stimulating it to increase energy reserves (Ferrucci et al., 2002).
The effect of an SCE in elderly has already been studied a lot in the literature (Borde, Hortobágyi, & Granacher, 2015). However, studying different types of exercise intervention is necessary to check how new strategies for organizing exercise routines can improve Pf-adl performance and SWL in elderly persons. Additionally, the high prevalence of this kind of studies is done with samples of female participants (Borges et al., 2012; Fraga et al., 2011). In this sense, the purpose of this study was to check the effects/efficiency of a SCE on Pf-Adl and SWL in elderly men that underwent a 12-weeks MSE program when compared to a control group (non-practitioners).

**METHODS**

**PROCEDURES**

Participants were older men living in two social and health care support centres, located in the city of Pocos de Caldas, Brazil. All participants (or responsible) were required to give a full informed consent before beginning the research. The study protocol has been approved by University Centre of Educational Guaxupé Foundation Ethical Committee, under protocol number UNIFEG-000/321. Respected the Brazilian National Council Resolution nº 466/12-CNS (Novoa, 2014), on ethics in exercise science research (Shephard, 2002) and still, complied with the guidelines for research with human beings of the Helsinki Declaration (Petrini, 2014).

**SAMPLE**

The sample consisted of male participants from two elderly care institutions. The participants were randomly divided into an experimental group (EG; n = 27; age = 78.2±4.1 years) and a control group (CG; N= 24; age 77.9±3.7 years). The exclusion criteria stipulated for the older participants were: a) poor physical fitness performance; a) involvement in other structured exercise programs; c) suffer from severe cardiovascular disease or similar clinical condition; d) presence of severe mental disorder; e) need of palliative health care or special nutritional support.

**MEASURES**

**Anthropometric**

Weight and height were measured using a scale (Seca® brand) with stadiometer attached to the scale (accurate to 100 grams) and (height to .01 cm in length). The whole procedure was performed according Anthropometric Standardization Reference Manual (Lohman, Roche, & Martorell, 1988). Body mass index (BMI) was calculated using the formula BMI = (kg / m²) = MC / ES² where; MC = body mass (kg); ES = height in meters.

**SWL**

The validated Brazilian version of the satisfaction with life scale was used (Albuquerque, Sousa, & Martins, 2010). The SWL is a 5-item scale designed to measure global cognitive judgments.
of one’s life satisfaction. Many authors now emphasise SWL as a central component of subjective PWB (Kong, Zhao, & You, 2012; Wirtz, Chiu, Diener, & Oishi, 2009). It is often regarded as the single most important contribution to life adjustment as well as an important aspect of quality of life (Parker et al., 2008). Some studies have demonstrated the sensitivity of SWL scale to the effects of exercise (Gonçalves, Vale, Barata, Varejão, & Dantas, 2011; Lucas, Freitas, Oliveira, Machado, & Monteiro, 2012).

**Pf-Adl**

Was analyzed through the LP protocol validated in the Brazilian elderly population by Dantas & Vale (2004). These tests consist in: 10-m walk (W10-m); rising from a sitting position (RSP); rising from the ventral decubitus position (RSVP); rising from a chair and moving about the house (RCMH); putting on and removing a t-shirt (PRTS). The results obtained in these tests represent the final test scores LP* Index (Siqueira Rodrigues, Ali Cader, Bento Torres, Oliveira, & Martin Dantas, 2010). After the accomplishment of the tests, the LI was calculated and with a lower score corresponding to a better result following the formula, where W10-m, RSP, RSVP, PRTS e RCMH = time in seconds.

\[ \text{LPI} = \left[ \frac{(W10-m+RSP+RSVP+PRTS) \times 2}{RCMH} \right] + \frac{RCMH}{4} \]

Because it is a protocol of easy and fast application, several studies have been conducted using this protocol, which helped to establish the sensitivity caused by modulation of different exercise programs (Borges et al., 2012; de Noronha Ribeiro Daniel et al., 2011; Gonçalves, Vale, Barata, Varejão, & Dantas, 2011; Martin Dantas & Gomes de Souza Vale, 2004; Pernambuco et al., 2013; Siqueira Rodrigues et al., 2010).

**SCE Program**

The development of the SCE program was conducted by specialists in exercise prescription for older adults and consisted of an exercise class performed by determined number of sets, repetitions, cadence of execution and rest between sets using Thera-band® elastics bands (EB) divided in a) warm-up: 10 minutes with exercises for general body mobilization, PSE 1-2; b) Muscle strength workout: 40 minutes SCE with elastic-band, PSE 3-5; c) cool-down 5 minutes static flexibility for ‘breath’ control. The SCE intensity will be measured through the OMNI Perceived exertion scale (O-PES) with EB (Colado et al., 2014). The O-PES consists of an arbitrary scale ranging from 0 to 10 points, with identical intervals and with reference to the quality of effort: (0) extremely (1-2) easy, (3-5) somewhat easy, (6-7) somewhat-hard; (8) hard (9-10) extremely-hard. The goal is to keep the exercise activity levels between levels 6 to 8 (Robertson et al., 2003). We will expect that the relationship with the real effort is 60-75% of maximum heart-rate values recommended by the ACSM (Nelson et al., 2007). This would allow the training stimulus dosage to be precisely controlled in both the session in progress and between different sessions (Colado et al., 2014). The EG underwent a SCE program lasting 12-weeks twice a week while the pparticipants in the CG did not undergo any exercise programs. The tests were applied before and after the 12-weeks of exercise intervention in both groups. An adherence to the exercise program between of 70% was established as minimum amount for each participant
(Picorelli, Pereira, Pereira, Felício, & Sherrington, 2014). Precaution was taken to avoid interaction of strength exercises between individuals of the two groups by staggering the timings of the sessions.

STATISTICS

The Kolmogorov-Smirnov was accessed to check the distribution of data and descriptive statistics are presented as mean/standard deviation for Pf-adl, SWL, BMI and age variables for both groups. All dependent variables were log-transformed before analysis to reduce non-uniformity of error and to express effects as percent changes, except for the SWL indicator that were based on Likert scales (Nevill & Lane, 2007). Changes in Pf-adl and SWL indicators as a consequence of SCE program were examined based on paired-t statistics. The between-subject standard deviation for each dependent variable was used to convert the log-transformed changes indicators into standardized [Cohen effect size (ES)] changes in the mean. The effect sizes were considered as trivial (d ≤ 0.2), small (0.2 < d < 0.6), moderate (0.6 < d < 1.2), large (1.2 < d < 2.0), very large (2.0 < d < 4.0) and nearly perfect (d > 4.0). Statistical significance was set at p ≤ 0.05. (Cohen, Cohen, West, & Aiken, 2013).

RESULTS

Characteristics of experimental and control groups at baseline are presented in Table 1. The results show that were no statistically significant differences between CG and EG groups.

<table>
<thead>
<tr>
<th></th>
<th>Control group (n=24)</th>
<th>Experimental group (n=27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>77.9 (3.7)</td>
<td>78.2 (4.1)</td>
</tr>
<tr>
<td>Stature (cm)</td>
<td>170.1 (3.2)</td>
<td>169.1 (4.6)</td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>73.2 (6.4)</td>
<td>72.6 (3.5)</td>
</tr>
<tr>
<td>10 meters walk (s)</td>
<td>18.2 (3.8)</td>
<td>17.2 (4.1)</td>
</tr>
<tr>
<td>Rising from a sitting position</td>
<td>17.0 (1.7)</td>
<td>18.3 (2.1)</td>
</tr>
<tr>
<td>Putting on and removing a t-shirt (s)</td>
<td>25.6 (4.6)</td>
<td>24.8 (4.0)</td>
</tr>
<tr>
<td>Rising from the decubitus frontal position</td>
<td>14.6 (7.8)</td>
<td>13.9 (4.8)</td>
</tr>
<tr>
<td>Rising and walk through house (s)</td>
<td>102.4 (10.0)</td>
<td>103.6 (11.1)</td>
</tr>
<tr>
<td>IG index (#)</td>
<td>60.1 (9.7)</td>
<td>59.0 (9.3)</td>
</tr>
<tr>
<td>Satisfaction with life (#)</td>
<td>23.2 (6.0)</td>
<td>22.5 (6.8)</td>
</tr>
</tbody>
</table>

Table 1. Characteristics of experimental and control groups at baseline

**p<0.01; * p<0.05, comparisons between pre- and post-exercise based on t-statistic; SD: standard deviation

Table 2 shows the effects of the SCE in the EG and GC. There were significant improvements in the Pf-adl indicators ‘walk 10 meters’, ‘rising from a sitting position’, ‘rising from a chair and
moving about the house’, ‘putting on and removing a t-shirt’ and LPI during the 12-week SCE program. A significant improvement was also found for the SWL.

<table>
<thead>
<tr>
<th>Experimental group (n=27)</th>
<th>Pre-exercise</th>
<th>Post-exercise</th>
<th>Changes in mean, 95% CL (%)</th>
<th>Coefficient of variation 95% CL (%)</th>
<th>Practical inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 meters walk (s)</td>
<td>17.2 (4.1)</td>
<td>15.9 (2.3)</td>
<td>-5.3 (-8.0 to -2.4) **</td>
<td>6.0 (4.8 to 8.0)</td>
<td>Benefit possible</td>
</tr>
<tr>
<td>Rising from a sitting position</td>
<td>18.3 (2.1)</td>
<td>16.6 (1.8)</td>
<td>-2.5 (-3.8 to -1.2) **</td>
<td>3.2 (2.7 to 4.1)</td>
<td>Benefit possible</td>
</tr>
<tr>
<td>Putting on and removing a t-shirt (s)</td>
<td>24.8 (4.0)</td>
<td>23.7 (3.3)</td>
<td>-4.4 (-7.5 to -1.5) *</td>
<td>7.8 (6.4 to 10.0)</td>
<td>Benefit possible</td>
</tr>
<tr>
<td>Rising from decubitus frontal position</td>
<td>13.9 (4.8)</td>
<td>9.6 (2.3)</td>
<td>-0.4 (-0.8 to -0.0)</td>
<td>0.9 (0.8 to 1.2)</td>
<td>Benefit possible</td>
</tr>
<tr>
<td>Rising and walk through house (s)</td>
<td>103.6 (11.1)</td>
<td>97.8 (15.5)</td>
<td>-5.6 (-9.8 to -2.8) **</td>
<td>9.3 (7.6 to 11.9)</td>
<td>Benefit possible</td>
</tr>
<tr>
<td>IG index (#)</td>
<td>59.0 (9.3)</td>
<td>55.0 (8.1)</td>
<td>-7.0 (-11.0 to -2.9) *</td>
<td>10.7 (8.8 to 13.8)</td>
<td>Benefit possible</td>
</tr>
<tr>
<td>Satisfaction with life (#)</td>
<td>22.5 (6.8)</td>
<td>23.7 (4.7)</td>
<td>9.2 (-4.1 to 24.2)</td>
<td>35.7 (28.9 to 47.3)</td>
<td>Benefit possible</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control group (n=24)</th>
<th>Pre-exercise</th>
<th>Post-exercise</th>
<th>Changes in mean, 95% CL (%)</th>
<th>Coefficient of variation 95% CL (%)</th>
<th>Practical inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 meters walk (s)</td>
<td>18.2 (3.8)</td>
<td>18.9 (3.5)</td>
<td>-1.3 (-3.0 to -0.4)</td>
<td>5.0 (3.6 to 9.1)</td>
<td>Likely Trivial</td>
</tr>
<tr>
<td>Rising from a sitting position</td>
<td>17.0 (1.7)</td>
<td>18.0 (5.1)</td>
<td>-0.9 (-2.9 to -0.0)</td>
<td>4.1 (4.5 to 5.1)</td>
<td>Likely Trivial</td>
</tr>
<tr>
<td>Putting on and removing a t-shirt (s)</td>
<td>25.6 (4.6)</td>
<td>25.3 (3.8)</td>
<td>-0.4 (-1.5 to -3.1)</td>
<td>6.9 (9.4 to 11.0)</td>
<td>Likely Trivial</td>
</tr>
<tr>
<td>Rising from decubitus frontal position</td>
<td>14.6 (7.8)</td>
<td>15.2 (6.7)</td>
<td>0.4 (-0.4 to -2.2)</td>
<td>1.2 (1.1 to 2.3)</td>
<td>Likely Trivial</td>
</tr>
<tr>
<td>Rising and walk through house (s)</td>
<td>102.4 (10.0)</td>
<td>100.8 (9.2)</td>
<td>-1.6 (-3.5 to -2.1)</td>
<td>9.3 (1.6 to 13.9)</td>
<td>Likely Trivial</td>
</tr>
<tr>
<td>IG index (#)</td>
<td>60.1 (9.7)</td>
<td>64.8 (7.9)</td>
<td>4.7 (9.5 to 26.6)</td>
<td>10.7 (9.8 to 11.9)</td>
<td>Very unlikely</td>
</tr>
<tr>
<td>Satisfaction with life (#)</td>
<td>23.2 (6.0)</td>
<td>22.0 (3.4)</td>
<td>7.4 (-3.5 to 22.8)</td>
<td>35.9 (26.8 to 41.4)</td>
<td>Likely Trivial</td>
</tr>
</tbody>
</table>

Table 2. Mean changes in Pf-adl and SWL, pre and post-exercise in the EG group of male elders and chances in which the true difference in the changes is substantial

** p<0.01; * p<0.05, comparisons between pre- and post-exercise based on t-statistic; s: seconds.

DISCUSSION

The objectives of this study were to assess the effects of a SCE program of in a population of older men in physical fitness related to activities of daily living and subjective perception of satisfaction with life.

The trend of changes in Pf-adl as consequence of SCE seems to be ‘possibly beneficial’ in all the indicators, except from the ‘Rising from decubitus frontal position test’. Unlike the control group that did not show statistically significant differences. Similar results were found in a sample of elderly women when subjected to Pilates (Siqueira Rodrigues et al., 2010) and aquatic exercise programmes (Pernambuco et al., 2013) that is, significant improvements in dimensions of quality of life related to well-being, in addition, to the improved performance of the motor tasks LP protocol (Siqueira Rodrigues et al., 2010). The literature reports that strength gains can help even in tasks requiring strength and quick reaction in a short time, especially in older populations (Hewitt, Refshauge, Goodall, Henwood, & Clemson, 2014) and in samples were the participants possess sedentary routines and who do not regularly participate in activities that involve development of strength, as is the case of our study samples. Not only the musculoskeletal
diseases, but low active lifestyles are strongly related to disuse of muscles that in extreme conditions can cause muscle atrophy (Cruz-Jentoft et al., 2010). In physiological terms, this can be caused by decrease of the muscle cross-sectional area, increased variability and size of fibbers and fibber dispersion, among others (Ferrucci et al., 2002). However, other morphological changes occur during the atrophy process impacting negatively on muscular strength and endurance. Still, even in populations with advanced ages, these conditions may be improved if the magnitude of the effort is controlled and adapted to cause the common adaptations to strength exercises (Donnelly et al., 2009). In our study sample, this aspect was controlled during the sessions, whose average (standard deviation) PSE values ranged between 3.8(1.2) and 6.2 (3.6) during the SCE program. When compared to other studies, adherence to exercise was considered satisfactory, and dropouts, which occur only in the control group (Picorelli, Pereira, Felício, et al., 2014). Acute health affections and negative mood states (Schoenborn & Stommel, 2011), were more frequent in this population reasons for missing classes.

As for the SWL dimension there were significant differences with the magnitude of the effect size indicating that the changes occurred represented a ‘possible benefit’. The positive results obtained for the SWL corroborate other literature findings that demonstrated the sensitivity of the SWL scale to exercise (Gonçalves, Vale, Barata, Varejão, & Dantas, 2011; Lucas, Freitas, Oliveira, Machado, & Monteiro, 2012; Parker et al., 2008), and the positive correlation between physical activity levels and SWL (Chou et al., 2012). These studies, as well as ours, show increased motor proficiency and appear to be associated with the subjective perception of general well-being. In addition, the negative CG results of our study support the premise that SCE can improve the subjective perception of SWL and this fact may be related to the improvement of proficiency to perform the daily live tasks.

**CONCLUSION**

The present study demonstrates that a 12-weeks MSE program can improve Pf-adl and SWL perception in older men, evidencing possible benefits to physical health and psychological adjustments that may be associated in these participants. Research on female samples and the use of more precise physical fitness indicators may help to explain more precisely, the association between these two dimensions.

**CONFLICTS OF INTEREST**

The authors declare that they have no competing interests.

**ACKNOWLEDGMENTS**

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REFERÊNCIAS


