The Effect of a Physical Activity Intervention on Burden and Depressive Symptoms in Depressed Family Caregivers of Patients With Schizophrenia: A Randomized Controlled Trial

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Background: The study aimed to investigate the efficacy of a 12-week physical activity intervention for caregivers of patients with schizophrenia. Method: Family caregivers of patients with schizophrenia were recruited and randomized into either a physical activity group (n = 31) or a control group (n = 31). The 12-week “Physical Activity Program” consisted of 10 minutes of warm-up activities as the initial segment, 20 minutes of rhythmic exercises as the activity segment, 10 minutes of cool-down exercises as the final segment, and 40 minutes of free walking. The physical activity program was designed to accommodate the ergonomics and physiological structure of the caregiver. The program consisted of 12 sessions. The Zarit Caregiver Burden Scale and the Beck Depression Inventory were used to the physical activity and control groups before the program’s implementation. Results: A total of 62 caregivers were randomized to the intervention (n = 31) or control group (n = 31). Postintervention measurement was completed by 61 caregivers, and all the caregivers completed the intervention. Mean scores of Zarit Caregiver Burden Scale score and Beck Depression Inventory score in the physical activity group of caregivers at postintervention, significantly reduced at <.05 level than their mean baseline scores. Conclusions: Engagement in a 12-week physical activity intervention can improve the perceived burden of caregiving and symptoms of depression. Future research should examine with larger sample groups, carry out interventions, and apply the physical activity intervention by targeting caregivers, along with different interventions.

Keywords: randomized controlled study, mental health, distress, caregiving

Schizophrenia commonly presents itself in early adulthood and disrupts patients’ lives, as they can exhibit a wide range of social and relational disabilities, necessitating long-term caregiving. Schizophrenia is a mental disorder in which caregivers are likely to experience increasing burden and stress. The concept of burden can be divided into objective and subjective aspects. Subjective burden refers to the tangible costs incurred because of the disease. Subjective burden refers to emotional distress caused by personal evaluations of the person’s status and disturbing behaviors on the part of the patient. Caring for a family member with schizophrenia necessarily involves a significant commitment of time, energy, and money from family caregivers over an extended period, which may result in increased caregiver burden and psychological distress. Long-term care involves physical, emotional, and financial costs.1–3 These difficulties may cause caregivers to be more vulnerable to serious mental health problems. Notably, high levels of caregiver burden and psychological distress among caregivers may also have an adverse effect on caregiver mental health.4 Several studies on caregivers of patients with schizophrenia found that caregivers face a significant burden and psychological distress, such as stress, anxiety, and depression.5–8

A high prevalence of depressive symptoms and anxiety has been reported in caregivers of patients with chronic mental illnesses. Furthermore, depression and stress levels have emerged as important determinants of caregiver burden.9 Depression among caregivers of patients with schizophrenia has been positively associated with younger caregiver age and lower levels of caregiver education, being assaulted by patients, stigma perceived by caregivers, increased number of hours spent providing care, older caregiver age and duration of caregiving, and having a poor social support system.10 Care burden has been extensively regarded as a strong predictor of depression in family caregivers caring for patient with schizophrenia, as well as a mediator of the relationship between other factors and depression.11 Given that depression is one of the main causes of disability and disease burden around the world, higher levels of depression will have an impact on family caregivers’ ability to care for patients with schizophrenia. Non-pharmacological interventions for caregivers have been regarded as the potential methods for relieving the burden of caregivers of patient with schizophrenia.12

To support caregivers, most interventions are based on the principles of psychoeducation and self-management. Although most psychoeducation or self-management interventions address caregivers’ needs regarding the psychosocial impact of a chronic disease, these interventions frequently do not address preventive health behaviors that caregivers could engage in to reduce the potential adverse psychological and physical outcomes associated with their role. Physical activity has been shown to reduce the risk of cardiovascular disease and some types of cancer in the general population, as well as reduce stress and depression, improve mental and cognitive health, and improve general well-being and sleep.13 In a study, it was shown that physical activity has a positive effect on physical health, quality of life, and cognitive functions, as well
as recovery of depressive symptoms. Individuals who did not engage in physical activity had more depression and anxiety symptoms than those who did, according to a study conducted by Thunyadee et al. A meta-analysis by Rebar et al. reported that regular physical activity has a preventive effect on the development of anxiety disorders.

Regarding the role of family caregivers in providing support and care for patients with schizophrenia, as well as the lack of appropriate support and education systems for family caregivers in the health system, interventional and experimental studies are required. Given the limited evidence for physical activity interventions, especially for the effects on caregivers, this randomized controlled study aimed to determine whether a 12-week physical activity program would be effective in improving burden and depressive symptoms of caregiver. The hypotheses of this study were,

- The care burden of the experimental group who was subjected to physical activity was lower than that of the control group.
- The depressive symptoms of the physical activity group were lower than the control group.

Methods

Design

This was a randomized controlled study with 2 groups and was designed in the experimental pretest-posttest pattern. This randomized controlled study was conducted at the Community and Mental Health Center (trial registration: NCT05257948). The RCT had 2 conditions: the intervention condition and a waiting list control condition. The participants were blinded to the principal author, randomized into one of the conditions after the preintervention assessment. To investigate the effect of a 12-week physical activity program on outcome measures for caregivers, preintervention and postintervention measurements were conducted in both experimental and control groups.

Participants

Caregivers of patients with schizophrenia were recruited from the Community and Mental Health Center. The study’s inclusion criteria were consenting to participate in the study, being literate and over the age of 18, being the primary caregiver responsible for the care and treatment of a patient diagnosed with schizophrenia at least 1 year prior to the study for a period of more than 3 months, and having at least ≥10 points from the Beck Depression Inventory. The exclusion criteria included diagnosed and untreated mental illness, having any physical or disability that may prevent participation in exercise, or continuing another physical activity program. A total of 62 caregivers were randomized to the intervention (n = 31) or control group (n = 31). Postintervention measurement was completed by 61 caregivers, and all the caregivers completed the intervention.

Sample Size

In calculation of the sample size, effect size was taken as 0.73 (Cohen d). Power as 0.80, type I margin of error as .05, and the sample size was calculated as 62 (http://danielsoper.com/statcalc3/calc.aspx?id=47). The sample included a total of 62 persons with 31 being in the experimental group and 31 in the control group.

Randomization

The caregivers who agreed to participate in the study were selected randomly using the simple randomization method. The participants were assigned to the experimental (n = 31) and control groups (n = 31) using the website http://www.randomizer.org/form.htm. The files of 174 caregivers were evaluated by the author in accordance with the criteria for inclusion or exclusion from the sample, and 76 names were put into the randomization process (Figure 1). In terms of sociodemographic characteristics, sex, marital status, and education level showed no statistically significant differences between the experimental and control groups.

Intervention

Before the study was conducted, the content of the program was designed in line with the relevant literature. The authors sought expert opinions from 2 faculty members in the psychiatric nursing department who specialized in working with families of patients with schizophrenia, as well as 2 faculty members in the sport science department. The physical activity program was designed to accommodate the ergonomics and physiological structure of the caregiver. The program consisted of 12 sessions. The Zarit Caregiver Burden Scale and the Beck Depression Inventory were used to the physical activity and control groups before the program’s implementation. The 12-week “Physical Activity Program” consisted of 10 minutes of warm-up activities as the initial segment, 20 minutes of rhythmic exercises as the activity segment, 10 minutes of cool-down exercises as the final segment, and 40 minutes of free walking. Caregivers in the experimental group were provided with the program by a psychiatric nurse and an associate professor in sports health science. The program was planned in accordance with ergonomics and the physiological characteristics of caregivers. Warming (10 min) was the soft physical activity of the muscles, joints, respiratory system, and circulatory system performed at the beginning of an exercise session to prepare the body for active exercise. Rhythmic exercise (20 min) was the phase in which the exercise program was implemented. To speed up the respiratory, circulatory, and locomotor systems, moderate activities including 22 simple movements (3–6 metabolic equivalent [ME]) were chosen for this phase. The phase began with proper breathing, and then continued with stretching and stamina exercises (repeating exercise of each muscle group 4 times or more). The duration and intensity of 22 rhythmic exercise activities were chosen by the caregiver. The ME level was measured for each exercise. ME assesses the concept of an individual’s level of physical activity. The ME is the amount of oxygen used by the body during physical activity as a unit in the calculation. Cool-down (10 min) exercises were performed to enable the lactic acids accumulated in the muscles and blood to quickly return to normal levels, gradually lowering the heart rate and blood pressure, which had increased following the activity program. After 10 minutes of low-intensity exercise, the exercises were completed. For walking (40 min), a suitable area was selected for the participants to walk easily in normal steps and in balance. Caregivers were given a comfortable and balanced walk in the open area during normal steps for this phase. The authors participated in the Physical Activity Program and performed all activities with the
caregivers. During the walking exercise, each participant wore a pedometer, and the number of steps they took was recorded.

All the practices in the 12-week Physical Activity Program were first explained to each of the caregivers in the experimental group and then together with their own group, and the authors ensured that the participants understood and adapted to the program. The caregivers in the experimental group were divided into 5 groups of 6 to 7 caregivers. All the activities in the program were performed as a group of individuals. The sessions were conducted by authors. During each session, the associate professor in sports health science showed how to perform these activities. At the end of the Physical Activity Program, The Zarit Caregiver Burden Scale and the Beck Depression Inventory were administered to both physical activity and control groups. No application was made to the control group during the 20-week program. The control group was asked to not change their normal routine for 12 weeks. Participants received the same assessments at the same timepoints as the experimental group. At the end of 12 weeks and after the participants completed their postintervention surveys, they received a 12-week physical activity program.

**Measures**

Questionnaires were used to collect information about the demographic characteristics of caregivers. Each caregiver’s sociodemographic characteristics included age, gender, education level, relationship with the patient, duration of care, job status, economic status, and number of family members (siblings, daughter, son, and spouse), and the presence of another person with mental illness in the family.

Zarit Caregiver Burden Scale was used to measure burden. This scale was developed by Zarit, Reever, and Bach-Peterson and was utilized to examine the stress of those who provide care to individuals with special needs or to older adults. The scale can be completed by the caregivers or the researchers through asking questions. It consists of 22 statements that determine the effect of caregiving on the individual’s life. This was a Likert-type scale including items scored from "0" to “4,” which refer to never, rarely, often, or almost every time. A minimum of 0 (zero) points and a maximum of 88 points can be obtained from the scale. The scale has no cut-off point. The scale items reference social and emotional concerns. Higher scale points indicate that the respondents have a higher level of difficulty. Inci examined the validity of the Caregiver Burden Scale in 2006 using the language equivalence, content equivalence, and structural equivalence methods. The reliability of the scale was examined using internal consistency, item analysis, and test–retest reliability methods. The alpha score obtained in this study was .81.

Beck Depression Inventory was used to measure depression. Beck Depression Inventory was developed by Beck et al to measure the behavioral manifestations of depression in adolescents and adults. Its Cronbach alpha values ranges between .73, .86, and .92. The inventory consists of emotional, cognitive, somatic, and motivational components. It makes a 4-point Likert-type measurement by scoring each item between 0 and 3. Depression severity was interpreted as 0 to 9 = minimal, 10 to 16 = mild, 17 to 29 = moderate, and 30 to 63 = severe according to the total score obtained from the scale. The Turkish validity and reliability study of the 1978 form of Beck Depression Inventory was conducted by Hisli; its Cronbach alpha value was .80. In this study, the Cronbach alpha value was found to be .86. The Beck Depression Inventory is a self-rating scale, which was developed by Beck in 1961 to assess emotional, cognitive, somatic, and motivational components. It is one of the most common tools used in research and in clinical practice. This enables individuals to provide

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information on themselves. Although the main purpose of the inventory is to assess the depression indications comprehensively, it also assesses cognitive content. The Beck Depression Inventory is a self-rating scale, which consists of 21 items and enables the researcher to assess the symptoms observed in depression. Of the items, 2 were about feelings, 11 about cognition, 2 about cognition, 5 about physical symptoms, and one about interpersonal indication. Each question has 4 answer options having weighted degrees, ranging from 0 to 3. In the Beck Depression Inventory, the total score of 9 or less indicates “no depression,” 10 to 16 indicates “mild,” 17 to 23 indicates “moderate,” and 24 or higher indicates “severe depression.” Although different values were regarded as the cutoff point of the Beck Depression Inventory value in similar studies which were conducted using the Beck Depression Inventory, the cutoff point was set at 17 in general in this study. The alpha score obtained in this study was .86.

**Statistical Analyses**

All analyses were conducted using SPSS (version 26.0). Descriptive statistics were used to determine the demographic characteristics of the participants. When the normality assumption of continuous variables was not met, the findings were presented with mean (SD) values and evaluated with nonparametric tests. The Mann–Whitney U test was used to compare the pretest–posttest scale mean scores of the physical activity and control groups. The Wilcoxon signed-rank test was used to assess the pretest and posttest data of the experimental group and the control group within themselves. The Cronbach α coefficients were calculated for the reliability of the scale and its subdimensions. Statistical significance was set at $P < .05$.

**Ethical Considerations**

The study protocol was approved by the Ethics Committee of Selçuk University Faculty of Medicine (No.: 10156/18 Decision no: 203). An institutional approval was received from the Community and Mental Health Center. All participants were given information about the name, aim, length, and type of the study, and each read the agreement form. Written informed consent was obtained from each of the participants before the data collection process and the implementation of the Physical Activity Program were initiated.

**Results**

**Sample Characteristics**

Sixty-two caregivers were enrolled in the study. The comparison of the data obtained from the caregivers regarding their sociodemographic characteristics showed that there was no statistical difference between the physical activity group and the control group. The mean age of caregivers in the control group was 45.14 (6.74), and it was 46.24 (5.37) in the physical activity group. There were more female participants in both control and physical activity groups than male participants. The duration of care in the control group was 3.54 (1.02), and it was 45.14 (6.74) in the physical activity group. The findings related to the caregivers’ sociodemographic characteristics are shown in Table 1.

**Caregiver Burden**

We evaluated the caregivers’ total Zarit Caregiver Burden Scale scores before the intervention and found that between-group ($P = .76$) difference was not statistically significant. The Wilcoxon test was used to test the significance of the differences between the physical activity group and the control group. The post physical activity intervention (at the end of 12 wk) mean Zarit Caregiver Burden Scale score of the physical activity group was significantly lower (51.42 [5.78]) than the mean score of the control group (68.23 [8.83]) ($P < .05$) (Table 2).

**Depressive Symptomatology**

Caregivers’ depressive symptomatology was assessed using the Beck Depression Inventory. There was no significant difference between the Beck Depression Inventory mean scores of the physical activity group and the control group before the intervention (day 0). The study found that the mean scores of the individuals in the physical activity group on the Beck Depression Inventory decreased at the end of the intervention process (after 12 wk) in comparison with the preintervention scores (day 0). The Beck Depression Inventory was administered before and after the 12-week Physical Activity Program, and the difference between the scores on the inventory was examined. The Wilcoxon test was used to test the significance of the physical activity and control group itself. The mean score of the caregivers with The Beck Depression Inventory in the physical activity group (baseline:

**Table 1 An Analysis of the Descriptive Characteristics of Caregivers in the Experimental Group and the Control Group**

<table>
<thead>
<tr>
<th>Sociodemographic characteristics</th>
<th>Experimental group ($n = 31$)</th>
<th>Control group ($n = 31$)</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>46.24 (5.37)</td>
<td>45.14 (6.74)</td>
<td>.82</td>
</tr>
<tr>
<td>Caregiving year</td>
<td>3.12 (0.65)</td>
<td>3.54 (1.02)</td>
<td>.53</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td>66.6</td>
<td>17</td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>33.4</td>
<td>13</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>20</td>
<td>66.6</td>
<td>16</td>
</tr>
<tr>
<td>High school higher degree</td>
<td>10</td>
<td>33.4</td>
<td>14</td>
</tr>
</tbody>
</table>

*Since there were less than 25 subjects included in observation, it was analyzed with Yates-corrected chi-square test.
Population. Physical activity is accepted as a nonpharmacological strategy for reducing caregiver burden and depressive symptomatology. It has been suggested that a 12-week physical activity program can improve feelings of burden and reduce psychological distress. However, the evidence for these effects is mixed in previous randomized controlled trials. Some studies have found that physical activity had a significant positive impact on caregiver burden, with a decrease in the total mean score of depression in the physical activity group compared with the control group. This was consistent with the study by Loi et al., who showed the effectiveness of physical activity interventions in reducing depression among caregivers. According to Mammen and Faulkner’s systematic review, physical activity is effective in improving mental health and reducing the risk of depression. Similarly, a meta-analysis by Rebar et al. found that physical activity moderately reduces depression by a medium amount. Some studies have reported significant effects of physical activity on improving psychological health in areas such as depression, anxiety, stress and general mental health, while other studies have reported no significant changes.

Limitations of the Study
To our knowledge, no other study has evaluated the effects of physical activity on reducing burden and depression in caregivers. Findings suggest that caregivers of patients with schizophrenia may experience depressive symptoms and that physical activity intervention may be an effective approach for improving these symptoms.

Table 2 Descriptive Statistical Data of Zarit Caregiver Burden Scale Intervention and Control Group

<table>
<thead>
<tr>
<th>Zarit Caregiver Burden</th>
<th>Intervention group (n = 31)</th>
<th>Control group (n = 31)</th>
<th>U</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>68.12 (3.45)</td>
<td>67.86 (6.24)</td>
<td>125.00</td>
<td>.76</td>
</tr>
<tr>
<td>Postintervention</td>
<td>51.42 (5.78)</td>
<td>68.23 (8.83)</td>
<td>275.00</td>
<td>.005**</td>
</tr>
<tr>
<td>Z*</td>
<td>−1.862</td>
<td>−.647</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p**</td>
<td>.02**</td>
<td>.79</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 Descriptive Statistical Data of the Beck Depression Inventory Scale Intervention and Control Group

<table>
<thead>
<tr>
<th>Beck Depression Inventory Scale</th>
<th>Intervention group (n = 31)</th>
<th>Control group (n = 31)</th>
<th>U</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>17.45 (3.06)</td>
<td>17.23 (4.08)</td>
<td>175.00</td>
<td>.92</td>
</tr>
<tr>
<td>Postintervention</td>
<td>10.63 (4.63)</td>
<td>18.36 (4.63)</td>
<td>650.00</td>
<td>.001**</td>
</tr>
<tr>
<td>Z*</td>
<td>−0.734</td>
<td>−7.376</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p**</td>
<td>.001**</td>
<td>.77</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion
The purpose of this study was to determine the efficacy of a 12-week physical activity program for improving burden and depression among caregivers of patients with schizophrenia by analyzing the results of a randomized controlled study of a 12-week physical activity program versus a control group. This is the first randomized controlled trial that investigates the effectiveness of a 12-week physical activity program in which caregivers of patients with schizophrenia participated. This randomized clinical trial found that the 12-week physical activity intervention decreased symptoms of depression and burden in caregivers of patients with schizophrenia. Our study adds to the existing body of literature by assessing burden and depressive symptoms in caregivers who completed a 12-week physical activity program. There was inconclusive evidence in a descriptive review by Lambert et al., as to whether exercise interventions result in decreased subjective distress and burden. In their systematic review, Lambert et al. noted a lack of high-quality studies. The current study adds to the evidence that a 12-week physical activity program can improve feelings of caregiver burden and depressive symptomatology.

Caregivers of patients with schizophrenia experience an excessive psychological burden. Physical activity is accepted as a nonpharmacological intervention for improving psychological functioning. For caregivers, this burden has been associated with depression. The effects of physical activity interventions on this burden have been mixed in previous randomized controlled trials. Some studies found that physical activity had a significant impact on burden reduction. Similarly, a study by Shimazaki et al. noticed that physical activity reduces psychological burden. Some studies found no differences in caregiving burden between groups but found a significant positive impact within the experimental group. In the systematic review and meta-analysis conducted by Epps et al., it is stated that physical activity training applied to caregivers of individuals with chronic diseases improves the physical and mental well-being of caregivers. The present randomized controlled study showed that physical activity can reduce subjective caregiver burden for caregivers, but it would be important to test whether varying the intervention is likely to reduce potential benefits. This is likely to be useful in terms of a protocol of treatment recommendations for this population.

Caregiving to patients with schizophrenia can result in various psychological and mental health complications. Depression is among the greatest psychological side effect of caring for patients with schizophrenia. The findings of this study illustrated a significant decrease in the total mean score of depression in the physical activity group compared with the control group. This was consistent with the study by Loi et al. who showed the effectiveness of physical activity interventions in reducing depression among caregivers. According to Mammen and Faulkner’s systematic review, physical activity is effective in improving mental health and reducing the risk of depression. Similarly, a meta-analysis by Rebar et al. found that physical activity moderately reduces depression by a medium amount. Some studies have reported significant effects of physical activity on improving psychological health in areas such as depression, anxiety, stress and general mental health, while other studies have reported no significant changes. Importantly, our findings suggest that caregivers of patients with schizophrenia may experience depressive symptoms and that physical activity intervention may be an effective approach for improving these symptoms.

17.45 (3.06) was found to be lower at the end of the physical activity program (postintervention: 10.63 (4.63)) and the difference was found to be statistically significant (P < .05) (Table 3).
However, this study has some limitations. The most important limitation of the current study was the small sample size. The results obtained from this study are limited to the caregivers who care for patients with schizophrenia. The authors were unable to identify the underlying psychological or biological mechanisms that confer significant benefit on burden and depression symptoms. While it is likely that physical activity is primarily responsible for the brain-altering effects, it is also possible that the lifestyle structure underlies some of the improvements measured in psychological functioning.

**Conclusion**

In the current study, the effect of the 12-week physical activity intervention on the caregiver burden and depression symptoms among the caregivers of patients with schizophrenia was examined, and it was found that the caregivers in the experimental group had lower mean Zarit Caregiver Burden Scale score and Beck Depression Inventory scores after practicing the 12-week physical activity intervention. The comparison of the caregiver burden and mean depression scores of the caregivers in the experimental and control groups, however, revealed no statistically significant difference. Based on this study’s findings, it is recommended to conduct studies with larger sample groups, carry out interventions, and apply the physical activity intervention by targeting caregivers, along with different interventions. Further research is required to assess whether there may be additional benefits such as increased feelings of positive aspects of caregiving. Given the global burden of caregiving, discovering nonpharmaceutical methods for improving caregiver psychological functioning is essential, and physical activity intervention is proving to be one such approach.

**References**


