

The Impacts of Different Types of Exercises on Caregivers Stress Levels for persons with Alzheimer's Disease

By Lydia Sun

Author Bio

Lydia Sun is currently a junior at the Bishop Strachan School in Toronto, Canada and she is taking great amounts of science courses as she is interested in studying Neuroscience. She wants to pursue Neuroscience and Research later on in University and in her career. Some of her major hobbies are the following: running her non-profit Cognitive Compass Connections, dancing (ballet and contemporary), volunteering at organisations such as Alzheimer's Society of Canada and Sisters of St. Joseph (CSJ), baking, catching up on a few episodes of Grey's Anatomy. Lydia has been particularly interested in exploring more about Alzheimer's Disease and how it can not only affect not only the individual diagnosed but also their caregivers. She has realised the lack of research targeted towards caregivers and thus why she conducted this research. Lydia's non-profit Cognitive Compass Connections is actually dedicated towards spreading awareness and raising funds for people with Alzheimer's Disease. Her organisation has currently raised over \$1300

Abstract

Alzheimer's Disease (AD) is the most common type of Dementia, affecting over 55 million individuals. This type of disease is caused by the abnormal chemical changes causing toxic taus to detach from microtubules and attach to other taus, forming tangles in the brain. Leading to form tangles inside neurons, disturbing the synaptic communication between these individual neurons.

Keywords: Alzheimer's Disease, caregivers, aerobic exercises, anaerobic exercises, resistance exercises, stress response

Methods

We analysed the responses of 105 individual caregivers, caregiving for people with AD. We focused on asking questions that resolve to multiple-choice answers asking about the type of exercising being performed by caregivers and the most stress-relieving types of exercises. Surveyors' responses were analysed and percentages as well as results were generalised and averaged, to form a single and accurate conclusion.

Results

The survey among Alzheimer's caregivers showed that aerobic exercises, like jogging, significantly reduced stress levels, with a consistent reduction shown across all participants. Dance also proved beneficial, not just physically but also socially, enhancing emotional well-being through increased social interactions.

Conclusions

Different exercises affect caregiver stress differently. Aerobic activities offer the most stress relief, likely due to improved physical health and emotional well-being. Dance adds unique social benefits. Caregivers might consider integrating these exercises into their routines for better stress management and overall health.

Hypothesis

Aerobic and resistance exercises, along with dance interventions, are expected to beneficially influence the stress levels of caregivers looking after individuals with Alzheimer's Disease, though the advantages will differ between these interventions. Aerobic and resistance exercises are likely to increase brain health and reduce caregiver stress. On the other hand, dance interventions are anticipated to be more effective in improving social interactions, thereby affecting the stress levels.

Introduction

Alzheimer's Disease (AD) is a neurodegenerative disorder characterised by cognitive decline and memory impairment. According to the World Health Organization, over 55 million people currently suffer from dementia, a category that includes AD, with nearly 10 million new cases annually (J (Ott), 2017). In the United States, approximately 6.7 million people aged 65 and older are living with AD, a condition that incurs substantial societal costs (Pubmed, 2023). In 2023, the national expense for caring for individuals with Alzheimer's or other dementias is projected to reach \$345 billion (Pubmed, 2023). Looking toward the future, the importance of AD and other dementias is expected to rise significantly. The number of Americans living with these conditions is projected to nearly double to about 13 million by 2050 (Doyle, 2020). Globally, the number of people with dementia is forecasted to nearly triple, increasing from an estimated 57.4 million cases in 2019 to around 152.8 million cases by 2050 (Alzheimer's Disease Fact Sheet, 2023). This dramatic increase is largely attributed to population growth and ageing (Alzheimer's Disease Fact Sheet, 2023). Current pharmacological treatments, while beneficial, offer limited efficacy and often come with side effects for people with AD, prompting the exploration of alternative approaches. Often, when AD worsens, people experience an exponential loss of memory and experience other cognitive difficulties, such as vision issues and spatial issues (Alzheimer's Disease Fact Sheet, 2023).

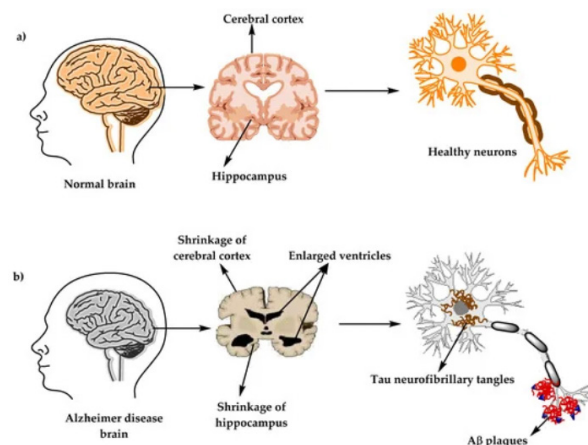


Figure 1. The physiological structure of the brain and neurons in (a) healthy brain and (b) Alzheimer's disease brain (acquired from Breijyeh, 2020)

AD consists of three general stages: mild, moderate, and severe. Most people experiencing AD on a mild level experience possible occurrences such as losing themselves or wandering to unfamiliar settings. On a moderate level, memory loss and confusion get worse, and often people forget how to proceed with actions they would normally do with ease, such as putting on clothes or utilising technologies (Llanque, 2014).

In the last stage of AD, plaques and tangles spread through the brain system and impair the brain tissues by shrinking them down, making the person affected lose most of their memory (Llanque, 2014). In the brain of people with AD, toxic changes happen in the brain, destroying the healthy balance that maintains the system within the brain (Llanque, 2014). These changes occur years and even decades before the first signs and symptoms of dementia formed within a person. As researched, scientists believe that the two proteins involved in this process, named beta-amyloid and tau proteins, when abnormal tau accumulates it forms tangles within a neuron and beta-amyloids clumps into plaques building up between neurons (Llanque, 2014). Currently, many advances in technology have been made to further study the effects of AD and pathology, these common methods include brain imaging allowing doctors and scientists to see the course of plaques and tangles allocated in the brain. These studies enable designed drugs to reduce the increase of tau and amyloids building up, exercising and dietary implementations are also reinforced to reduce the chance of this occurring in a person. Despite research on developing AD medication, there are currently a lack of effective treatment options thus medications are being made to treat the progression of the disease by targeting its cause, beta-amyloid and tau proteins (Llanque, 2014).

As AD advances in society with the increase in ageing and population rate, the need for caregivers also increases at an exponential rate. Currently, there are more than 15 million unpaid caregivers for persons suffering from AD, being stressful for caregivers due to the chronic nature of the disease's progress, as well as other factors such as – balancing their personal life and relationships with others (Schulz, 2016). Walter Cannon, proposed the terminology of caregiver stress. It was around the twentieth century in which describing stress as a fight or flight response or a heightened arousal state allows animals to flee from

threat or fight off threat (Schulz, 2016). Following the discovery of Cannon, Hans Selye popularised this idea of concept of stress, where they hypothesised the idea of three stages of a person's response to stress, in which there happens to be a cognitive appraisal in the stress response. The concept of family caregiving was first appointed around the 1980s, to describe persons caring for elderly family members in their homes.

Formal caregivers are volunteers or paid employees connected to the social service or healthcare systems, assisting with the daily care and needs for the care receiver potentially resulting in caregiver stress (Schulz, 2016). It is usually depicted as a burden or strain that most caregivers face when caregiving for someone with a chronic illness or disease, accompanied with depression and other mental health issues. This stress often refers to the mental health of caregivers as studies have shown that the physical health of caregivers remains constant rather than fluctuating, unlike mental aspects (Schulz, 2016). The defining attribute associated often with caregiver stress is the unequal distribution of responsibilities on the caregiver as a result of caring for someone with prolonged impairment. Due to the lack of support, and the daily needs of care receivers, the build-up of duties often cause a breakdown in the majority of caregivers on the route. Research shows that studies on caregiver stress often look at it from both subjective (personal feelings) and objective (measurable events) perspectives (Schulz, 2016). This creates a contradiction because objective signs of stress, like a care receiver's challenging behaviour, are seen as leading to the caregiver's feeling of stress. Essentially, caregiver stress is about the caregiver feeling overwhelmed due to an imbalance in the caregiving relationship, feeling tired, or tense, which stems from experiencing challenging situations with the person they are caring for.

Researchers in the Current Field go into the Research of Caregiver Stress and Bring in Interventions

The increasing importance of chronic illnesses, especially AD, has brought attention to the immense burden carried by caregivers, showing a demand for effective strategies to suppress all of these caregiver's stress (Vu., et al, 2022). Despite

the role caregivers have within a healthcare system, the comprehensive toll—spanning from physical, emotional, and psychological aspects—have been examined in an abundant amount of research and a lot of policy discussions currently existing in our society. However, recent shifts in academic and clinical paradigms have allowed an era of increased attention towards implementing intervention-based and preventative strategies aimed to increase a caregivers' quality of life. Caregiver stress, characterised by a complex combination of emotional turmoil, physical strain, and financial insecurity, emerges distinctly in those caring for AD patients due to the disease's progressive, unpredictable trajectory (Vu., et al, 2022). The emotional distress of witnessing a loved one's cognitive decline, added by the exhausting demands of daily care and economic burden, establishes a foundation for stress, anxiety, and depression amongst caregivers.

In response, contemporary research allows a shift towards an approach depicting psychological support, technological innovations, and preemptive measures to combat the onset and escalation of caregiver stress (Liu, 2020). Psychological interventions, including counselling, stress management training, and educational programs about disease management, have shown efficacy in ameliorating feelings of helplessness and enhancing caregivers' emotional resilience (Vu., et al, 2022). Such initiatives not only provide caregivers with essential coping mechanisms but also deepen their overall understanding of the disease, empowering them to navigate the caregiving journey with increased competence and confidence. Concurrently, the emphasis on lifestyle modifications underscores the importance of caregivers' self-care, advocating for regular physical activity, balanced nutrition, and adequate rest as pivotal components in sustaining mental and physical well-being. Research the positive correlation between physical well-being and reduced stress levels, spotlighting the critical need for caregivers to prioritise their health alongside their caregiving responsibilities. Preventative strategies represent a forward-thinking dimension of caregiver support, focusing on early identification and intervention for at-risk individuals (Schulz, 2009). By offering resources and support preemptively, these approaches aim to forestall the accumulation of stress, preserving caregivers' health and prolonging their capacity to provide care. The burgeoning body

of intervention-based research on caregiver stress signifies a promising trajectory toward developing holistic, effective support systems that acknowledge and address the challenges caregivers face (Alzheimer, 2022). Nevertheless, the path forward is fraught with obstacles, including the need for personalised intervention strategies that reflect the diverse experiences of stress among caregivers and the broader implementation of proven interventions.

The variability in stress experiences necessitates an approach to support, underscoring the importance of continued innovation and research in the field. Moreover, the effective dissemination of intervention strategies remains uneven, highlighting the imperative for policy reforms and enhanced funding to expand caregiver support programs, such as the longitudinal impacts of these interventions and explore avenues for scaling successful models to benefit a wider caregiver population (Alzheimer, 2022).

Studies have shown that exercising is highly beneficial to improving the health of caregivers and significant increase in health outcomes of caregivers after exercise training in this analysis supports that physical fitness activities can be somewhat beneficial for the well-being of caregivers (Farran, 2016).

In conclusion, to mitigate caregiver stress is an ongoing journey marked by significant advancements and persistent challenges. The collective efforts of researchers, healthcare professionals, and policymakers are crucial in forging a supportive ecosystem that uplifts caregivers, ensuring they receive the recognition, support, and resources necessary to thrive in their pivotal roles. Through other research and the use of evidence-based interventions, there can be other potential to substantially increase the overall quality of life for caregivers, allowing better health and well-being of caregivers to be regarded as more important.

This research paper aims to compare the impacts of different lifestyles: aerobic, anaerobic, resistance exercises, and dance activities, on the amount of caregiver stress reduced on caregiving for people with AD. Focusing on studying the hypothesis on how aerobic and resistance exercises, along with dance interventions, are expected to beneficially influence the stress levels of caregivers looking

after individuals with AD, though the advantages will differ between these interventions. Aerobic and resistance exercises are likely to increase brain health and reduce caregiver stress. On the other hand, dance interventions are anticipated to be more effective in improving social interactions, thereby affecting the stress levels.

Methodology

To identify the impacts and correlation of different lifestyles on caregiver stress, a survey was given to caregivers of all age, race, gender and demographic and also made available on google form online. This survey was made on Google Forms and was later on sent to 100 caregivers based in China for more research to be collected. The survey fabricated (primary research) consists of a total of 14 questions given out to caregivers of all age, race, gender and demographic.

Survey Participants

The participants are found through different organisations, institutions and databases. All participants are verified to be legitimate caregivers, caregiving for only people with AD. Participants are verified as a caregiver through a self-reported question in the conducted survey. All participants gave their consent on using their shared information for research purposes. We will be de-identifying any personal information that can be associated with you and utilise the survey results only for research purposes.

Questionnaire Design and Data Collection

The survey conducted aims and directs questions to specifically caregivers for persons with AD, asking whether or not aerobic or anaerobic exercises, as well as resistance and dance exercises, help reduce the amount of stress that builds up within the individual. As well as the different levels of stress that pertains within an individual due to caregiving and the different levels of mediation from the different types of exercises being performed. This is a platform for caregivers for people with AD to respond to questions that target their emotional and psychological effects of caregiving.

To gain an understanding of the levels of stress being mediated from caregivers, especially through the process of caregiving for people with AD, the researcher conducted a series of multiple choice questions and short response questions. These specific types of exercises demonstrated a diverse cross-section of the caregivers, including aerobic, anaerobic, resistance and dance exercises. Each survey responded was methodically structured to last 5-10 minutes, ensuring for participants to share their thoughts accurately and not be bored by the specific survey. The survey format was curated, including a broad range of questions designed to have a broad perspective on the chosen topic of this research paper.

This questionnaire consists of two parts, the first part is self reported including different aspects – consisting of two aims, ask questions regarding exercises and the type of exercises performed. The second aim is understanding caregivers' stress that they are faced with and the potential reasoning behind their stress levels. The second part consists of a caregiver stress scale adapted from Headway Organisation. This survey is constructed with primarily multiple choice questions, in order to make the answering process faster and more efficient. All questions that are slightly broader, consist of an "other" option for individuals to choose from. The question focuses on finding out the main reason for a caregiver's stress, the amount of hours per week a caregiver puts into the designated sport or sports. Questions such as the reason as to why they have specifically to perform this type of exercise and their own beliefs if the chosen exercise/exercises have improved their overall stress levels. These questions are able to help us build our conclusion for the research study and allow us to understand the process of managing stress as a caregiver for persons with AD.

Amongst the numerous questions posed, some of the most important ones included:

1. Types of exercises done by caregivers: "Which exercise did you prefer to do the most?"
2. The main cause of their caregiver stress: "What is the main reason that contributes to your caregiver stress?"
3. Their belief if these exercises affected their

caregiver stress: “Do you believe that your experience in resistance exercises have affected your caregiver stress ?”

4. Types of exercise that impacted their stress levels: “Which exercise do you think impacts your caregiver stress the most?”

The intent behind these informed questions was to understand the immediate cause of stress in caregivers and also be informed on the different types of exercises that caregivers undergo in order to mediate their stress or subconsciously mediate them. The data from the survey is collected after the caregiver finishes his/her response, it is collected through forms of short response texts and selected choices from multiple choice sections.

All responses is extracted from Google Forms and *platform*. A brief summary of those responses are made in an Excel Document.

Results

5 caregivers have filled out the caregiver burden form, thus, we’ll be summarising at the end the overall collection of the 5 average results that we have calculated alongside with the 105 responses correlation with the study. The survey was conducted with 105 caregivers, with a level of stress of mean 4.01/5, standard deviation of 0.8 and variance of 0.63. The highest score was a 5 from caregivers and the lowest score given was a 1, this graph happened to be skewed to the left and had a mean lower than the median, with most of the responders replying with a stress level of 4 or higher. Demonstrating a high level of caregiver burden within the sampled caregivers. We have received a total of 105 answers to the survey, including caregivers from different geological areas, such as China, Canada and The United States.

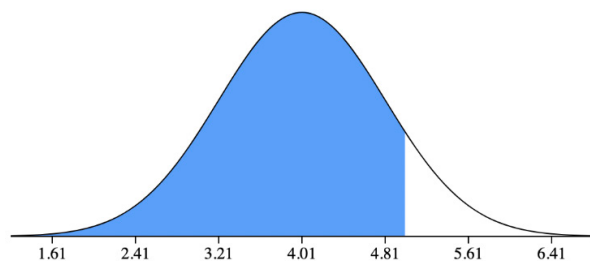


Figure 2. Normal Distributed Graph, demonstrating

the z-score and where most of the data lies (blue area indicates where most of the data lies ranging from levels 1-5)

Table 1. Most common answers to these 5 important questions targeting Aerobic Exercises

Common Questions and Common Answers	Caregiver 1	Caregiver 2	Caregiver 3	Caregiver 4
Q1. Which exercise did you prefer to do the most?	Aerobic	Aerobic	Aerobic	Aerobic
Q2. Why did you prefer the chosen exercise?	Easier to learn	Requires less commitment	Believes that regular physical activity can also reduce the risk of many diseases	Read a lot in terms of dealing with stress and feels like exercising might help
Q3. Do you believe that your experience in aerobic exercises have affected your caregiver stress?	7/10	7/10	7/10	7/10
Q4. Which type of caregiver stress do you think is most affected by these activities?	Psychological and emotional Stress	Psychological and emotional Stress	Psychological and emotional Stress and Physical Stress	Psychological and emotional Stress and Physical Stress
Q5. Which exercise do you think impact your caregiver stress the most?	Aerobic Exercises	Aerobic Exercises	Aerobic Exercises	Aerobic Exercises

Of the 105 caregivers surveyed, 45% spend around 3-5 hours caring for their people with Alzheimer’s Disease, 44% of the caregivers spend 1-3 hours caregiving and 11% spend over 5 hours on caregiving.

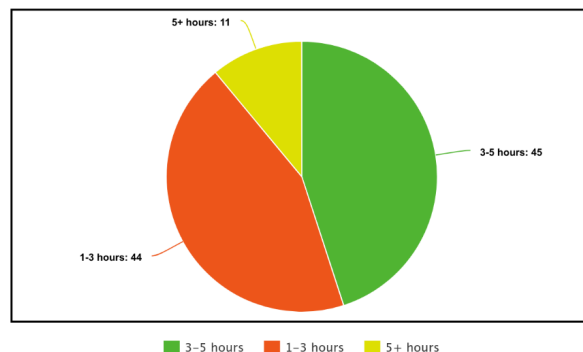


Figure 3. Percentage of number of hours caregivers spent on caregiving

The caregivers replied in their last week, 27% spent less than 1 hour on exercising, 47% spent 1-3 hours exercising, 21% spent 3-5 hours exercising, only 4% spent over 5 hours and 1% not exercising at all. The primary exercises that were engaged consisted of (main categories): 12% doing yoga, 24% doing dance, 31% doing aerobic activities, 18% on strength training,

7% with free combat and other exercises consisting of 8% of the caregivers surveyed.

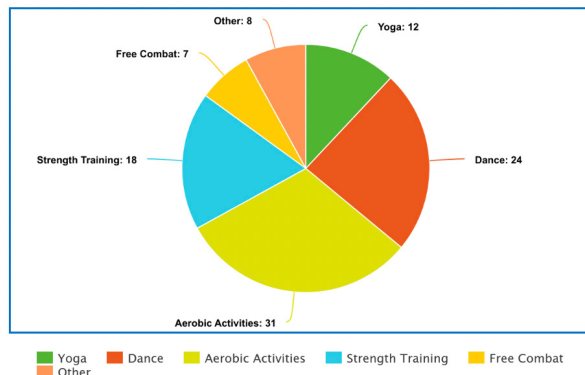


Figure 4. Percentages of each exercise Caregivers participated in

The type of exercise from the named ones that help relieve stress the most happens to be jogging with 63% (type of aerobic exercise) answering so, happening to be a type of aerobic exercise. The overall responders who think aerobics exercising helps relieve stress the most is 84% of the entire sampled responders. When asked why they chose the considered type of exercise, 64% of responders responded with “no special equipment or venue needed, resulting in easier accessibility and can exercise anytime”. 72% of caregivers also responded that it is easier to learn and time efficient. When asked if they exercised regularly before becoming a caregiver for people with AD, 70% responded with yes and 30% responded with no. Lastly, when asked the question if they think regular exercise practices helps with resilience in becoming a caregiver for people with AD, 89% responded with “yes”, and 11% responded with “no”.

Induced from the survey, the majority believes that regular exercise practices can enhance their capacity to manage stress related to their caregiving responsibilities. Shown through a large proportion of caregivers engaged in exercising, primarily jogging, which they find effective for stress relief. The choice of exercise is influenced by its accessibility, ease and level of learning, and minimal equipment and monetary requirements. The detected challenges that induce stress for caregivers are the communication and self-care difficulties when they have to balance their personal life with the life of the people with AD that they are taking care for (Han,

2019). Exercising is shown to be a prominent form of self-care, allowing caregivers to maintain a healthy physical life but also a mental life when approaching and balancing the stress refracted from caregiving. Exercises prove to be a coping mechanism for most caregivers, allowing them to have time for themselves in an effective and easier way, reducing stress and prominent mental health issues such anxiety and depression. Most replied with exercising allowing them to have time to reflect upon their lives, switching from a negative perspective to a more positive scope, finding the joys of caregiving and why they became caregivers in the first place. For example, “caregiver 99” replied before exercising they thought about the difficulty in communication and after exercising they had satisfaction in helping others. .

Discussion

The majority of caregivers who responded to this survey are males (61%) and relatively young, with the largest age group being 25-30 years old (42%). This demographic distribution reflects the overall trend of societal and familial relationships across the globe where younger family members, possibly children or siblings, take on caregiving roles for possibly their parents or grandparents who developed AD. The survey reveals a high level of commitment, with most caregivers spending between 1 to 5 hours daily in caregiving tasks. As expected, the emotional implications and situation of caregivers is extremely high and significant, as indicated by the high average stress level of 4.01 on a 5-point scale. Challenges that have induced these mental stress, occurred when managing incontinence and communication difficulties to dealing with the people with AD’s non-compliance and memory issues.

These difficulties show the demands on caregivers for constant representation of vigilance, patience, and adaptability. Despite these emotional turmoils, caregivers also detected joy in what they performed, showing moments of clarity and recognition from the patient, child-like innocence, and the overall emotional fulfilment of helping someone in need are highlighted by responders (McCoy & Raver, 2011). Furthermore, the survey explores the overall role of exercise in managing caregiver stress and the negative correlation with exercise and caregiver stress. A significant portion of respondents engage in

regular physical activity, with jogging being the most popular form of exercise, anaerobic exercise, due to the easy integration into daily routines and minimal requirement for equipment. The majority of caregivers believe that regular exercising improves their resilience and ability to cope with the stress associated with their caregiving duties. This finding is consistent with research suggesting that physical activity can reduce symptoms of depression and anxiety (Cadore, 2013). Exploring this correlation more, physical activity is widely recognized as a beneficial strategy for managing stress and improving mental health, with numerous studies supporting its overall effect. According to the National Institutes of Health (NIH), regular exercise can significantly decrease symptoms of depression and anxiety (Craft & Perna, 2004). The mechanism behind this benefit also applies to other correlational variables such as exercising; this promotes the release of endorphins, which are known to be natural mood lifters and also helps regulate the body's stress hormones, such as adrenaline and cortisol.

Physical activity also has the ability to serve as a distraction, allowing individuals, caregivers, to find respite from negative thoughts or stressors (Mahindru, 2023). Exercise has also been shown to improve sleep, which can be negatively impacted by stress, anxiety, and depressive states (Craft & Perna, 2004). Better sleep schedules increase the overall mood and energy levels, contributing to mental health stabilities and can improve the performance of caregivers when they take care of people with AD. For AD caregivers, who often experience extremely high levels of chronic stress and emotional strain, incorporating exercise into their routine can be particularly beneficial as seen with the gathered data. Caregivers usually who engage in regular physical activity reported better emotional well-being and reduced feelings of burden compared to those who do not exercise (Doyle, 2020). Furthermore, specific forms of exercise, such as aerobic activities (including jogging as the main choice caregivers go to shown in the conducted survey), have been shown to benefit their cardiovascular systems, which is known to be directly linked to improving brain health. This could also be relevant for caregivers, who need to maintain optimal health to manage their duties effectively. Overall, the study reports that caregivers are aware of the benefits of exercising as well, as most answered that it helps release endorphins and helps reduce stress

to have time for themselves.

Amongst the participants, there was a differentiation in stress relief depending on the type of exercise performed. Aerobic exercises, known for enhancing cardiovascular health, also appeared to improve emotional well-being more significantly than anaerobic exercises. Resistance training participants highlighted improvements in physical strength and endurance, which indirectly contributed to better stress management by enhancing overall health resilience (Strickland & Smith, 2014). Dance, as a form of exercise, stood out for its social and emotional benefits. Participants reported not only physical relief but also a significant enhancement in social interaction, which is crucial for mental health (King, 2002). This social component of dance may explain its unique position in reducing caregiver stress through increased emotional support and community feeling (Champagne, 2023).

Conclusion

The survey results suggest that different types of physical activities— aerobic, anaerobic, resistance exercises, and dance—have different impacts on stress levels among caregivers for individuals with AD. Aerobic exercises seem to offer the most significant reduction in stress, likely due to their impact on both physical health and emotional well-being through endorphin release and improved cardiovascular function. Resistance exercises, while beneficial physically, may not offer the same level of stress relief as aerobic activities but still contribute positively to overall health. Dance exercises provide a unique combination of physical activity and social interaction, which can be especially beneficial for emotional relief and stress reduction. These findings support the hypothesis that while all exercise types are beneficial, the context of the exercise—such as the social interaction involved in dancing—can enhance the stress-reducing effects. Given these results, caregivers can be advised to incorporate a combination of exercise types into their routines, prioritising those that offer both physical and emotional benefits. This approach can be crucial in managing the high stress levels associated with caregiving for individuals with AD, potentially leading to better overall health outcomes for caregivers and improved care quality for recipients.

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References

- Anderson, E., & Shivakumar, G. (2013). Effects of exercise and physical activity on anxiety. *Frontiers in psychiatry*, 4, 27.
- Breijyeh, Z., & Karaman, R. (2020). Comprehensive review on Alzheimer's disease: causes and treatment. *Molecules*, 25(24), 5789.
- Champagne, E. R. (2024). Caregiver Resilience and Dance/Movement Therapy: A Theoretical Review and Conceptual Model. *Journal of Applied Gerontology*, 43(3), 319-327.
- Craft, L. L., & Perna, F. M. (2004). The benefits of exercise for the clinically depressed. *Primary care companion to the Journal of clinical psychiatry*, 6(3), 104.
- Doyle, K. L., Toepfer, M., Bradfield, A. F., Noffke, A., Ausderau, K. K., Andreae, S., & Pickett, K. A. (2021). Systematic review of exercise for caregiver-care recipient dyads: what is best for spousal caregivers—exercising together or not at all?. *The Gerontologist*, 61(6), e283-e301.
- Duong, S., Patel, T., & Chang, F. (2017). Dementia: What pharmacists need to know. *Canadian Pharmacists Journal/Revue des Pharmaciens du Canada*, 150(2), 118-129.
- Hill, C. V., Pérez-Stable, E. J., Anderson, N. A., & Bernard, M. A. (2015). The National Institute on Aging health disparities research framework. *Ethnicity & disease*, 25(3), 245.
- Han, S., Chi, N. C., Han, C., Oliver, D. P., Washington, K., & Demiris, G. (2019). Adapting the resilience framework for family caregivers of hospice patients with dementia. *American Journal of Alzheimer's Disease & Other Dementias*, 34(6), 399-411.
- Liu, Z., Heffernan, C., & Tan, J. (2020). Caregiver burden: A concept analysis. *International journal of nursing sciences*, 7(4), 438-445.
- Llanque, S., Savage, L., Rosenberg, N., & Caserta, M. (2016, January). Concept Analysis: A Alzheimer's Caregiver Stress. In *Nursing forum* (Vol. 51, No. 1, pp. 21-31).
- Mahindru, A., Patil, P., & Agrawal, V. (2023). Role of physical activity on mental health and well-being: A review. *Cureus*, 15(1).
- McCoy, D. C., & Raver, C. C. (2011). Caregiver emotional expressiveness, child emotion regulation, and child behavior problems among head start families. *Social Development*, 20(4), 741-761.
- Schulz, R., & Sherwood, P. R. (2008). Physical and mental health effects of family caregiving. *Journal of Social Work Education*, 44(sup3), 105-113.
- Schulz, R., Eden, J., & National Academies of Sciences, Engineering, and Medicine. (2016). *Family caregiving roles and impacts*. In *Families caring for an aging America*. National Academies Press (US).
- Strickland, J. C., & Smith, M. A. (2014). The anxiolytic effects of resistance exercise. *Frontiers in psychology*, 5, 97398.
- Vu, M., Mangal, R., Stead, T., Lopez-Ortiz, C., & Ganti, L. (2022). Impact of Alzheimer's disease on caregivers in the United States. *Health Psychology Research*, 10(3).
- 2023 Alzheimer's disease facts and figures. (2023). *Alzheimer's & dementia : the journal of the Alzheimer's Association*, 19(4), 1598-1695. <https://doi.org/10.1002/alz.13016>