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**A Meta-Analysis on the Effect Gardening has on the Mental Health of the Population**

**Abstract**

The COVID-19 pandemic has changed our world forever, leaving us with a new normal and more stress factors that could affect our mental health such as the loss of a job or spreading the virus unintenionally. There are many different ways of dealing with stress, however one way which is rapidly gaining in popularity is horticultural therapy which utilizes gardens and the outdoors to help relieve stress. Through a meta-analysis of published literature, we explore how horticultural therapy can affect the mental health of the population of the world. We characterize the studies useful to ours by taking into account the time spent in the garden and the effect the garden had on the mental health of the participants. More research is needed in order to determine the specific effects that horticultural therapy can have on the population.

**Introduction**

The world has been thrust into a state of uncertainty by SARS-CoV-2. The virus has affected everybody and every facet of our lives. Buying groceries, playing sports, meeting up with friends, going to school, and a whole array of different events have all turned into possible risks of contracting the virus and putting people around you in danger unintentionally. The virus has also made life harder for millions of people around the world by putting them in economic instability with the loss of a job or mental instability. According to Statista, the unemployment rate of the United States in March was 4.4% which is miniscule compared to the 10.2% unemployment rate in July[[1]](#footnote-1). Additionally, the whole population had to be in solitude without any human contact other than family members for four months in constant anxiety and stress of when life will return to normal. On top of being in solitude, people were scared and worried of the virus affecting someone they love. With all of these factors coming together at once, the mental health of many people suffered. The stress and anxiety quickly turned into depression which can potentially present life-long challenges.

Stress is defined as mental, emotional, or physical tension brought about by internal or external pressures like anxiety or being overworked[[2]](#footnote-2). During stress, many biochemical changes occur which if exaggerated or prolonged can start to cause destructive changes that can lower the body’s immune system. Since the COVID-19 pandemic has been raging since March 2020, many people have been in a prolonged state of stress which in turn can cause them to have depression. According to the National Institutes of Health (NIH), 6.7 percent of the adult, US population or 15 million people, have an episode of a major depressive disorder within a year and with the COVID-19 pandemic, those numbers will only have increased[[3]](#footnote-3). Depression has multiple symptoms such as loss of appetite, affecting sleep, loss of interest, and a change in behavior. Depression is shown by a low mood, lack of pleasure in everyday activities, anxiety, social withdrawal, and, unfortunately, even suicidal ideation. Depression is the result from a neurochemical imbalance that has reduced quantities or reduced activity of the neurotransmitter serotonin and norepinephrine within the brain[[4]](#footnote-4). Neurotransmitters are chemical agents released by neurons to stimulate other neurons, allowing the electrical impulses to be sent throughout the nervous system. Serotonin is in the brain and regulates mood, happiness, and anxiety so a low level of serotonin transmitted throughout the body can cause depression.

Now, more than ever, there is a need to deal with mental health and lots of recent research has brought mental health issues to light. Mental health is becoming more prevalent throughout the science world as more people are affected by depression especially the younger population because of the increased levels of stress in our environment. For example social media, bullying, domestic violence, economic problems, or school are all possibilities that can increase stress. As a result more and more ways of dealing with these stress factors are more widespread. However even though there are multiple different ways to deal with stress, some of them are not practical for some people in certain situations.

One way of dealing with stress is horticultural therapy. Horticultural therapy is rapidly gaining more popularity in the therapeutic world because of its simplicity[[5]](#footnote-5). Horticultural therapy consists of a garden and potentially a trained therapist. A therapeutic garden is a plant-dominated environment designed to facilitate interaction with the healing facets of nature. Interactions can passive, reading a book or watching the plants, or active, watering the plants or pulling weeds. The therapeutic horticulture gardens can be specifically suited for elderly persons, like some elderly with dementia or other special needs[[6]](#footnote-6). The gardens however are not limited to any one group. The therapy promotes low intensity exercise and improves motor skills, stimulates memory, encourages positive social interactive, and promotes mindfulness. The plants in a therapeutic garden can be fruit bearing or solely flower plants. The fruit plants give a rush of dopamine because when a fruit or smell is noticed, the brain is flushed with dopamine as a reward for growing the fruit. Dopamine will increase your mood and well-being throughout the day. Additionally when taking part in tactile activities such as touching soil, your serotonin levels will increase. A bacteria in the soil called Mycobacterium vaccae triggers the release of serotonin in our brain.[[7]](#footnote-7) As mentioned earlier, the higher serotonin levels, the less that stress will affect you mentally.

For this reason I believe that one way of coping with stress could be through gardening and spending time outside. How can vegetable or flower gardening affect the mental state(positively or negatively) of someone if they are suffering from depression or another form of mental health problems like PTSD? I believe that horticulture will have lasting positive effects on anyone suffering from mental health issues.

**Methods**

The study originated from a need to learn how to cope with the stress of the modern world throughout the COVID-19 Pandemic, economic struggles, school, and multiple other factors that could increase the stress of someone that could eventually lead to depression. In order to fully understand how plants are able to help destress, multiple questions surrounding the topic had to be asked. In order to find research papers that were similar to this study, I used multiple different credible databases to garner the data such as Gale Virtual Reference Libraries, the National Center for Biotechnology Information (NCBI), the Brown University Library, and Google Scholar. The keywords used to find articles which resembled the topic were “Gardening reduces stress,” “Horticultural Therapy,” “Horticulture,” and “Gardening’s effect on depression.” After gathering multiple articles, I used a series of inclusion/exclusion criteria to find the articles that would be used in the meta-analysis. The first criteria was in regards to the amount of time spent in a garden that would elicit a noticeable difference in the serotonin and cortisol levels in the person who is in the study. The study had to specify if the participants had some type of mental health issue during the study. The study will also have to have recorded the stress levels of the subjects either by measuring their serotonin and cortisol levels or by asking the subjects how they felt. Then all the quantitative and, mostly, qualitative data was compared to see the effects that gardening had on the mental health of the different people.

**Results**

Table 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Citation | Method | Sample Size | Procedure | Results | Mean | Standard Deviation | Test Statistic | P-value |
| Lehmann et al., 2018 | Questionnaire | 17 - 22 | Box-Gardening | Through discussion | N/A | N/A | N/A | N/A |
| [[8]](#footnote-8)Stowell et al., 2018 | Paired T-test and survey | 8 | Horticulture | Paired T-test Stress | 6.25 | 5.23 | t(7) = 3.38 | 0.01 |
|  |  |  |  | Depression Severity | 5 | 2.56 | t(7) = 5.52 | 0.001 |
|  | Discussions with Subjects | Not Specified | Horticultural Therapy | Through discussions | N/A | N/A | N/A | N/A |

One study focused on the mental health issues of the veterans in the United States Army as military service can be very stressful and many veterans are left with PTSD or unemployment which can both lead to mental health issues[[9]](#footnote-9). The study showed that the nine veterans with mental health issues felt a difference after spending 10 minutes to 2 hours daily for 5 weeks gardening. The veterans who reported significantly lower depression. Also as a way to quantify the veterans’ decrease in stress, the study reported the veterans’ cortisol content in their salivary glands which decreased. The veterans also reported a high self-esteem, increased physical activity, and an increase in social engagement. This study recorded that as little as 30 minutes a day gardening will result in reduced stress and an improved mood. See Table 1 for the statistical values.

Another study relating to veterans observed veterans with substance abuse problems and these veterans were enrolled in the 28-day Substance Abuse Rehabilitation Treatment Program (SARRTP) used self-initiate box gardening as a way to reduce stress and deal with the substance abuse[[10]](#footnote-10). In this particular study, the veterans were brought back after 2 years, from 2014 to 2016, because the pilot program for the horticultural therapy ended in 2014, but the veterans informally continued the box gardening activities. The study recorded passive activities which include reading and looking at the plants in the garden. The study also recorded active activities such as pulling weeds or watering the plants in the garden. The veterans had greater engagement, confidence, and developed skills in managing their own physical and mental health. The veterans also reported being “calm,” “serene,” and “refreshed” while in the garden because it was their “safe haven.”. The veterans were able to gain so much knowledge about horticulture and felt the beneficial effects of horticulture that they shared horticultural therapy, box-gardening, to other veterans suffering from mental health issues as well.

Another study focused on the effects of horticulture therapy on Taiwanese undergraduates[[11]](#footnote-11). After 8 weeks of gardening the students reported having a significant improvement in their gardening skills, confidence and social skills, and also alleviated stress. The participants learned a sense of mission and responsibility, the importance of cooperation in groups, and interpersonal communication. The participants also reported regaining physical and psychological well-being, improvement on depression, and increased physical activity and focus. This study also showed how high school students who took part in weekly gardening activities reported having better social adaptation and interpersonal relations. Some limitations were that the study did not have any quantitative data.

**Conclusions**

The data from the three studies analyzed had stark comparisons. The participants all reported having an increase in physical activity, greater social confidence, and reduced stress. Although the studies did not all have the same length, the shortest having 5 weeks, the participants did report a change in their mental health. The participants all enjoyed the process of gardening at the end of each study. Even though all the participants did not have mental health issues, they still reported a reduction in stress and the study which utilized box-gardening quantified the stress levels with the cortisol levels in salivary glands which decreased[[12]](#footnote-12). The meta-analysis of the studies had a wide range of ages from high school students to United States Army veterans and the final results all had stress reduction and an increase in social confidence. The results of this meta-analysis show that horticulture can reduce the stress of people with mental health issues and regular people. Horticulture is a relatively simple form of therapy that can be utilized by a multitude of people with any age and still have the same results.

**Limitations**

Limitations in this meta-analysis are that not all of the studies had quantitative data. This study was primarily qualitative. The participants were not the same throughout the meta-analysis because the data was taken from multiple sources. Another limitation was the amount of data I had. The data used was from 3 studies, so more studies with more quantitative data points could give more perspective on this topic. The different studies were not conducted over the same length of time. Additionally, not all the studies used statistics to quantify the subjective data.

**Future Studies**

If possible try to find or conduct studies with more quantitative data so that the data obtained can be quantified. After more data is conducted, a study can be solely for people diagnosed with mental health issues after quarantine to see the effect of different types of stress relieving activities. With the study that I conducted, the COVID-19 quarantine was relatively recent, so not much data has been collected as of now. Additionally, more methods of measuring the participants stress levels should be utilized to back up the subjective data

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