
PhD THESIS

Studies regarding the influence of therapeutic horticulture on the human-nature relationship and the increase of well-being

(SUMMARY OF THE PhD THESIS)

PhD student **Timea Hitter (Buru)**

PhD Supervisors **Professor Maria Cantor, PhD**
Professor Ionel Papuc, PhD



INTRODUCTION

Often, throughout the history of landscape architecture it was found that people intuitively walked through green spaces at any time of year, regardless of their health or material situation. Man's constant search to be in a direct connection with the surrounding nature is highlighted in research studies carried out ever since the XXI century, studies which show that, in addition to the aesthetic attraction of space, the search for nature is a reflection of neurological processes occurring at the interaction between man and plant living matter. Therefore, people's sense of belonging to nature is validated by several theories, including Biophilia (KELLERT, 1995) and Attention Restoration Theory (KAPLAN, 1995).

Horticulture is defined as the agronomic science that studies garden cultivation, as well as the aesthetic aspect of landscape architecture, but *horticulture therapy* has been recorded ever since ancient Egypt (KAPLAN, 1973; SIMSON and STRAUS, 1997; COOPER MARCUS and SACHS, 2013) and includes landscape-mediated interventions, using plant elements and gardening activities (SÖDERBACK et al., 2004) carried out by professional staff for obtaining medical results, using ornamental plants to create a therapeutic environment.

Therapeutic horticulture emphasizes the practical part of this domain in order to carry out passive recreational activities, relaxation or walking, and not medical (GONZALEZ et al., 2009; KAM and SIU, 2010), or active activities, such as gardening (ADEVI and MÅRTENSSON, 2013), and currently its application in the field of landscaping has the effect of healing and improving the well-being of people who practice it. In the 21st century urbanization has spread rapidly throughout the globe, and to-day, worldwide, more than 50% and over 70% of Europeans are living in urban environments, 38% of them are struggle with various mental illnesses: 21% suffer from anxiety and 39% have mental well-being disorders (WOOD et al., 2016; HARTIG et al., 2014). The lack of green spaces in urban communities is a major stress factor (ROE et al. 2013), and according to global statistical data, depression affects 9.5% of all women and 5.8% of all men (GONZALEZ et al., 2009). According to the World Health Organization (WHO), depression is a common mental disorder (www.who.int).

Depression can be assessed in two ways: subjective (the investigation of depression level assessed with psychological inventories) and objective (by assessing the levels of biomarkers contribution obtained from biological samples, which are independent of the person's subjective perception). The analysis of tryptophan metabolites obtained by the contribution of searched fluorophores to the total fluorescence of urine samples (KYN and KYNA) can be an objective research method.

From the total number of patients diagnosed with major depression (MDD), more than 20% are resistant to antidepressant treatment (REUS et al., 2015), and 30% of patients with depression do not respond to the monoaminergic antidepressant treatment (OGYU et al., 2018), thus, depressive disorders represent a global problem according to data proposed by the WHO in 2008 (FERRARI et al., 2013).

The investigation of the tryptophan-related metabolites fluorophores by using spectrofluorimetric analysis is a non-invasive procedure on human subjects. The results of experimental research have shown that KYN may be involved in the pathophysiology of depression. According to studies from the specialty literature, there are abnormal concentrations in patients with depression (OGYU et al., 2018).

Nature exposure can reduce the risk of disease due to chronic stress and improve physical and mental well-being. Green areas improve the quality of social life, providing a suitable environment in which people can optimize their resources and adaptability (HARTIG et al., 2014). Gardening activities are recreational, stress-relieving, relaxing, can influence the tryptophan concentration, induce a lower salivary cortisol levels and improve the well-being (MYNT et al., 2007; AKSHARA and MANOJ, 2015).

RESEARCH AIM AND OBJECTIVES

Therapeutic horticulture is a relatively new field of research that has required in recent years a scientific approach to the link between people and nature, in the sense of defining concepts and validating objective methods of measuring the physiological and psychological effects of gardening or activities and relaxation in nature on people.

The aim of this research is to follow-up on the effect of therapeutic horticulture on people identified with mild or moderate depression, by involving them in gardening or recreational activities. The influence of sensory ornamental plants and gardening sessions on depressed people was monitored by the resulted from such factors on the quality of life and on some physiological parameters considered health markers.

The objectives of the research and the organization of experimental design were based on the hypothesis that the therapeutic landscape and gardening activities can improve health and increase people's quality of life due to their innate biological attraction to nature, nature being considered a powerful space, healing in many diseases, including depression. In order to achieve the proposed goal and deepen the knowledge related to the beneficial effects of the therapeutic landscape and horticultural therapy, several general and specific objectives were established in order to organize the research design:

1. evaluation and interpretation of the respondents' knowledge regarding green spaces and capitalization of the therapeutic potential of the landscape;

2. research design management in accordance with similar studies in TH;
3. organizing TH sessions and monitoring the evolution of urinary fluorophores, tryptophan metabolites, and mental health indicators, as a result of human contact with nature and their influence on increasing the quality of life;
4. correlating the nature-based contact of the studies subjects with their level of depression – BDI score (assessed with the Beck Depression Inventory);
5. statistical analysis of TH-induced changes in urinary fluorophores.

The research topic is an interdisciplinary one, investigating the effect of therapeutic horticulture on human subjects diagnosed with mild to moderate depression, assessed with psychological questionnaires (Beck Depression Inventory- BDI and The World Health Organisation - Five Well-Being Index - WHO-5), and by spectrofluorimetric analysis in order to obtain the contribution of searched fluorophores to the total fluorescence of urine samples. The use of TH aimed to develop an innovative and interventional method, a non-invasive alternative, which would have long-term beneficial effects on people with depression.

STRUCTURE OF THE THESIS

The paper entitled *“Studies regarding the influence of therapeutic horticulture on the human-nature relationship and the increase of well-being”*, counts 144 pages and is written in compliance with university and national editing regulations. The thesis is structured in two parts, containing 10 chapters, 17 tables, 59 figures and graphic, 6 annexes and 257 scientific literature citations.

The first part, the literature review was structured in 5 chapters and has over 50 pages. This part synthesises scientific information regarding therapeutic horticulture (**Chapter 1.**) and implementation modes of the therapeutic principles in the landscape (**Chapter 2.**). Also, using this type of landscape, it was monitored the effect on people consisting of the arrangement of sensory ornamental plants in green areas (**Chapter 3.**). Therapeutic gardens can improve mental health (**Chapter 4.**), proven by the use of subjective and objective research methods, the questioning of subjective well-being and the symptoms of depression.

Fluorescence spectroscopy is an advantageous non-invasive research method, used to identify tryptophan metabolites (KYN and KYNA) present in the urinary biological samples of the persons studied. In the last chapter of this part, were highlighted the results of scientific research and studies regarding the effect of therapeutic horticulture, in order to observe their evolution at international and national level (**Chapter 5.**).

The second part of the thesis was structured in other 5 chapters and has over 94 pages. The personal contribution covers the aim and objectives of this research study (**Chapter 6.**). The research materials and method layout (**Chapter 7.**) identifies the experimental design methods according to three approaches: (i) therapeutic landscape architecture concept with sensory design, (ii) subjective interpretation of the TH notions reached by designing an own assessment scale regarding green spaces evaluation, (iii) performing and correlating subjective and objective measurements to validate the effect of therapeutic horticulture interventions on people quality of life. The scientific results of the four research studies (**Chapter 8.**), are followed by the presentation of the conclusions and recommendations (**Chapter 9.**), defined based on the recent findings. The originality of this research (**Chapter 10.**) highlights several study directions, offering the opportunity for a new future research.

RESULTS OF THE RESEARCH

In the present study, we investigated the therapeutic landscape potential, taking into consideration the green areas of the Campus of the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, by designing a sensory layout with perennial ornamental plants. Following the subjective analysis, it was observed a close connection between human contact to nature and green spaces, respectively the depression symptoms. Thus, there have been organized sessions of therapeutic horticulture in order to improve mental health, using non-invasive method. After attending TH, the results showed that gardening activities can have a beneficial effect on people with mild to moderate levels of depression and lead to an increase of their levels of well-being.

According to the ethical considerations, this research study was approved by the Committee for Bioethics in University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania. All the participant involved in the experimental studies have been informed, provided written informed consent.

Chapter 8 of this thesis consists of four subchapters, according to studies carried out. A first result following the landscape analyses carried out at UASVM CN, followed by the *landscaping proposal of a sensory arrangement*, engaged a part of the civil society in the activity of landscaping. The design concept of the landscape layout was to identify a suitable space in the university campus, in which the planting was chosen in correlation with the way people perceive them in the landscape, through visual, olfactory, auditory, tactile and taste analysers. The selected species of perennial ornamentals presents various sensory valences and economic advantages in terms of landscape sustainability, offering sensory experiences throughout the year.

Evaluating the effect of landscape on people was carried out by the result obtained after questioning the participants on the topic of green spaces, by developing a *Therapeutic Landscape Assessment Scale*, highlighted a clear link between a lower depression among respondents, which was correlated with an increased access to green environment and the presence of a larger number of ornamental indoor plants (CANTOR et al., 2018; HITTER et al. 2016; HITTER et al. 2017; KÁLLAY et al., 2019).

The involvement of volunteers by attending therapeutic horticulture activities (3 days, 10 days and 6 weeks) has improved considerably and significantly the Beck Depression Inventory – BD index and the subjective well-being. Therefore, it is possible to observe differences between pre- and post-test assessments, compared to the result obtained for control groups. Analysing the three types of activity programs, it can be concluded that, the longer the period and frequency of participation in TH sessions, the more obvious the improvements in case of depressive symptoms. Moreover, following the 12 sessions of TH, an improvement is also highlighted by applying the Five Well-Being Index - WHO-5 for assessing well-being.

The results obtained from spectroscopic analyses regarding tryptophan metabolites, based on the biological biomarkers analysis of kynurenine and kynurenic acid contributions show modifications, even though the results did not indicate statistical changes. Another observation consisted in the follow-up of a controls that did not show significant changes in the parameters analysed in the experimental study (HITTER et al., 2019).

The evaluation of the participants' perception after attending therapeutic horticulture sessions regarding the *quality of life following the gardening activities* showed in large proportions positive answers regarding the psychological side, the security, from a social perspective, as well as in terms of self-esteem and emotional state. So, most people involved in different TH sessions enjoy spending time and gardening in the green area, facilitating also social interaction. An important aspect confirmed after the interpretation of these results is that gardening activities must be chosen according to the physical abilities of each participant

GENERAL CONCLUSIONS

Chapter 9 summarizes the conclusions regarding the research studies carried out in this thesis, as follows:

1. therapeutic landscape has a strong influence on the human mental, physical and emotional well-being, and the sensory plants used in landscaping have an aesthetic and functional potential;
2. landscape analyses highlight the possibility of integrating sensory layouts

- in the existing spaces, which can facilitate the interaction of the local community for a better sense development;
3. the regular nature-based connection for people in green spaces (through passive or active activities), both through the landscape and/or as indoor plants care, can help lower levels of depression;
 4. therapeutic horticulture highlighted the beneficial effects of gardening activities on the mental well-being, using objective and subjective measurements, in order to improve people's mental health, level of depression and subjective well-being;
 5. observations made on biomarkers with possible implications for mental disorders, identified in a less studied biological fluid (urine), present the advantages of experimental research using non-invasive methods and offer the possibility to correlate the results with similar scientific research of other biological fluids;
 6. involving participants in several therapeutic horticulture activities, whose perception on subjective benefits has been assessed, positive responses in most cases.

RECOMMENDATIONS

Following the previous conclusions, the recommendation is to integrate more often in the design of the landscape project proposals layout ornamental flowering plants, for their sensory potential, in order to facilitate the interaction between man and plants. Due to sustainability of these biannual plant species, the maintenance costs are low, offering a long-lasting vegetation period

We recommend green spaces development so as to provide people's access to nature, especially in urban areas. We propose therapeutic horticulture activities to be included in an organized and structured framework as a non-invasive intervention method such as complementary therapy in the treatment of depression, in order to improve the well-being of people.

This study offers new research directions, and further research is recommended for larger target groups. Comparative studies between changes induced in urine or other biological fluids, monitoring also the intake of food and water consumption of the subjects can provide even more conclusive results. We recommend continuing the monitoring of fluorescent biomarkers to the total fluorescence of urine, by investigating also other metabolites of tryptophan such as quinolinic acid, serotonin or cortisol, which are related to the symptoms of depression, in experimental and control groups.

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