The Effects of Gardening on State Mindfulness and State Mental Wellbeing.

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Abstract

Introduction: Previous research support the effectiveness of therapies involving gardening for improving trait mental wellbeing and mindfulness in clinical and vulnerable populations. Little evidence currently support the efficacy of everyday gardening enhancing state mental wellbeing or mindfulness on general adult populations.

Aims and Research Questions: This study investigates whether gardening enhances state mindfulness and mental wellbeing. We predict significantly higher levels of state mindfulness, state self-esteem and significantly lower levels of state anxiety after gardening. We also predict significant positive correlations between gardening duration and degrees of change in outcome scores (state mindfulness, anxiety and self-esteem).

Method: We recruited 37 adults habitually gardening in urban allotments, excluding anyone unable to give informed consent and allotments associated with vulnerable groups. Participants were given questionnaires to complete before and immediately after a usual gardening session. We received level 2 ethics approval from the Department of Clinical and Health Psychology Ethics Research Panel of the University of Edinburgh.

Results: A paired t test found a significant increase in state mindfulness scores after gardening, $t(36)=2.86$, $p=0.0035$. Wilcoxon signed rank tests found a significant increase in state self-esteem scores after gardening, $Z=4.79$, $p<0.001$ and found state anxiety scores were significantly lower after gardening, $Z=-4.05$, $p<0.001$. We found no significant correlation between gardening duration and degree of change in outcome scores.

Conclusions: There is evidence gardening enhances state mindfulness and wellbeing, but further research is needed for serious implications on practice, policy and theories.

Keywords: State Mindfulness, State Mental Wellbeing, Gardening, State Anxiety, State Self-esteem

Introduction

Our study attempts to find evidence that gardening can enhance short-term state mindfulness and mental wellbeing. We hope to contribute toward filling the gap in the current literature, specifically the lack of evidence for the act of gardening by itself (i.e. without any accompanying professional or therapeutic guidance) having an effect on mindfulness and mental wellbeing. We believe this study could be valuable to future research and to people who are gardening or looking to take it up, since most current evidence are based on studies employing gardening as a part of some sort of professional therapy which would be much less available than normal gardening for most people. In considering the context for this study, it would be useful to understand a brief history of gardening and mental health; some theory behind how gardening may enhance mental wellbeing and mindfulness; and analysing related evidence currently in the literature.

Gardening has long been associated with mental wellbeing, gardening may be defined as the practice of growing and cultivating plants as part of horticulture, including activities like watering, landscaping, trimming, pruning, seeding, planting, weeding and grafting. In the 19th century, early psychiatric institutions employed gardening activities in their care of patients, but the history of horticultural therapy arguably dates back to the ancient Egyptians (Davis, 1998). Victorian mental institutions had farms where patients could work and claims of the mental health benefits of gardening dates back to 1798 in the US (Farrell, 2017). More recently, gardening has been increasingly used for therapeutic purposes. In the UK, the number of horticultural projects for vulnerable groups have gone up from 45 in the mid 1980s to more than 900 in 2005 (Sempik, Aldridge & Becker 2005). Considering the long tradition

of gardening in mental health, further empirical investigation into this area seemed appropriate.

State anxiety and state self-esteem were chosen as state mental wellbeing constructs to explore in this study as there is much evidence in the literature suggesting anxiety and self-esteem have major impacts on mental health. Paradise and Kernis (2002) investigated the extent to which Ryff's psychological wellbeing measure scores could be predicted by self-esteem level and stability. They found a main effect for self-esteem levels for all six subscales of Ryff's wellbeing measure, suggesting higher self-esteem was associated with greater wellbeing than lower self-esteem. Correlation studies (Beck, Steer, Epstein & Brown, 1990; Patton, 1991) have demonstrated a significant relationship between low self-esteem and depression. Anxiety also seems important to mental wellbeing and is included in instruments measuring wellbeing like the General Well being Schedule (Dupuy, 1978), the four measure of personal wellbeing used by the Office for National Statistics (2018) and the General Health Questionnaire (Goldberg & WIlliams, 1988).

There are two main theories which can help understand how gardening may be beneficial to mental wellbeing, namely attention restoration theory (Kaplan and Kaplan, 1989; Kaplan, 1995) and psycho-physiological stress reduction theory (Ulrich, 1983). Both were based on the biophilia hypothesis, which proposes that humans have developed an innate need for interacting with the natural environment they evolved in (Wilson, 1984). There is notable evidence, especially involving fears and phobias which support this hypothesis that people are predisposed to respond to natural stimuli (Gullone, 2000). However, people have been spending more and more time with man-made stimuli and becoming increasingly separated from the natural environment. It is estimated people in highly industrialised societies have

typically been spending 90-95% of their time indoors since the 1980s (Chalquist, 2009). Eleonora Gullone (2000) suggested spending so much time away from the natural stimuli humans have been evolving in for around two million years may have an adverse effect on the human psyche. Fortunately, both attention restoration theory and psycho-physiological stress reduction theory indicate interaction with natural environments can be restorative, albeit via different mechanisms. These theories imply gardening could enhance mental wellbeing, as gardening requires considerable interaction with natural environments involving multiple senses like touch, smell, sight and even taste.

Attention restoration theory involves cognitive functioning and proposes two types of attention, namely directed attention and fascination. Direct attention requires conscious effort, is limited and could be overloaded thus causing stress while fascination requires no effort, is hard to redirect and actually restorative. Natural environments like gardens can be seen as abundant sources of fascination because they contain many captivating natural stimuli. Thus natural stimuli provided through gardening can theoretically help restore cognitive functioning. The psycho-physiological stress reduction theory is mostly concerned with how nature can improve emotional and physiological functioning. It suggests humans evolved to find non-threatening natural stimuli relaxing and being exposed to such stimuli would trigger a response in the parasympathetic system and an immediate effect on affect such as feelings of heightened wellbeing and relaxation. Gardens could provide exposure to different non-threatening natural stimuli, theoretically triggering the parasympathetic response and improving affect. Interacting with natural environments have been theorised to affect immediate feelings of wellbeing, but gardening is often more than just contact with nature. There may be social aspects to gardening which can enhance feelings of wellbeing, especially in allotment or community gardens. Social aspects may provide more opportunities

for social interactions and an enhanced sense of social inclusion, building up social supports that are important for mental wellbeing. Our study will try to account for these other aspects of gardening. In addition to these two theories, our study hopes to establish evidence of links between mindfulness, mental wellbeing and gardening. The type of mindfulness this study investigates is short-term state mindfulness characterised by attention of physical and mental present moment experience. Evidence suggest mindfulness enhances mental wellbeing (Kabat-Zinn, 1990; Brown & Ryan, 2003), so it may be reasonably hypothesised that gardening could improve mental wellbeing by enhancing present moment awareness, a key component of mindfulness. Investigating gardening and mental wellbeing through mindfulness provides a slightly alternative model to the biophilia hypothesis for understanding underlying mechanisms.

A literature review by Sempik, Aldridge and Becker (2003) analysing evidence for horticultural based interventions examined over 300 research articles, it found horticultural based interventions to be beneficial for vulnerable groups including those suffering from mental health difficulties. However, it recognised a need for more research with greater detail and a greater range of groups. Many studies reviewed based their outcome on the researchers' own observations, which could potentially be a source of bias. Additionally, none of the studies appeared to have objective and validated outcome measures, nor were there any controlled trials or pre-post testing. A later systematic review of nature assisted therapy by Annerstedt and Währborg (2011) found a small yet reliable evidence base supporting the efficacy of nature assisted therapy for a wide range of diagnoses, from obesity to schizophrenia. This review included both observational and controlled studies, but it also included all kinds of nature assisted therapy such as wilderness therapy and adventure-based therapy as well as horticultural therapy, all of which required a professional therapist.

Clatworthy, Hinds and Camic (2013) conducted a critical review of gardening-based mental health interventions and found all the research they reviewed reported beneficial effects of gardening as a mental health intervention. Two of ten studies reviewed conducted controlled trials with a control group, but designation to the conditions was not randomised, introducing potential for bias. Unlike the studies reviewed by Sempik and colleagues in 2003, most of the quantitative studies reviewed used validated outcome measures, most commonly measuring depression. This allows for validated quantifiable data for assessing effectiveness of interventions. While the studies reviewed by Clatworthy et al. (2013) had bigger sample sizes than those reviewed by Sempik et al. (2003), they were still relatively small (N=10-50, M=31.40). The current research base seems to mostly consist of clinical populations rather than the wider population and interventions researched were gardening based therapies which differ from normal everyday gardening, for example professionally trained and certified therapists are almost always involved in some way in gardening based therapies. These studies provide evidence for the efficacy of interventions involving gardening, indicating gardening could potentially be beneficial to mental wellbeing, but the literature would benefit from larger and more detailed studies, especially randomised controlled trials. Moreover, the current literature does not specifically address the question of whether everyday gardening by itself, without being a part of therapy (i.e. with a certified therapist), has any impact on short-term state wellbeing in non-clinical adult populations. Our study hopes to contribute towards addressing this gap in the literature.

Furthermore, the literature suggests a link between mindfulness and gardening. Mindfulness can be defined as 'self-regulation of attention so that it is maintained on immediate experience, thereby allowing for increased recognition of mental events in the present

moment' and 'adopting a particular orientation toward one's experiences in the present moment, an orientation that is characterised by curiosity, openness, and acceptance' (Bishop et al., 2004, 232). *Gardening for Mindfulness* (2017), published by the Royal Horticultural Society offers many helpful tips on making gardening a mindful activity, from advising on things to be aware of while gardening to having a mindfully designed garden and selection of plants for stimulating different senses. However, it lacks empirical evidence as to whether techniques in the book actually raise levels of mindfulness. The book also does not provide any evidence as to whether the act of gardening by itself, without any instructions on doing it mindfully, have any impact on state mindfulness and wellbeing.

A pilot study (Okvat, 2011) conducted randomised controlled trials of Traditional Community Gardening (TCG) and a new intervention, Mindful Community Gardening (MCG) for urban older adults' wellbeing indicated participants partaking in those two interventions had significantly higher levels of mindfulness compared to a wait-listed control group, but there were no significant differences on other wellbeing constructs or social support. TCG involved usual gardening activities completed in collaboration with a group of seven to ten. MCG was the same as TCG except with added guidance on developing non-judgmental, present-focused awareness. This study explored community aspects of gardening, gardening with mindfulness guidance and links between gardening and wellbeing of older urban adults. However, since all participants were older urban adults, the results may not be generalisable to other populations. The sample size was also relatively small at N=50 and fell short of the stated goal of N=90. Another study report an attempt to bring gardening and permaculture into mindfulness and acceptance based therapies in a healing forest in Denmark called Nacadia (Corazon, Stigsdotter, Moeller & Rasmussen, 2012). Their therapy is influenced by Acceptance and Commitment Therapy, a type of third wave mindfulness and

behavioural therapy with a substantial evidence base indicating it is at least as effective as traditional treatments for common mental health disorders (Hacker, Stone & MacBeth, 2016). The study was a diagnostic post-occupancy evaluation of the Nacadia therapy garden and found significant improvement in participant's general health over the 10 weeks treatment period using the self-assessed questionnaire EQ-VAS. However, the evaluation used a clinical sample consisting of those who are unable to work due to stress related symptoms for a period of 3-24 months, so it may not be generalisable to the general population. While the results of these studies (Okvat, 2011; Corazon et al., 2012) suggest gardening may enhance mindfulness, the interventions used were structured therapy which is considerably different from everyday gardening and the results may not be generalisable to gardening without any therapeutic structure or guidance. Nevertheless, these studies point towards a link between mindfulness, mental wellbeing and gardening.

Research Aims

Our study aims to investigate whether gardening can enhance short-term state mindfulness and short-term state mental wellbeing. The direction of our study appears to be supported by evidence and theories in the current literature and by gardening's long tradition in mental health. However, there are gaps in the current literature and our study hopes to help future research in this area by contributing to addressing these gaps. The studies in the literature investigating mindfulness and gardening-based interventions seemed more interested in long-term trait mindfulness rather than short-term state mindfulness, using only instruments measuring trait mindfulness. The pilot study by Okvat (2011) used the Mindful Attention Awareness Scale and the Kentucky Inventory of Mindfulness Skills, both of which measures mindfulness as a trait. There appears to be a need for more studies investigating state mindfulness.

Furthermore, most current evidence are obtained from clinical or vulnerable populations and utilised structured therapeutic gardening that is almost always accompanied by guidance from professional therapists. Hence this evidence may not be directly generalisable to the wider population or every day gardening (i.e. not a part of therapy and not involving a professional therapist). Our study aims to find empirical evidence directly supporting the short-term immediate mental health benefits of everyday gardening, we believe this will be valuable as it would help address some gaps in the current literature and everyday gardening is much more available than any sort of gardening-based therapies for most normal people.

Hypothesis

1) There will be an increase in levels of state mindfulness immediately after gardening.

2) There will be an increase in levels of state self-esteem immediately after gardening.

3) There will be a decrease in levels of state anxiety immediately after gardening.

4) The degree of change in levels of state mindfulness will be positively correlated with length of gardening session.

5) The degree of change in levels of state self-esteem will be positively correlated with length of gardening session.

6) The degree of change in levels of state anxiety will be positively correlated with length of gardening session.

Methods

Design

A single group pre-test post-test design will be employed. Data will be gathered just before and immediately after a gardening session and the two data sets will be analysed. Similar studies (e.g. Okvat, 2011) also employed pre- post- intervention designs.

Sample

Using g*power with a Cohen's d effect size of 0.3, error probability of 0.05 and a power of 0.8, it was calculated that 71 participants would be an ideal number for one tailed paired t-test analysis. For one tailed Pearson's Correlation Coefficient, 67 participants was calculated as an ideal sample size with an effect size of 0.3, error of probability of 0.05 and a power of 0.8. We contacted all allotments with over 30 plots in Edinburgh to see if they would be interested in participating in our study. Information about our study was also circulated in the newsletters of the various allotment associations and the Federation of Edinburgh and District Allotment and Gardens Associations. In Glasgow, we contacted the city council growing spaces natural environment officer who relayed information about our study to allotments there. We received some interest from Inverleith Allotments, Victoria Park Allotments, Bridgend Growing Communities and Midmar Allotments in Edinburgh and Kennyhill Allotments, Merrylee Allotments and Kelvinside Allotments in Glasgow. We then recruited our participants from these allotment and community gardens by distributing 193 questionnaire packets to these gardens. A nonprobability combination of convenience and snowball sampling was employed because probability sampling methods, although more

generalisable with less chance of systematic error and sampling bias, were unfeasible for this project as attaining a sampling frame for our population would be unrealistic.

The inclusion criteria for our sample were being aged 18 or over; being in the habit of gardening, which we have defined as at least 30 minutes per week during the growing season; and gardening in an urban allotment or community garden. Our exclusion criteria were inability to give informed consent for any reason; and gardening in an allotment or community garden designated for or associated with vulnerable groups.

We chose to recruit from allotment and community gardens for the relatively easy, low cost and less invasive access to the large number of eligible participants we needed. Another benefit to recruiting from allotment and community gardens is that almost all plot holders will fit in our definition of being 'in the habit of gardening' as plots that are seldom attended or otherwise not productive are usually given to someone else. The population this study is interested in is the general adult population, so we excluded children and we did not actively seek to recruit people who may suffer from mental or physical ill health. Community gardens and allotments associated with vulnerable groups were thus not approached for recruitment for this reason.

Procedure

Questionnaire packets (a copy of which can be found in Appendix 1) were placed in the community huts of the allotment and community gardens so participants can easily take one and complete it at a time most suitable for them. We placed collection boxes next to the

questionnaire packets for our participants to return their packets upon completion. The boxes were sealed and designed in a letterbox style to safeguard completed questionnaire packets and ensure feelings of secure anonymity for our participants. The first few pages of the questionnaire packet provide participants with a brief introduction to our study, information regarding their rights, relevant contact information as well as simple instructions on how to take part in the study. Following the instructions, participants completed a consent form and then proceeded to completing the first half of the packet just prior to their usual gardening routine. After completing the first half of the packet, participants were presented with instructions directing them to commence with their usual gardening routine, which is gardening they would have done regardless as to whether they were participating in this study or not. These instructions invited them to come back to complete the second half immediately after they finished gardening.

The questionnaires ask participants to answer all questions as honestly as possible and to the best of their knowledge in an attempt to collect data that is as accurate and as useful as possible. This seems to be the best plausible way by which we could have ensured the accuracy and validity of our data. All particularly important instructions such as instructions to complete the second half immediately after gardening and instructions to answer all questions as honestly as possible were emphasised through underlining, italics and in places a bigger font to try and draw participants' attention towards them. We chose to produce the questionnaire packet in a paper booklet format to try and make the process of participating as simple and easy as possible. We did not produce an electronic online version of the questionnaire packet as it could make participation more complex and can create more room for errors. Computers tend not to be readily available at the allotments and the screens of mobile devices may be difficult to read in bright sunlight. Electronic versions of the

questionnaires may also be difficult to use in practice immediately after gardening and may be more likely to involve a delay, increasing the likelihood of missing temporary state effects. The above steps were taken in hopes of reducing as much as possible the chances of participants completing the questionnaire packets incorrectly.

Ethical Issues

While all participants remain completely anonymous in our study, which is ensured through not requesting any identifiable data, there remain a few ethical issues. Our study does not ask our participants to garden, only to fill in questionnaires before and after any gardening that they would do even if they did not participate. Nevertheless gardening outdoors may expose participants to the elements and physical injury or discomfort. The measures selected do not appear to contain any particularly sensitive, intrusive or offensive items, but any focus on psychological issues may trigger existing psychological distress. Hence participants were provided with contact information for the support organisation Breathing Space. Given the ethical issues, we submitted our project for review by the Department of Clinical and Health Psychology Ethics Research Panel of the University of Edinburgh, where it was independently reviewed and approved for a level 2 ethics approval. The approval letter can be found in Appendix 2.

Measures

State Mindfulness. The State Mindfulness Scale (SMS) was used to measure the participant's levels of state mindfulness. The conceptual model of SMS was developed by integrating traditional Buddhist and current scientific psychological models of mindfulness. It is self-reported and has 21 items where the scores are recorded with a five point Likert scale (1 =

not at all to 5 = very well). The SMS can further be divided into two sub-scales each quantifying an interrelated level, namely mindful attention to and awareness of mental events and mindful attention to and awareness of bodily sensations. Both subscales are designed to measure present moment aspects of mindfulness. The SMS was designed to quantify levels of state mindfulness for specific durations of time and in specific contexts which sets it apart from other instruments that measure state mindfulness for more general situations. This made it especially suitable for our purposes of measuring state mindfulness in the specific context of gardening and in the specific timeframe of the period immediately after gardening.

In a randomised controlled study (Tanay & Bernstein, 2013), the SMS scores indicated strong construct validity as well as strong test-retest reliability for a control group for 1 week (mean $r = 0.65$, $p < 0.01$) and 6 weeks (mean $r = 0.68$, $p = < 0.01$) and a mindfulness intervention group for 1 week (mean $r = 0.68$, $p < 0.01$) and 6 weeks (mean $r = 0.68$, $p < 0.01$). The study also found the SMS to be context sensitive, finding only small to moderate test-retest reliability of SMS scores between daily living and mindfulness meditation contexts in 1 week ($r = 0.47$, $p < 0.01$), 2 weeks ($r = 0.22$, *n.s.*) and 6 weeks ($r = 0.45$, $p < 0.01$). This is supported by other studies (e.g. Luberto & McLeish, 2018; Paz, Zvielli, Goldstein & Bernstein, 2017; Roche, Barrachina and Fernández, 2016; Shoham, Goldstein, Oren, Spivak & Bernstein, 2017) reporting that mindfulness practice and training leads to significant increases in SMS scores compared to control groups. This is useful for our study as we hope to capture any changes in levels of state mindfulness before and after a gardening session. Furthermore, the SMS demonstrated good internal reliability with Cronbach's alpha scores ranging from 0.88-0.95 across various population groups, of which some may be generalisable to our sample, including college and university students (Hussein, Egan & Mantzios, 2017), adults from the general community (Roche, Barrachina & Fernández,

2016), people who have never meditated before, experienced meditators (Bravo, Pearson,

Wilson & Witkiewitz, 2018) and people undergoing mindfulness training or mindfulness

based interventions (Calma-Birling & Gurung, 2017; Jislin-Goldberg, Tanay & Bernstein,

2012). However, a Cronbach's alpha that is too high may be problematic as it may reflect that

some items may be redundant.

State Self-Esteem. The self-reported State Self-Esteem Scale (SSES) was used to quantify

state self-esteem (Heatherton & Polivy, 1991). It was developed from the widely used Janis-

Field Feelings of Inadequacy Scale and its conceptual model of self-esteem accepts the

assumptions that self-esteem can be changed temporarily but only by a small magnitude,

fluctuating merely slightly around a stable self-concept. Therefore it was designed to be

sensitive to these small temporary fluctuations which suits our need to detect changes in

current mental wellbeing before and after a gardening session. It is scored using a five point

Likert scale and it has 20 items divided into three sub-scales reflecting three dimensions of

self-esteem, namely performance, social and appearance. Findings from a study (Heatherton

& Polivy, 1991) using principal-axes factor analysis support these subscales and suggests that

the factors accounted for 50.4% of the overall variability in scores. The study also found that

all the items were positively intercorrelated ranging from 0.09 to 0.69 (mean interitem

correlation = 0.36; Bartlett's test of Sphericity, x^2 (209, $N = 428$) = 4287.7, $p < 0.001$) and

that the scale has high internal validity ($\alpha = 0.92$). Another study by the same researchers

found evidence for the discriminant and construct validity of the SSES (Heatherton & Polivy,

1991) and that the SSES is sensitive to both natural changes in and manipulation of self-

esteem. Using a one-way ANOVA, they found that participants put in a failure condition

which is expected to lower self-esteem experienced significantly lower state self-esteem

scores relative to a control group, $F(3,75) = 3.17$, $p < 0.05$. This sensitivity to change is

useful in our study as we are seeking to measure any changes in the relatively short time of a gardening session.

State anxiety. Levels of state anxiety was measured with the Current Anxiety Level Measure (CALM), a 16 item self-report measure with a five point Likert scale. It was developed to measure current, in-the-moment levels of anxiety, so it seems suitable for our purposes of measuring state anxiety. Although the Stait-Trait Anxiety Inventory (STAI) has a state subscale and is more well-established and widely used, its fees, conflicting diagnosis questions and complex scoring directions makes it less accessible than the CALM. There is much evidence supporting the validity and internal reliability of the STAI, with test-retest reliability scores ranging from 0.65 to 0.75 and Cronbach's alpha ranging from 0.86 to 0.95 (Spielberger et al., 1983). In one study (Marris, Sladyk, St Pierre & Dey, 2017), the CALM was administered to participants along with the Stait-Trait Anxiety Inventory (STAI) to establish concurrent validity, using Pearson's Correlation Coefficients, a strong concurrent validity was found ($r = 0.904$, $p < 0.001$). The study then investigated the CALM independently from the STAI and found a significant relationship of $r = 0.702$, $p < 0.001$ for test-retest reliability (N=102). However, the majority of participants in that study were young, highly educated females and so the results may not be generalisable to the wider population. Nevertheless, the CALM remains one of the only measures quantifying current state anxiety, as most other anxiety measures tend to treat anxiety as a trait.

Analysis

The *Statistical Package for the Social Sciences* (SPSS) was used to aid in analysing the data. There were four cases of missing data for our outcome measures. A mean substitution

approach was used to deal with the missing data as the missing data represented less than 10% of total data in their respective scales and seemed to be missing at random, so more complex approaches of dealing with missing data did not seem necessary. Descriptive statistics were calculated for participants' demographic information (i.e. age, gender, education level and income) and gardening habits (i.e. usual amount of time spent gardening per week and type of gardening plot) as well as all outcome measures analysed. Assumptions of normality were tested using the Shapiro-Wilk test to test the differences in pre- and post-gardening scores which were calculated by subtracting the pre-gardening scores from the post-gardening scores. For outcome measure data meeting assumptions of normality, paired t tests were conducted to see if there are any significant differences between the pre-gardening scores and the post-gardening scores, as paired t tests seemed appropriate for our single group pre-test post-test design. For outcome measure data not meeting assumptions of normality, the nonparametric Wilcoxon signed rank tests were used instead. The dataset for the length of gardening sessions was tested with a Shapiro-Wilk test and did not meet assumptions of normality, so the nonparametric Spearman's rank correlation coefficient was used to analyse any correlation between length of gardening sessions and differences in pre- and post-gardening scores.

To analyse exploratory findings, differences in pre- and post- gardening scores meeting assumptions of normality were analysed with one-way ANOVA tests to see if there are significant differences in changes in scores across categorical independent variables (i.e. weather conditions, number of gardening partners and perceived importance of social aspects). Kruskal-Wallis tests were used for data not meeting assumptions of normality.

Results

Participants

We recruited 37 participants from allotment gardens in the Edinburgh (Inverleith Allotments, Victoria Park Allotments and Midmar Allotments) and Glasgow (Kennyhill Allotments, and Kelvinside Allotments) regions. Even though this is under our ideal sample size, an effect size of Cohen's d=0.42 can still be achieved with 0.05 probability of error and a power of 0.8. This effect size is close to Cohen's (1992) suggested medium effect size of 0.5. Most participants gardened in their own plots in allotments (81.1%). The age of participants ranged from 19-76 with a mean of 60.03 (SD=12.03), 68.6% of those who reported their age were over the age of 60, the distribution of participant age is graphically depicted in *Figure 1*. Most of the participants were female (62.2%). The majority of participants were also university educated (70.3%) and 64.8% had a household income of over £26,000. More detailed demographic information can be found in *Table 1*. The length of time participants (N=35) usually gardened for per week this growing season (2019) range from 2 hours 15 minutes to 30 hours, with a mean of 8 hours 47 minutes and standard deviation of 5 hours 25 minutes.

Table 1, Participant Demographic Details.

Participant Demographic Details

		Frequency (N)	**Percentage**
Gender			
	Male	13	35.1
	Female	23	62.2
	Prefer not to say	1	2.7
Education			
	High School	10	27.8
	University or Above	26	72.2
	Prefer not to say	1	2.7
Household Income			
	£52,000 or less	1	2.7
	£10,400-£15,599	3	8.1
	£15,600-£20,799	1	2.7
	£20,800-£25,999	4	10.8
	£26,000-£36,399	7	18.9
	£36,400-£51,999	7	18.9

	£52,000-£77,999	4	10.8
	More than £78,000	6	16.2
	Prefer not to say	4	10.8
Individual Income			
	£52,000 or less	1	2.7
	£10,400-£15,599	10	27.0
	£15,600-£20,799	3	8.1
	£20,800-£25,999	4	10.8
	£26,000-£36,399	7	18.9
	£36,400-£51,999	5	13.5
	£52,000-£77,999	2	5.4
	Prefer not to say	5	13.5
Usual Gardening Setting			
	Own plot	30	81.1
	Shared plot	3	8.1
	Community/organised group	1	2.7
	More than one	1	2.7
	Prefer not to say	2	5.4

Figure 1, Participant Age Histogram.

Participant Age Histogram
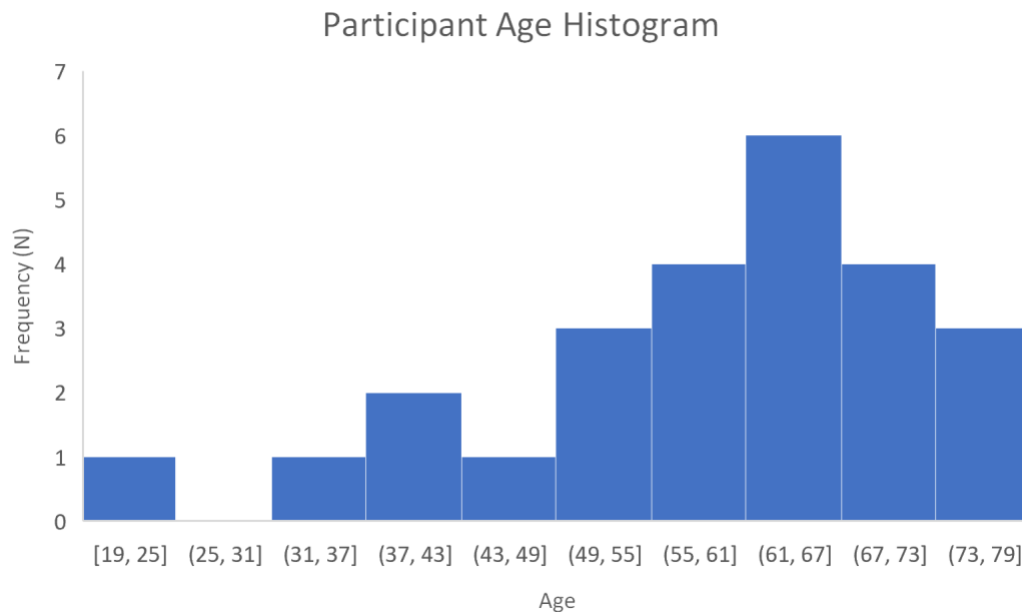
Internal Reliability

The Cronbach's alpha for SMS items before gardening is 0.931 and after gardening it is 0.955. For SSES items before gardening it is α=0.948 and for after gardening it is α=0.905. For CALM items before gardening it is α=0.971 and after gardening it is α=0.952. These high Cronbach's alpha values are consistent with the those found in previous studies mentioned in the *Measures* section above. However, very high Cronbach's alphas may indicate redundancy of some items.

State Mindfulness

The mean SMS score (N=37) for the sample before gardening was 65.92 (SD=13.90) and the mean SMS score after gardening was 74.86 (SD=17.76), indicating an increase in levels of state mindfulness after gardening. The data met assumptions of normality after using the Shapiro-Wilk test to test the participants' SMS score difference before and after gardening

(p=0.572). The score differences had a skewness of 0.379 and kurtosis of 0.226. Since the data met assumptions of normality and we are comparing the scores of the same group before and after an intervention, a paired samples t test was conducted with the participants' SMS scores to test our hypothesis on state mindfulness. It showed a significant increase in SMS scores after gardening compared to before, t(36)=2.86, p=0.0035.

State Anxiety

The CALM score median (N=37) for the sample before gardening was 21 (IQR=12) and the CALM score median after gardening was 17 (IQR=3), indicating a decrease in levels of state anxiety after gardening. A Shapiro-Wilk test was used to test assumptions of normality for the participants' score difference on the CALM before and after gardening and found the data did not meet assumptions of normality (p=0.007). The score differences had a skewness of -1.946 and kurtosis of 3.735. As the data did not meet assumptions of normality, a Wilcoxon signed rank test was chosen instead of a paired-samples t test, it indicated CALM scores after gardening were significantly lower than CALM scores before gardening, Z=-4.05, p<0.001.

State Self-Esteem

The SSES score median for the sample (N=37) before gardening was 74 (IQR=21.50) and the SSES score median after gardening was 85 (IQR=10), indicating an increase in levels of state self-esteem after gardening. A Shapiro-Wilk test was used to test assumptions of normality for the participants' score differences on the SSES before and after gardening and found the data did not meet assumptions of normality (p<0.001). The score differences had a skewness of 1.076 and kurtosis of 0.834. Since the data was significantly abnormally distributed, a

Wilcoxon signed rank test was employed, it indicated SSES scores after gardening were significantly higher than SSES scores before gardening, Z=4.79, p<0.001.

Gardening Duration

The length of time our participants (N=35) gardened for on the day they filled in the questionnaires ranged from 1 to 7 hours, with a mean of 2 hours 42 minutes and standard deviation of 1 hour 35 minutes. Using the Shapiro-Wilk test, we found the data did not assumptions of normality (p<0.001). The data has a skewness of 1.42 and kurtosis of 1.16. Since the data does not meet assumptions of normality, the Spearman's rank correlation coefficient was chosen, which found no significant correlation between length of gardening time on the day and the differences in scores before and after gardening for SMS (r_s[35]=0.068, p=0.345), SSES (r_s[35]=0.222, p=0.093) or CALM (r_s[35]=-0.082, p=0.315). The differences in scores for the scales was calculated by subtracting pre-gardening scores from post-gardening scores and a higher score difference would reflect a larger degree of change in scores before and after gardening.

Exploratory Findings

Weather. Our participants gardened across a variety of weather conditions, namely sunny, partial cloud cover, cloudy and light rain, more details can be found in *Table 2* below.

Table 2, Gardening Weather

	Gardening Weather	
	Frequency (N)	**Percentage**
Sunny	11	29.7
Partial Cloud Cover	15	40.5
Cloudy	9	24.3
Light Rain	2	5.4

For differences in SMS scores before and after gardening, there appears to be a difference across the different weather conditions, as the mean score difference for sunny weather is 1.36 (SD=16.81), partial cloud cover is 13.33 (SD=22.61), cloudy weather is 9.33 (SD=15.79) and light rain is 16.00 (SD=2.83). It is possible participants gardening on sunny days had higher SMS scores before gardening and so there would be relatively little scope for improvement, this can be somewhat corroborated with the mean for SMS scores before gardening for sunny weather (M=68.18, SD=15.24) compared to partial cloud cover (M=65.07, SD=15.06) and cloudy weather (M=63.22, SD=12.44). One-way ANOVA was chosen to analyse these differences as the data has previously been tested to meet assumptions of normality and Levene's test show that it also meets assumptions of equality of variance (F=1.540, p=0.223). However, it was calculated using G*Power with 0.05 probability of error, a power of 0.8 that a sample size of 180 was required for an effect size of Cohen's f=0.25 for this one-way ANOVA test, this would be considered a medium effect size by Cohen (1988). Our sample of 37 can only be estimated to achieve a very large effect size of around 0.59. The one-way ANOVA indicates these variations across different weather

conditions in differences of scores before and after gardening are not significant

(F[3,33]=0.938, p=0.434). When looking at these results, it must be kept mind that the

strength of these exploratory findings regarding weather is very weak as the effect size is

very large, the sample size is greatly underpowered and there are big disparities in group

sizes, with only two participants gardening in light rain.

Since the data for differences in SSES and CALM scores before and after gardening did not

meet the assumptions of normality, a nonparametric test, the Kruskal-Wallis test was chosen

to analyse this data. There appears to be a slight difference across the weather conditions for

the means of differences in SSES scores before and after gardening, with a mean of 10.00

(SD=13.61) for sunny weather, a mean of 9.93 (SD=10.40) for partial cloud cover, a mean of

9.56 (SD=8.05) for cloudy weather and a mean of 14.50 (SD=3.54) for light rain. The

Kruskal-Wallis test indicate this variation in the change between SSES scores before and

after gardening is not significant (H[3]=1.590, p=0.662). The means of the differences in

CALM scores before and after gardening across the different weather conditions also seem to

differ, with a mean of -8.18 (SD=14.21) for sunny weather, a mean of -4.40 (SD=7.55) for

partial cloud cover, a mean of -8.00 (SD=9.99) for cloudy weather and a mean of -21.50

(SD=21.92) for light rain. The Kruskal-Wallis test indicates this variation in differences in

CALM scores before and after gardening was also not significant (H[3]=3.510, p=3.19).

However, just like the previous one-way ANOVA, it must be kept in mind that the sample

size is very small, especially in certain groups.

Social Aspects. Most participants reported that the social aspect of gardening is one aspect

but not the most important (70.3%) and 97.3% of participants gardened with no more than

two other people on the day they completed the questionnaire. More details can be found in *Table 3* below.

Table 3, Social Aspects

Social Aspects		Frequency (N)	Percentage
Importance of social aspect			
	Not at all	4	10.8
	One aspect but not the most important	26	70.3
	Very Important	6	16.2
	Prefer not to say	1	2.7
Number of people participants gardened with on the day			
	Alone	16	43.2
	1-2	20	54.1
	3-4	1	2.7

There appears to be a difference in SMS score differences before and after gardening between those who perceived the social aspect of gardening as not important at all (M=-4.25, SD=20.97), those who perceive it as one aspect but not the most important (M=10.12, SD=19.96) and those who perceive it as very important (M=8.5, SD=8.60). The data has

previously been shown to meet assumptions of normality and passes Levene's test for homogeneity of variances (F=1.712, p=0.196). A one-way ANOVA was conducted to explore these exploratory findings, indicating these differences in means were not significant (F[2,33]=1.014, p=0.374). However, it was calculated using G*Power with 0.05 probability of error and a power of 0.8 that even a medium Cohen's f effect size of 0.25 would require a sample size of 159. Our sample size of 36 can be estimated to achieve only a large Cohen's f effect size of 0.55. The one-way ANOVA conducted here had a large effect size and the sample sized was underpowered, affecting the reliability of these findings. The means of SSES score differences also appear to differ between those who do not perceive the social aspect as important (M=5.50, SD=5.45), those for whom it is one aspect but not the most important (M=9.35, SD=9.16) and those for whom it is very important (M=15.17, SD=16.94), with greater differences in scores for higher perceived importance of social aspects. A Kruskal-Wallis test suggested these differences were not significant (H[2]=1.10, p=0.580). The means of CALM score differences seem to differ between those who do not perceive the social aspect as important (M=-0.50, SD=0.58), those for whom it is one aspect but not the most important (M=-7.35, SD=10.65) and those for whom it is very important (M=-11.50, SD=17.36), with greater differences in scores for higher perceived importance of social aspects. A Kruskal-Wallis test indicated these differences were not significant either (H[2]=2.128, p=0.345).

Those who gardened alone on the day (M=8.75, SD=16.87) and those who gardened with 1-2 people (M=8.65, SD=21.34) seem to have quite similar SMS score differences, but the one participant who gardened with 3-4 people had a much larger score difference (M=18). The data was tested with Levene's test and met equality of variances assumptions (F=1.003, p=0.324). A one-way ANOVA indicated SMS score differences across different numbers of

gardening partners were not significant ($F_{[2,34]}=0.111$, $p=0.895$). However, as with the previous one-way ANOVA for perceived importance of social aspects of gardening, a sample size of 159 would be required for even a medium effect size and our sample size of 37 can only be estimated to have a Cohen's f effect size of 0.55. The means of SSES score differences also appear to remain similar between those who gardened alone on the day (M=10, SD=11.11), those who gardened with 1-2 people (M=10.10, SD=10.47) and the participant who gardened with 3-4 people (M=12). This is supported by a Kruskal-Wallis test indicating the differences between the means are not significant ($H_{[2]}=0.344$, $p=0.842$). There appear to be further similarities between the means of CALM score differences for those who gardened alone on the day (M=-8.88, SD=13.40), those who gardened with 1-2 people (M=-6.15, SD=9.94) and the participant who gardened with 3-4 people (M=-6). This is also supported by a Kruskal-Wallis test indicating the differences between the means are not significant ($H_{[2]}=0.235$, $p=0.889$). However, none of these exploratory results about the social aspects of gardening should be taken at face value since the sample size is very small and there are considerable differences in group sizes.

Discussions

Key Findings

This study investigates whether gardening by itself has any effects on state mindfulness and state mental wellbeing in the general adult population. We hypothesised a significant increase in levels of state mindfulness, state self-esteem and a significant decrease in state anxiety after gardening. Our findings supported these hypotheses and indicated gardening can significantly enhance short term state mindfulness and state mental wellbeing. Our findings are consistent with current evidence in the literature. The studies reviewed by Annerstedt and Währborg, Clatworthy, Hinds and Camic (2013) and Sempik, Aldridge and Becker (2003) generally support the mental health benefits of professional therapies involving gardening for clinical populations. Our findings further imply that gardening by itself (i.e. without the involvement of a certified therapist) can be beneficial for the general adult population too and may suggest that the gardening component of the therapies in the studies reviewed might actually have contributed to improvements in mental health that were reported, at least in the short term.

While Okvat's pilot study (2011) investigating the efficacy of structured gardening interventions on urban older adults found significant increases in aspects of mindfulness for their intervention group, she reported no significant effect of the interventions on subjective wellbeing. Our study did find significant improvements on our wellbeing constructs after a session of normal gardening, but we used different wellbeing measures. Our study used state anxiety and state self-esteem as wellbeing measures whereas Okvat examined positive and negative affect, quality of life and vitality, all of which were assessed as traits. It is also

possible gardening has more short term than long term effects on mental wellbeing. We also had a slightly different population and these reasons may explain our different findings regarding wellbeing.

Additionally, we hypothesised a positive correlation between the length of gardening session and the degree of change in our outcome measures (i.e. state mindfulness, state self-esteem and state anxiety). It seemed sensible to predict that longer gardening sessions could be correlated with bigger differences between pre-gardening and post-gardening outcome measures scores, but no significant correlations were found.

Limitations

There were several limitations to this study. Our sample was recruited with nonprobability methods which introduces a higher chance of systematic error and sampling bias than using probability methods. The results derived from this sample may also be less generalisable than a sample attained using probability methods. However, probability sampling methods were deemed unfeasible as getting a sampling frame for our general gardening adult population would have been unrealistic. Although our sample size of 37 is within the range of N=10-50 in similar studies investigating interventions involving gardening (Clatworthy et al., 2013), it was still below our intended sample size of 71. Hence our results may be less reliable than we initially hoped. The problem of our small sample size becomes worse for analysing exploratory findings, our study was underpowered for the one-way ANOVA tests conducted to analyse them. Our sample also consisted mostly of university educated middle-aged and older adults, all gardening in allotments in Edinburgh and Glasgow, so the findings of this study may not be directly generalisable to other demographic groups, people gardening in

other regions with different climates and to some extent even people gardening in places other than allotments.

Another limitation of this study is the absence of control groups, as having control groups can isolate the effects of gardening on state mindfulness and mental wellbeing and would make the findings of this study more reliable. This study's reliance on self-report questionnaires presents yet another limitation. Getting accurate and reliable data from self-report questionnaires relies on the participants being honest, having the ability for introspection and understanding the questions correctly, this reliance increases the chance of collecting inaccurate or untrue data. Nonparametric tests were used when data was found not to meet assumptions for parametric tests. This is a limitation because nonparametric tests typically have lower power than parametric tests and our small sample size further exacerbates this problem, limiting the usefulness of our results. Many of these limitations were difficult to avoid because this study was part of a MSc programme, therefore we had no budget and tight time restrictions. Despite these limitations, our simple pre- post- test design still allowed our findings to provide fairly reliable and valid evidence that our participants had higher levels of state mindfulness and mental wellbeing after gardening than before.

Implications for Theory and Practice

Our findings can be seen as indirect evidence for the attention restoration theory and psycho-physiological stress reduction theory and thus the biophilia hypothesis on which both are based. Our outcome measure scores regarding state mental wellbeing (i.e. state anxiety and state self-esteem) significantly improved after gardening, which involves exposure to natural stimuli. However, the findings cannot infer that the mechanisms proposed by attention

restoration theory or psycho-physiological stress reduction theory were directly responsible for higher levels of state mental wellbeing after gardening. Neither can the findings infer that exposure to natural stimuli that humans have evolved with for millions of years is directly responsible for higher levels of state mental wellbeing after gardening, as the biophilia hypothesis would suggest. While our findings can associate gardening and hence exposure to natural stimuli with enhanced state mental wellbeing, they cannot infer a cause and effect relationship.

Indirect evidence for the assumption that gardening improves the present moment awareness aspects of mindfulness which enhances mental wellbeing can also be provided by our findings. Both state mindfulness levels (measured by the SMS, which heavily focuses on present moment awareness) and state mental wellbeing levels (i.e. state anxiety and state self-esteem) significantly improved after gardening. However, we can only infer that higher levels of state mindfulness after gardening are associated with higher levels of state mental wellbeing after gardening but not a causal relationship where gardening caused increased state mindfulness which caused improved state mental wellbeing.

Furthermore, there are practical implications for those gardening or looking to take it up. Normal everyday gardening (i.e. without the involvement of a certified therapist) is much more accessible than gardening that is a part of a professional therapy under the guidance of a trained and certified therapist. Therapies involving gardening can be more expensive than everyday gardening and attending therapy may carry with it stigmas of mental illness. Everyday gardening is stigma free and can be done in the comfort of one's own back garden. While allotment plots can have long waiting lists and may present a considerable long-term

commitment, they are relatively cheap to maintain and are fairly accessible for everyone. The findings of our study provide empirical evidence supporting the state mindfulness and state mental wellbeing benefits of gardening for those currently gardening or looking to take it up and may help encourage the practice of gardening amongst the general adult population. However, this study is not proposing gardening can replace or is equivalent to any type of psychological therapy, only that gardening may be beneficial for maintaining short term mental wellbeing.

Although our findings imply gardening can enhance state mindfulness and state mental wellbeing, our study is small, not randomised and there are no control groups. Any serious implications on relevant theories, healthcare policies or clinical practice would require further research involving randomised controlled trials, larger sample sizes, causal research designs and perhaps investigating a wider variety of mental wellbeing constructs and measures.

Recommendations for Future Research

Our small sample size was mentioned as a major limitation so future research with larger samples sizes would be able to confirm or reject any of our findings with much more confidence. Our study is also limited in the generalisability of our findings, since most of our participants are middle-aged to older adults who garden at allotment gardens in Edinburgh or Glasgow. The literature would benefit from future research with other populations, for example sampling from other age groups or from different regions with different climates and cultures. Such further research could confirm or reject our findings for a wider range of populations. We would also recommend more randomised controlled trials investigating the effects of gardening on state mindfulness and mental wellbeing for future research, since our

study was not randomised and lacked a control group. Their findings would be more generalisable with greater degrees of confidence than ours and the effects of gardening can be better isolated. Future research employing a causal design would be very valuable as well, since our findings could not infer causality.

Our exploratory findings indicated no significant differences in the degrees of changes in outcome measure scores after gardening across different weather conditions, the number of gardening partners or different levels of perceived importance of social aspects of gardening. This suggests that external variables, namely weather conditions and social habits of gardening had no effect on how much state mindfulness and mental wellbeing was enhanced after gardening. However, our sample size was too small for the results of these exploratory findings to be meaningful. Future research with larger sample sizes could further investigate these variables with greater degrees of confidence to see if they could be covariates and control for them if necessary. Our attempts to record and measure any social aspects of gardening was also very basic and future research focusing on this should use better, more validated ways to measure the social aspects of gardening.

Conclusion

Our study aimed to contribute towards addressing some gaps in the current literature by finding evidence that everyday gardening can enhance state mindfulness and mental wellbeing. To that end we employed a pre- post- test design experiment attempting to record participants' levels of state mindfulness, state self-esteem and state anxiety before and immediately after a usual gardening session. As was hypothesised, we found significant increases in state mindfulness and state self-esteem and a significant decrease in state anxiety

after gardening. This is mostly consistent with similar kinds of evidence currently in the literature and indicate that everyday gardening may enhance state mindfulness and mental wellbeing. Although causality cannot be assumed from our findings, they indicate higher levels of state mindfulness and mental wellbeing after some everyday gardening compared to before and this association between everyday gardening and enhanced state mindfulness and mental wellbeing can be revealing and useful in itself. Hence our findings can provide useful information for current gardeners and may help encourage the practice of gardening in addition to informing future research and contributing towards the current evidence base. We also hypothesised that the length of gardening sessions would be significantly positively correlated with the degree of change in outcome measures scores before and after gardening, but we found no significant correlations.

There were several limitations to our study, for example the small size of our sample limited the power of our design, this was the most problematic for our exploratory findings from which we cannot make any inferences within satisfactory degrees of confidence. Future research examining external variables like weather and social aspects of gardening would be necessary since there is currently no strong evidence relating to these variables and our exploratory findings were too underpowered for the results to be reliable. Other limitations include the reliance on self-report questionnaires, the lack of control groups and randomised sampling and the limited generalisability of our findings to different demographic groups. Nevertheless our study still managed to address our research questions and investigate our main hypotheses to a satisfactory degree in relations to what this study set out to do initially. Our relatively simple one-tailed pre- post- test design decreased the chance of errors and the chance of things going wrong and allowed us to achieve at least a medium effect size in analysing our key findings even with our small sample size. Our findings would benefit from

being confirmed by future research with larger sample sizes, a greater range of populations and randomised controlled studies. Such further future research would be necessary for any serious implications on the theories, practice and policy surrounding mindfulness, mental wellbeing and gardening, as the findings of our study alone is not enough to have serious impact.

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Appendices

Appendix 1: Questionnaire Packet
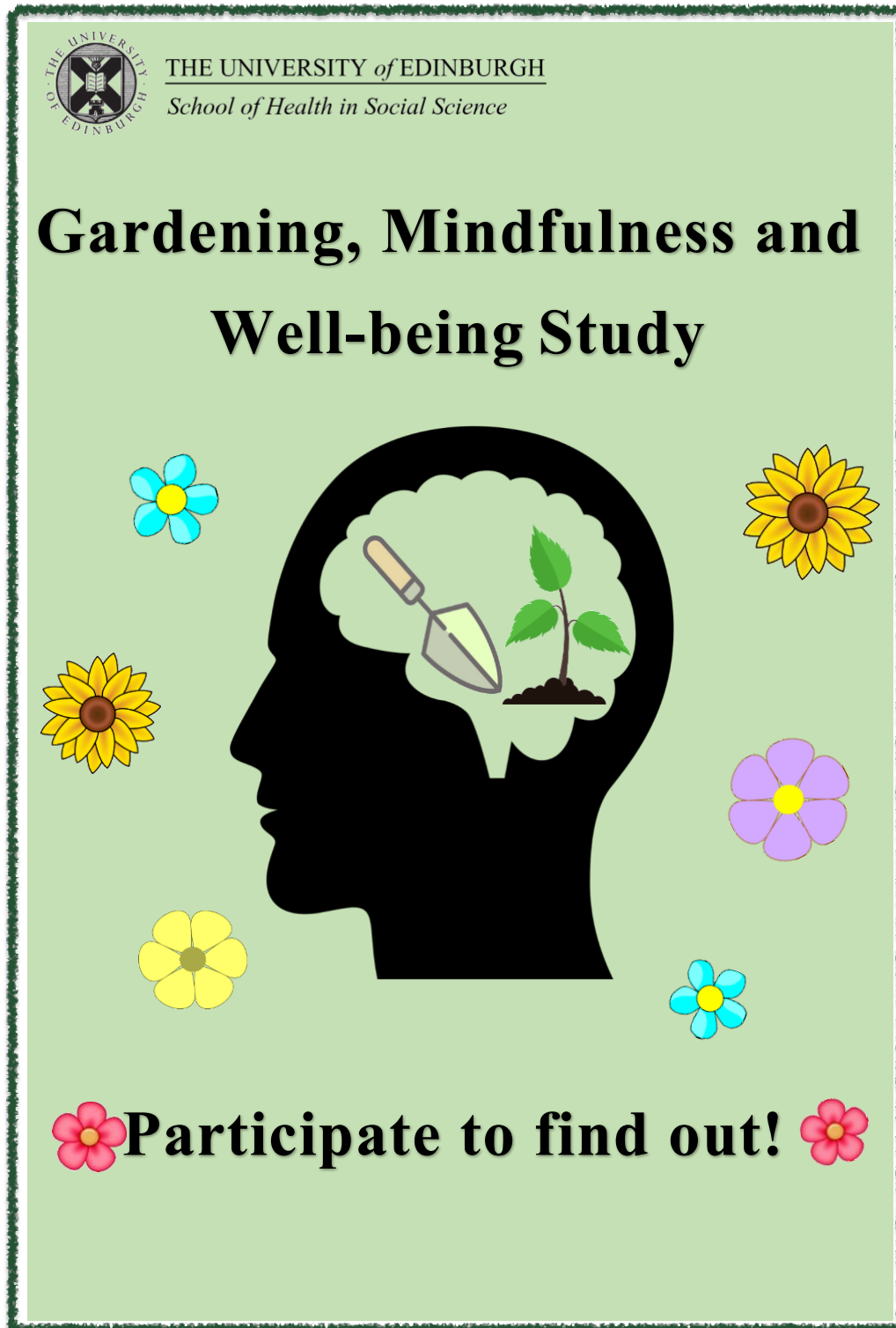
THE UNIVERSITY of EDINBURGH

Dear Gardeners,

We are a group of Masters students at the University of Edinburgh investigating whether gardening can enhance mindfulness and mental wellbeing. If you are over 18 and in the habit of gardening, we would like to invite you to participate in our study. Participation will involve completing some questionnaires before and after one session of your normal gardening. If you are interested in finding out more about our project, please have a look at the participant information sheet attached. We appreciate you taking the time to consider our project.

This project has been approved by the School of Health in Social Science Research Ethics Committee at the University of Edinburgh. If you have any queries regarding the project, please direct them to the project team at k.h.k.ng@sms.ed.ac.uk or p.lin-12@sms.ed.ac.uk.

Yours Faithfully,

Kelvin and Ruby

PARTICIPANT INFORMATION SHEET

How to Take Part

Step 1) Complete the consent form attached here.

Step 2) Set aside around 15 minutes **before** your usual gardening routine to complete the first half of the questionnaires.

Step 3) Do your usual gardening routine.

Step 4) Complete the second half of the questionnaires **immediately** after gardening

Step 5) Place the questionnaires inside the questionnaire packet collection box.

About Our Project

Our project aims to determine whether the act of gardening can enhance the short-term mindfulness level and mental well-being of individuals. Currently, there is not a lot of evidence in the literature to support the position that the activity of gardening by itself is beneficial to mindfulness and mental-wellbeing. This study hopes to contribute to this body of evidence behind the effects of gardening on mindfulness and mental well-being and to aid with future research. We hope you can be a part of this too! The results of this study will be shared through the following wiki page: https://www.wiki.ed.ac.uk/x/VQbeFw

- 2 -

Participants' Rights and Confidentiality

Participation in the study is completely optional and participants are under no obligation to answer any questions they feel uncomfortable anytime in the study. No identifiable data will be collected in this study to ensure your confidentiality and anonymity. Since the data is anonymous, it will be impossible to withdraw once it has been submitted. Additionally, no sensitive data will be collected. All information and data will be password-protected and used to support a masters research group project. The non-identifiable data may also be used to support other projects that are in the public interest.

Possible Risks

Gardening is a physical activity which can lead to bodily injury or exposure to the elements. Please be careful when gardening and handling tools and make sure to wear appropriate clothing and footwear. The current project is not asking you to engage in any gardening activities, only to complete questionnaires before and after your usual gardening activity(namely gardening which you would have done regardless of whether you took part in this study or not).

The measures used in this study do not appear to have any items that may be considered to be offensive, intrusive or sensitive. However, any focus on psychological issues may trigger existing distress. If you do experience any distress please contact your GP or contact Breathing Space, a helpline which is available to all people in Scotland:

Website: https://breathingspace.scot

Phone line: 0800 83 85 87 (open 6pm to 2am on weekdays and 24 hours at weekends).

Useful Contacts

If you have questions about the project then please contact the project team members by email: p.lin-12@sms.ed.ac.uk or k.h.k.ng@sms.ed.ac.uk

Alternatively you can contact our project supervisor:

Dr Paul Graham Morris

Telephone: +44 (0)131 651 3956

Email: p.g.morris@ed.ac.uk

If there are any complaints that cannot be satisfactorily resolved by the research team or supervisor, then please contact the head of the School of Health in Social Sciences:

Professor Matthias Schwannauer.

Telephone: +44 (0)131 651 3954

Email: m.schwannauer@ed.ac.uk

If the complaint remains unresolved, it can be progressed via details in the following form:

 http://www.ed.ac.uk/files/imports/fileManager WEB%20Complaint%20Form.pdf

<u>CONSENT FORM</u>

PROJECT TITLE: Effect of Gardening on State

Mindfulness and Well-being

By <u>ticking</u> the following boxes, you are agreeing that:

(1) You have read and understood the Participant Information Sheet ☐

(2) You have the opportunity to ask any questions about your participation in this study (e.g. by email to the project team), and that any such questions were answered satisfactorily ☐

(3) You are over the age of 18 and agree to participate in this study ☐

(4) The non-identifiable data collected in this study can be used to inform research reports and to support future projects that are in the public interest ☐

Gardening, Mindfulness and Mental Wellbeing Study

First Half of the Questionnaire Packet

This first half of the questionnaire packet is to be completed just before gardening.

Introductory Questionnaire

Please answer the following questionnaires **after filling in the consent form** on Page 5. Please answer **all** the questions as honestly as possible and to the best of your knowledge. Please circle or fill in the blanks where appropriate. There is no obligation to answer any questions in this packet that you are uncomfortable with, but the more questions you answer honestly, the better it will be for the results of this study.

(1) How much time do you usually spend gardening per week (during this year's growing season)?

_____ hours _____ minutes

(2) What is your individual and household income per annum classification? (Circle one for individual and one for household, circle the same for each if individual and household income is the same for you)

Individual Income	Household Income
Less than £5,200	Less than £5,200
£10,400-£15,599	£10,400-£15,599
£15,600-£20,799	£15,600-£20,799
£20,800-£25,999	£20,800-£25,999
£26,000-£36,399	£26,000-£36,399
£36,400-£51,999	£36,400-£51,999
£52,000-£77,999	£52,000-£77,999
£78,000 or more	£78,000 or more

(3) How many people do you usually garden with?

    Alone   With 1-2 people   With 3-4 people   More than 5

(4) Do you usually garden in… (circle all that applies)?

    Your own plot   A plot shared with family and friends
                             (E.g. helping out at others' plots)

    A community/organised group

(5) How important are the social aspects of gardening to you? (E.g. talking or working with others when gardening)

    Not at all   It's one aspect but not   Very Important
                  the most important

(6) How do you spend most of your day? (E.g. work setting. Please circle all that applies.)

    Outdoors   Indoors

    Seated   Performing physical activities

(7) Gender:

    Male   Female   Other

(8) Age:_____

(9) Education:

    No Formal Education   High School

    Tertiary Education (University) or above

State Mindfulness Scale

Please circle the number to indicate the extent to which you agree with the following statements (1 = not at all to 5 = very well) as they are true for you **right now**. Please answer **all** questions.

1) I was aware of different emotions that arose in me

   Not at all   Very well

   1   2   3   4   5

2) I tried to pay attention to pleasant and unpleasant sensations

   Not at all   Very well

   1   2   3   4   5

3) I found some of my experiences interesting

   Not at all   Very well

   1   2   3   4   5

4) I noticed many small details of my experience

   Not at all   Very well

   1   2   3   4   5

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5) I felt aware of what was happening inside of me

     Not at all   Very well

       1   2   3   4   5

6) I noticed pleasant and unpleasant emotions

     Not at all   Very well

       1   2   3   4   5

7) I actively explored my experience in the moment

     Not at all   Very well

       1   2   3   4   5

8) I clearly physically felt what was going on in my body

     Not at all   Very well

       1   2   3   4   5

9) I changed my body posture and paid attention to the physical process of moving

Not at all   Very well

1   2   3   4   5

10) I felt that I was experiencing the present moment fully

Not at all   Very well

1   2   3   4   5

11) I noticed pleasant and unpleasant thoughts

Not at all   Very well

1   2   3   4   5

12) I noticed emotions come and go

Not at all   Very well

1   2   3   4   5

13) I noticed various sensations caused by my surroundings (e.g., heat, coolness, the wind on my face)

Not at all   Very well

1   2   3   4   5

14) I noticed physical sensations come and go

Not at all   Very well

1   2   3   4   5

15) I had moments when I felt alert and aware

Not at all   Very well

1   2   3   4   5

16) I felt closely connected to the present moment

Not at all   Very well

1   2   3   4   5

17) I noticed thoughts come and go

Not at all   Very well

1   2   3   4   5

18) I felt in contact with my body

Not at all   Very well

    1   2   3   4   5

19) I was aware of what was going on in my mind

Not at all   Very well

    1   2   3   4   5

20) It was interesting to see the patterns of my thinking

Not at all   Very well

    1   2   3   4   5

21) I noticed some pleasant and unpleasant physical sensations

Not at all   Very well

    1   2   3   4   5

State Self-Esteem Scale

Please circle a number to indicate the extent to which you agree with the following statements (1 = not at all to 5 = extremely) as they are true for you **right now**. Please answer **all** questions.

1) I feel confident about my abilities

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

2) I am worried about whether I am regarded as a success or failure

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

3) I feel satisfied with the way my body looks right now

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

4) I feel frustrated or rattled about my performance

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

5) I feel that I am having trouble understanding things that I read

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

6) I feel that others respect and admire me

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

7) I am dissatisfied with my weight

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

8) I feel self-conscious

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

9) I feel as smart as others

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

10) I feel displeased with myself

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

11) I feel good about myself

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

12) I am pleased with my appearance right now

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

13) I am worried about what other people think of me

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

14) I feel confident that I understand things

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

15) I feel inferior to others at this moment

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

16) I feel unattractive

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

17) I feel concerned about the impression I am making

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

18) I feel that I have less scholastic ability right now than others

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

19) I feel like I'm not doing well

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

20) I am worried about looking foolish

Not at all	A little bit	Somewhat	Very much	Extremely
1	2	3	4	5

Current Anxiety Level Measure

Please try as much as possible to describe your **<u>current</u>** feelings and state of mind by circling a number for **<u>every</u>** question.

1) I am feeling nervous

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

2) I am experiencing shakiness

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

3) I am feeling on edge

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

4) I am experiencing restlessness

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

5) I am feeling overwhelmed

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

6) I am experiencing difficulty concentrating

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

7) I am feeling worried

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

8) I am experiencing repeating or uncontrollable thoughts

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

9) I am feeling scared

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

10) I am experiencing tension in my body

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

11) I am feeling panicked

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

12) My heart is pounding

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

13) I am feeling uneasy

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

14) My stomach is in knots

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

15) I am feeling closed in/trapped

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

16) I am experiencing difficulty breathing

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

Thank you for taking the time to complete the first half of this questionnaire packet. Please refrain from looking at it again after this time. Kindly <u>continue onto your usual gardening routine</u> and return to complete the second half of the questionnaire packet <u>immediately</u> after your gardening session.

Gardening, Mindfulness and Mental Wellbeing Study

Second Half of the Questionnaire Packet

This second half is to be completed **immediately** after gardening.

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Questions relating to your gardening session **today**

(1) How long did you spend gardening?

_____Hours_____Minutes

(2) How many people did you garden with?

Alone   With 1-2 people   With 3-4 people   More than 5

(3) What was the weather like today during gardening?

Sunny   Partial cloud cover   Cloudy   Light rain   Heavy rain

Snowing   Windy

(4) What activities did your gardening routine include today?

Watering   Trimming   Pruning   Planting   Grafting   Weeding

Removing dead plant matter   Other (please specify):_____

State Mindfulness Scale

Please circle the number to indicate the extent to which you agree with the following statements (1 = not at all to 5 = very well) as they are true for you **right now**. Please answer **all** questions.

1) I was aware of different emotions that arose in me

Not at all   Very well

1   2   3   4   5

2) I tried to pay attention to pleasant and unpleasant sensations

Not at all   Very well

1   2   3   4   5

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Not at all   Very well

1   2   3   4   5

4) I noticed many small details of my experience

Not at all   Very well

1   2   3   4   5

5) I felt aware of what was happening inside of me

Not at all   Very well

1   2   3   4   5

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6) I noticed pleasant and unpleasant emotions

Not at all   Very well

1   2   3   4   5

7) I actively explored my experience in the moment

Not at all   Very well

1   2   3   4   5

8) I clearly physically felt what was going on in my body

Not at all   Very well

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9) I changed my body posture and paid attention to the physical process of moving

Not at all   Very well

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Not at all   Very well

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13) I noticed various sensations caused by my surroundings (e.g., heat, coolness, the wind on my face)

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14) I noticed physical sensations come and go

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1 | 2 | 3 | 4 | 5

17) I feel concerned about the impression I am making

Not at all | A little bit | Somewhat | Very much | Extremely
1 | 2 | 3 | 4 | 5

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Not at all | A little bit | Somewhat | Very much | Extremely
1 | 2 | 3 | 4 | 5

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Not at all | A little bit | Somewhat | Very much | Extremely
1 | 2 | 3 | 4 | 5

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Not at all	Slightly	Moderately	Significantly	Extremely
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6) I am experiencing difficulty concentrating

Not at all	Slightly	Moderately	Significantly	Extremely
1	2	3	4	5

7) I am feeling worried

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16) I am experiencing difficulty breathing

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1	2	3	4	5

End of Questionnaire Packet

Thank you for taking the time to participate in this study. Please place this packet inside a collection box.

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Appendix 2: Ethical Approval Letter

SCHOOL *of* HEALTH IN SOCIAL SCIENCE
CLINICAL AND HEALTH PSYCHOLOGY

The University of Edinburgh
Medical School
Doorway 6, Teviot Place
Edinburgh EH8 9AG

Telephone 0131 651 3969
Fax 0131 650 3891
Email submitting.ethics@ed.ac.uk

Kelvin NG / Peilin Lin
MSc Students
Department of Clinical and Health Psychology
School of Health in Social Science
University of Edinburgh

22 May 2019

Dear Kelvin / Peilin,

Application for Level 2 Approval

Reference: CLIN621
Project Title: Effect of Gardening on State Mindfulness and Mental Wellbeing
Academic Supervisor: Paul Morris

Thank you for submitting the above research project for review by the Department of Clinical and Health Psychology Ethics Research Panel. I can confirm that the submission has been independently reviewed and was approved on the 10th May 2019.

Should there be any change to the research protocol it is important that you alert us to this as this may necessitate further review.

Yours sincerely,

Kirsty Gardner

Administrative Secretary
Clinical Psychology