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Vertical gardening and Syrian women refugees in Lebanon: an exploratory study on motivation for gardening and depression relief

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ABSTRACT
Refugees and the displaced experience challenges which can lead to mental health illnesses, including depression. In this study, the effectiveness of gardening in reducing depression and improving the lives of displaced Syrian women in Lebanon was explored. Considering that the displaced had limited outdoor space and no access to land, vertical gardening units were used. Forty-four participants residing in four displaced communities in North Lebanon joined the 6-months gardening programme, which was designed as a quasi-experimental exploratory study. Data on depression scores were collected at the preparatory phase and at 24 weeks post-intervention using the Beck Depression Inventory (BDI-II) and analysed using a paired t-test. Results revealed that participants were less depressed at the end of the gardening programme, with depression scores significantly lower than preparatory phase scores. Group interviews were also conducted to assess women's perception of gardening halfway through the intervention phase. Women's engagement in gardening activities was also reflected by estimating yields. Participants indicated that they joined the programme because they saw it as a stress relief activity, they were interested to learn about vertical gardening, they enjoyed the aesthetic value of plants, they wanted to produce food and they felt that gardening provided an opportunity to socialise. Our findings suggest that aid organisations may consider vertical gardening as a therapeutic and social activity in situations where displaced women are confined to limited open spaces.

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Introduction

Refugees and the displaced are subject to stress because of the violence they have witnessed or experienced and the resettlement which leads to confinement and loss of social circles (Laban et al. 2004; Bjertrup et al. 2018). In most cases, the displaced are distressed because they spend days in a "standby mode", with no future outlook, physical activity, productive engagement or social support. This constant state of distress can lead to depression, and studies show that depression is one of the most common mental health problems refugees face (Naja et al. 2016).

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Mental health of displaced Syrians in Lebanon

Lebanon, with an estimated population of 4 million, hosts the largest number of refugees in the world per capita (more than one million Syrian refugees), many of whom have survived physical violence or have witnessed atrocities of armed conflicts (Naufal 2012; Asaf 2017; Sadiki 2014). According to UNHCR, the most common psychological disorders among adult refugees in Lebanon are post-traumatic stress disorder (PTSD), depression and anxiety (Gluck 2016). Naja et al. (2016) have shown that large numbers of displaced Syrians exhibit signs of depression, with virtually no differences between genders. However, Syrian women and children constitute the largest percentage of displaced individuals (Sami et al. 2014), and many of these women (31%) reportedly experienced physical, sexual or psychological violence (Kazour et al. 2017; Usta and Masterson 2015). With the breakdown of their social system, displaced Syrian women face increased violence in family relationships and have limited access to mental health services to help them cope with the situation (Charles and Denman 2013). Experts have suggested interventions such as cognitive processing therapy and narrative exposure therapy to deal with mental disorders such as PTSD and depression (Kaysen et al. 2014; Kobach et al. 2015). However, Kazour et al. (2017) argue that such approaches present limitations due to the challenge of adapting Western derived methods and interventions to Arab cultural settings. Similarly, Bjertrup et al. (2018) examined the "social suffering" of Syrian refugees in Greece, seeking to understand the effects of "uncertain and disrupted lives and the loss of social networks". They found that individualised and medicalised perspectives of psychology (such as trauma-focused approaches) are often inadequate to do so, especially in capturing a life narrative.

Gardening and well-being

Gardening is directly and indirectly linked to reduced levels of distress and depression. It is considered beneficial not only as a personal experience but also as a community experience because of the resulting communal cohesion that it can engender (Jamison 1985). In the Netherlands, almost all participants (93%) who enrolled in seven different community gardens talked to others when they visited the gardens, and in some cases, exchanged help with issues outside of the garden (Veen et al. 2016). Moreover, Soga, Gaston, and Yamaura (2017) explained the positive indirect experiences where gardening encourages exercise, which in turn improves psychological health, provides opportunities to interact with others, which is likely to forge and reinforce social ties and ensures that engaged people have a healthier diet, rich in fruits and vegetables. Gardening also enhances health and well-being by providing a stress-relieving moment, a healthier lifestyle, a sense of personal development and contact with nature (Genter et al. 2015).

In non-refugee populations and on an individual level, gardening is reportedly therapeutic for a wide range of people experiencing mental or physical health difficulties, including the elderly, drug abusers, the marginalised, the incarcerated and the mentally distressed (Schmelzkopf 1995; Kingsley and Townsend 2006; Richards and Kafami 1999). By serving as a positive distraction that offers a psychological distance from everyday demands, gardening reduces depression severity and anxiety (Clatworthy, Hinds, and Camic 2013; Gonzalez et al. 2010). Person-centered gardening programmes increase the well-being of people with mental health problems, as well as help them to re-engage with and integrate into society (Howarth et al. 2016). Working with battered women in Korea, Lee et al. (2004) have shown the effectiveness of a gardening programme (horticultural therapy programme) in increasing self-esteem and decreasing depression. Richardson et al. (2019) found that young, socially vulnerable YMCA residents who enrolled in a nature-based community gardening programme developed a sense of community and experienced a "positive shift in identity".

Gardening benefits for refugees

In refugee populations, studies have shown that difficulties experienced by refugees could be alleviated when individuals engage in meaningful occupations such as gardening, which gives a sense of "producing" (Whiteford 2004). Reporting on positive responses by refugees involved in a garden allotment programme, Bishop and Purcell (2013) showed that the helpful effects of gardening were linked to dimensions of occupation, namely "doing" which consists of a purposeful activity leading to tangible outcomes, and a "being" dimension, which promotes happiness and enjoyment. Gardening may contribute indirectly by promoting a positive feeling of achievement and directly by contributing to food security, offering people the chance to produce part of their food. For refugees who have a sense of loss of control, gardening as a productive activity can help regain a sense of control, albeit minimal.

Studies examining the effect of gardening on well-being and social inclusion among refugee populations are not many. Eggert et al. (2015) explored the effect of developing a refugee community garden through a community coalition. The authors found that participants reported increased community engagement and formed a successful coalition. Gerber et al. (2017), who documented gardening experiences of Nepali Bhutanese refugees in the United States, found that community gardening was positively associated with social support, one main contributor to ideal functioning within communal cultures (Gerber et al. 2017). The authors, however, found no differences in levels of distress between refugees who participated in the community garden project and those who did not (Gerber et al. 2017).

The goal of this study was to investigate the impact of gardening on alleviating depression among displaced Syrian women in Lebanon and improving their family's lives. A unique aspect of the study is the use of vertical gardening modules (Figure 1) to respond to the challenge of offering a gardening programme to women who had limited outdoor space and no access to land. The specific objectives were to examine the effectiveness of vertical gardening in alleviating depression using validated depression scores, to explore the benefits of gardening, and understand the contributions of gardening to their quality of life through group discussions and thematic qualitative analyses.

Methodology

Study design

The elements of the study design were influenced by and responsive to the living conditions of Syrian women refugees and guided by the study objectives stated above. We chose to work with

Figure 1. A prototype of the vertical gardening units developed by the university grown in one of the participating sites.

women for several reasons. First, studies have shown that women and children comprise the highest levels of displaced with many reporting experiences of physical, sexual and psychological abuse. Second, reports indicate that before they were displaced, most Syrian women were homemakers and worked in agriculture (El Asmar, Shawaf, and Mikdashi 2019). Last, due to cultural and societal norms and expectations, women are more likely to stay on-site with the children while men are more likely to work off-site.

Due to the volatile situation of the participants, it was not feasible to include a control group, and instead, a quasi-experimental exploratory design was adopted. Participants were self-selected from four chosen study sites. The study included a preparatory phase and an intervention phase with a 20-week gardening programme. Participants' depression levels were measured before and after the gardening programme. Group interviews were conducted at each study site in the middle of the gardening programme to understand participants' motivations for and perceived benefits from gardening. Horticultural yields of each vertical gardening unit were estimated towards the end of the gardening programme. Details are described below.

Study sites

Consultations were made with international aid organisations and the Lebanese ministry of social affairs to identify potential intervention sites. According to on-the-ground government and international aid agencies, four displaced Syrian communities in North Lebanon expressed willingness to learn more about the project. The four different locations were designated using acronyms to ensure their anonymity. The first site (Site 1) was an abandoned factory grounds housing nine families, each living in a shed constructed from plastic covers and collected construction wood and sharing two outdoor toilets. The second site (Site 2) was an unbuilt open space in a residential, rural neighbourhood housing ten families, each living in a tent that consisted of a sitting area and a cooking area and one toilet shared by 3–4 families. The tents consisted of reused plastic and construction wood as covers, cement as the floor and gravel around each tent. The third site (Site 3) was a space between two agricultural fields and included nine tents that housed two families each. The site includes a small river, a few goats and a cow. The fourth site (Site 4) was an unfinished two-floor building with two apartments on each floor. Each apartment housed three families.

After we received approval to conduct the study from the Ethics Committee at the American University of Beirut (AUB) we visited women in every family in the study sites, explained the purpose of the project and invited them to join the introductory project session. Project staff received training on research ethics, informed consent and interview skills before going to the field. The trained staff conducted all group discussions and individual interviews in Arabic.

Preparatory phase

The preparatory phase, which spanned over several visits, served as an opportunity for researchers and participating women to become familiar with each other and to introduce the project through unstructured conversations and activities. During this phase, the researchers gave a more detailed presentation about the project, and they performed on-site demonstrations on principles and practices of vertical gardening. Attendees asked questions on how to prepare and plant vegetable crates, assess seed germination, set up the green wall, maintain plants and troubleshoot horticultural problems. Some participants shared their experience in gardening. The displaced Syrian women who attended the preparatory phase sessions were invited to join the study with the understanding that there were no financial or material incentives for participation. Towards the end of the preparatory phase, the 44 participants who chose to be part of the study gave their oral consent and self-selected into groups. Ten participants were recruited from Sites 1 and 14 were recruited from Sites 2 and 17 were recruited from Sites 3 and 10 were recruited from Site 4 (see Table 1).

Table 1. Number of Syrian women refugee participants in the vertical gardening programme.

Site	Number of participants*
Site 1	10
Site 2	14
Site 3	17
Site 4	10

*Note that while the number of interested participants was 51, only 44 gave their oral consent and were part of the qualitative study, while only 32 participants agreed to fill out the BDI-II both times.

Intervention phase

Grouping of participants. At the start of the intervention phase, participants in each site were asked to team up in groups to share gardening units, responsibilities and tools. Each group shared a gardening unit. Vertical gardening units consist of shoulder height stand-alone galvanised steel frames that support nine vegetable crates, which serve as planting containers filled with light soil mix, covered with Styrofoam sheets, and irrigated with plastic drip lines. Women formed groups based on family relations (mothers, daughters, cousins) and friendships. The groups were then asked to choose the most convenient location for setting up the gardening units. In one site, women formed five groups of two ($N = 10$) and chose a common location to place all the vertical units. In another site, women formed seven groups of two ($N = 14$) and chose to place the units each next to their tents. In a third location, women formed six groups of 2, one group of 3 and two women chose to work alone ($N = 17$). The women placed the units each near their residences. In the fourth location, eight women chose to work each alone in addition to one group of two women ($N = 10$), and they chose to place the units in front of their tents.

It is worth noting that the number of participating women per site ranged between 10 and 17; however, at every workshop visit, the average number of participants was seven, a reflection of the fact that women were free to attend all or some of the sessions at their convenience. This fluidity in participation explains the discrepancy which may occur between the number of participants and the number of filled questionnaires.

Gardening programme. During the gardening programme period, which lasted 20 weeks, the research staff conducted weekly visits to each site, followed up with all women groups and conducted activities outlined in Table 2. The gardening programme activities started with planting and setting up the vertical units, followed by monitoring germination and growth and ended with plant management sessions including environmental conditions such as sun and shade, water needs, plant thinning and the monitoring and control of pests and diseases. At every visit, researchers recorded their observations of the gardening activities and community interactions, they made no inquiries about absentees, and they reminded participants that participation is voluntary.

Data collection

Assessment of depression. To assess the effect of gardening on depression, the Beck Depression Inventory (BDI-II; Beck 1967) questionnaire was administered to participants before the start of the gardening programme and then again at 24 weeks after the start of the programme when the gardening programme ended. The BDI-II is a 21-item self-reported questionnaire designed as a self-assessment of recent depressive symptoms over a two-week-long period. Each symptom is rated on a 4-point scale ranging from 0 to 3, indicating the severity and total scores calculated by finding the sum of the 21 items can range from 0 to 63 (Beck, Steer, and Brown 1996). Scores between 0 and 13 indicate minimal levels of depression, scores between 14 and 19 indicate mild levels of depression, scores between 20 and 28 indicate moderate levels of depression and scores between 29 and 63 indicate severe levels of depression (Beck, Steer, and Brown 1996). The BDI-II was previously used to determine changes in depression intensity over time (Beck, Steer, and Carbin 1988; Gonzalez et al. 2010; Richter

Table 2. Gardening programme for Syrian refugee women in North Lebanon.

Distribute vertical units, containers, and related material, planting mix, and seeds.
Provide information on every item received and an explanation of its function and use.
Prepare planting boxes and plant (early March)
Raise boxes to 45-degree angles and address horticulture inquiries about various crops
Set-up of wall units and discuss the difference between vertical and horizontal gardening
Conduct weekly visits to check up on irrigation, pests and diseases, sun/shade issues and fertilisation
Thin plants
Start harvesting, visual estimation and local harvest (mid-April)
Discuss observed pests and diseases problems and their management

et al. 1998). Some studies argued that a clinically significant change would be a decrease exceeding 5 points on the total BDI score (Bright, Baker, and Neimeyer 1999; Dworkin et al. 2008).

For cultural concerns, we omitted the question related to sexual relations from the questionnaire. Consequently, the maximum score became 60 instead of 63, and cut-off scores were decreased by three points each. However, when analysing the results, we decided to adopt a conservative approach by assuming that the clinical significance of a decline in the reported scores remains the same as that described by Bright, Baker, and Neimeyer (1999). Ghareeb (2000) developed an Arabic-adapted version of the BDI-II, and the scale was previously used in several Arab countries such as Egypt and Bahrain using Arab samples (Al-Musawi 2001; Ghareeb 2000). For the current study, we performed our translation of the scale from English to Arabic and then had another researcher back-translated the measure from Arabic to English to make sure the meaning of each of the items of the BDI-II scale was fully captured.

While we intended to carry out the BDI-II with each participant at each site in a separate private room, the lack of privacy to which displaced women are subjected did not allow for this to be feasible. Instead, during the group visits at each site, participants were each taken aside and asked whether they would be willing to fill out the BDI-II and whether they would prefer to do it verbally with the help of the facilitator or written. Thirty-two of the 44 study participants agreed to fill out the BDI-II at both times (pre and post gardening programme). No names or identifiers were provided on any of the questionnaires to ensure anonymity. In the meantime, the other participants were at the other end of the room engaged in gardening-related discussions and inquiries.

Group interviews. Ten weeks into the gardening programme, a group session was organised at each site to learn about the women's motivations and perceived benefits from gardening. The 44 women participants were asked the following open-ended questions: Why did you join the vertical gardening programme? How do you think having a vertical garden programme will help your family? Do you think the vertical garden programme can help your family? If yes, how? The answers provided by each participant were recorded.

Horticultural yield assessment. The horticultural yield was assessed as an indicator of participants' engagement in the programme measured in terms of gardening productivity. To estimate horticultural yield, the university replica modules mirrored those in the intervention sites, including the set-up of modules, plant selection, planting techniques and planting and management schedules. We confirmed 100% coverage in all boxes to be when the leafy greens fully covered the surface of the box in the university replica, which we considered as a benchmark for optimal production conditions. In the intervention sites, the yield was similarly visually estimated as per cent vegetation coverage per box. The participants planted greens suitable for early spring production on the Lebanon coast (Table 3).

Data analysis

Quantitative data analysis using IBM SPSS Statistics was done to compute and compare depression scores on the BDI questionnaire. For participants' depression scores, we conducted paired t-tests to compare changes in BDI scores pre- and post-intervention.

Table 3. Yield assessment of vertical gardening in Syrian women refugee camps in North Lebanon.

	Per cent production*			
	The yield of plants grown by Syrian women refugees			
	Site 1	Site 2	Site 3	Site 4
Dandelion	Np	100%	np	100%
Portulaca	50%	100%	np	100%
Thyme	50%	100%	100%	100%
Parsley	50%	100%	100%	100%
Watercress	50%	100%	50%	100%
Cilantro	50%	100%	np	100%
Baby Spinach	50%	100%	20%	100%
Lettuce	50%	100%	100%	100%
Rockets	50%	100%	np	100%

*Based on maximum university yield estimated a 100% coverage of the box surface. The number of boxes per plant type per camp ranged from 5 to 34, depending on the plant selection made by participants. The total number of boxes per camp ranged from 74 to 272. np = not planted.

Qualitative data analysis was performed on responses to the group interviews using an inductive thematic approach, including familiarisation with the data, coding, generating and reviewing themes, defining and identifying the themes, and interpretation to analyse the data of the group interviews. Two researchers independently ran the thematic analysis of the responses, which first involved deconstructing participant responses by identifying and grouping keywords or phrases throughout the dataset. Once completed, the two coders discussed the findings, clustered the data and named the five themes.

Results

Effect of gardening on depression

Paired t-tests of the 32 women who undertook the depression assessments showed that the post-intervention depression scores were significantly lower than the preparatory phase scores ($p < .001$) (Table 4). At the end of the preparatory phase, 37.5% of participants were minimally depressed, and 25% were severely depressed. At post-intervention, the percentage of minimally depressed increased to 56%, and the percentage of severely depressed dropped to nil. Six participants who scored as severely depressed were moderately depressed at post-intervention, and four participants who were mildly depressed screened as minimally depressed at post-intervention. We found a clinically significant decline in the BDI score from pre- to post-intervention, whereby the mean score decreased from 18.8 to 13.7, with the average score shifting from mildly to minimally depressed.

Motivations and perceived benefits from gardening

Analysis of the data collected on participants' perceptions of the gardening programme revealed five major themes, one related to food production and four others were non-food related, including

Table 4. Depression scores pre and post gardening intervention contributed by Syrian women refugees in North Lebanon who chose to participate in the vertical gardening programme.

	Preparatory phase				Post-intervention			
	n	%	Mean *(SD)*	Min-Max	n	%	Mean *(SD)*	Min-Max
BDI-II	32		18.8 *(9.9)*	4–40	32		13.7 *(6.8)*	4–26
Minimal	12	37.5			18	56.3		
Mild	7	21.9			6	18.8		
Moderate	5	15.6			8	25		
Severe	8	25			0	0		

Note: BDI = Beck Depression Inventory; SD = standard deviation; Min = minimum; Max = maximum.

stress relief, learning, aesthetic value, and social factors (Table 5). A large number of participants either did not think (31%) or were uncertain (24%) about how the gardening programme will help their families or how it will contribute to their family's well-being (will not contribute to well-being, 47%; I do not know, 20%).

Food production. When asked why they joined the project, 38% of participants indicated that it is good to grow food stating, "it is good to have vegetables at home", "to eat when there is no food", that gardening allows them to have control over the quality of the food they consume "to eat something clean that we produced" and it helps improve their children's diets "for children to eat vegetables". However, a large number of participants (62%) did not have any expectations that gardening will improve their access to food. Moreover, when asked how vertical gardening will help their families, a third responded by producing food, but only 4% of participants indicated that the gardening programme would contribute to the family's well-being through food production.

Themes other than food production included stress relief, learning, aesthetic value and social factors and collectively constituted a large percentage (75%) of the responses explaining reasons why participants joined the programme.

Stress relief. Participants were more interested in explaining how gardening affected them personally. Many explained that they enjoy gardening, that it is their hobby, and were interested in elaborating on the values of gardening on stress relief. According to participants, gardening was a leisure occupation that kept them busy, made them lose track of time, and distracted them from their daily concerns:

> Gardening gives me something to do at home.
>
> To have fun, I am sitting all day with nothing to do.
>
> Gardening makes me leave the house.

Participants also saw gardening as an occupation that helped them focus on something else than their situation:

> Now, I have something to take my mind away from worries.
>
> Gardening helps me get distracted and to forget.
>
> Gardening helps me waste time and stop thinking.

Others relayed how gardening changes their state of mind and inspires a more positive mood:

> It [gardening] helps me change my mood.
>
> Gardening helps me stop worrying.
>
> Gardening gives me peace of mind.
>
> It [gardening] is something that calls for optimism.
>
> I love nature. I love gardening, and I love to eat what I grow.

Table 5. Responses of Syrian women refugees to group interview questions ($N = 44$ (100%); some participants provided more than one answer).

Question	Descriptive statistics
Why did you join the vertical gardening project?	Other (enjoy agriculture, fun, stress relief, innovation, aesthetic, peer pressure, socialisation): 34 (75%); Produce Food: 17 (38%).
How do you think having a vertical garden will help your family?	Produce Food: 16 (35%), No: 14 (31%); I don't know: 11 (24%); Other (stress relief, clean food): 4 (8%).
Do you think the vertical garden can help the well-being of your family? If yes, how?	No: 21 (47%); Other 13 (28%) (clean food, leave the house); I don't know: 9 (20%); Produce Food: 2 (4%).

I feel happy [when I garden].

Seeing the vegetables grow relaxes the soul.

Some participants explained that gardening increases their self-confidence:

We feel that we have achieved something.

I feel responsible [for the plants]

We felt joy, and that people are interested in us, I want to improve my situation so that I feel better about myself.

Maybe the [gardening] program will help increase my inner confidence.

Learning. Some participants had their interest stimulated by the "novelty" of vertical gardening and were critical or interested in learning more about it:

I am not convinced, and I am not sure I understand the concept.

I felt it is a nice idea.

At first, I did not understand [how plants grow vertically], but slowly I started learning.

This is the first time we hear about it [vertical green wall]

I like to learn.

It [vertical gardening] teaches the family new things.

Despite their harsh living context, some participants were interested in serving as citizen scientists to evaluate the productivity of vertical gardening, which stimulated discussions between participants:

Now, I understand the program, and I want it to succeed.

We should take care of it [green wall]

A new topic that we can discuss and observe the outcome.

It increased our interest in agriculture.

I am curious and excited and look forward to seeing how they will grow.

It is a strange idea, and I was excited to work to see what will come out.

We want to see if the yield will be good.

Aesthetics of the vertical garden. Participants also found the vertical gardens they created to be aesthetically pleasing in their deprived and underprivileged surroundings:

I like how the plants look like.

Pretty site, good food, and fun.

It is nice to have a vertical garden next to our house and within our reach.

Social factors. Participants also explained how women encouraged or supported each other to join the gardening programme:

My sister wants me to [join]

I joined because my mother likes to be part of the program.

[I joined] Because everyone in the camp joined the program.

Some participants explained how the programme turned out to be an opportunity to socialise:

I see the whole family when they come out to water the plants.

We meet with the neighbors and have fun.

We all work together to produce something pretty.

Engagement in gardening

It is worth noting that not all women were fully engaged in the project. One site was a success story; the different groups engaged the whole community. Women and children set-up boxes and planted them, men followed up on care and maintenance and all members of the group harvested plants at their leisure. In each of the other three sites, women groups worked separately, and levels of participation were mixed and equally distributed between those that did not engage, those that were partially engaged, and those that were fully engaged. Based on our informal observations, women who were fully engaged were team players who seemed to enjoy gardening and performed all horticultural tasks, including thinning, irrigating, fertilising and checking on the plants twice a day. In some cases, women worked together, shared tools, and involved the children and even the men.

Our study revealed that not all women were fully engaged in gardening. Some women were involved minimally in gardening or even delegated the work to their teammates just enough to partially maintain the plants. Women who did not engage were those who did not want to share gardening tools, those who joined assuming that other forms of aid would be handed out, and those who delegated the work to their teammates. Other reasons for low involvement in gardening were, in some cases, external such as women relocating to another camp or they were not allowed to leave their tent at their leisure. It appears that women that were previously engaged in farming or gardening took on the gardening programme more readily than those who had no prior experience in gardening or farming. Some were not interested or had no knowledge of how to use the plants in recipes. Yield estimated as per cent cover shed light on the extent of engagement and revealed technical difficulties participants faced such as the lack of water availability, attacks by pests and diseases, and in some cases, domestic animals (chicken) feeding on low growing greens. More specifically, based on our informal observations, low yields were the result of poor maintenance in sites 1 and 3 due to lack of interest, shortage of water or pressure from spouses to stop participating in the programme. In sites 2 and 3, the participants worked as a community, they shared resources and responsibilities and their involvement was supported by their children and spouses.

Discussion

Our exploratory study revealed that when open spaces are limited, unavailable or not suitable for cultivation in refugee camps, vertical gardening, like conventional gardening, helped to decrease depression and promote well-being. The vertical gardens also successfully engaged participants in what they saw as a positive occupation and served as an aesthetically pleasing focal point where they could come together and socialise.

We found that depression scores were significantly lower at the end of the gardening programme we provided. This is in line with studies conducted in a variety of settings and countries that confirmed gardening as a beneficial activity for people experiencing mental health difficulties, including depression (Clatworthy, Hinds, and Camic 2013; Soga, Gaston, and Yamaura 2017). Our findings are also in line with earlier intervention research related to depression and pleasant activities (Cuijpers, Van Straten, and Warmerdam 2007; Gonzalez et al. 2010; Lewinsohn and Graf 1973; Ludman et al. 2003) and with theories that propose that distracting activities are beneficial in depression (Nolen-Hoeksema, Wisco, and Lyubomirsky 2008; Watkins, Teasdale, and Williams 2000).

Concerning social and community cohesion, our findings show that participants viewed the vertical gardens as a place where they could come together and escape daily pressures, a source of advice and social support, and a place, which gave them a sense of worth and involvement. Similarly, Kingsley, Townsend, and Henderson-Wilson (2009) reported that members of an urban community garden considered the garden as a sanctuary. Our findings are also in line with a study on African refugee groups, where Harris, Minniss, and Somerset (2014) showed that community gardens are socially relevant interventions that offer tangible means for refugees to build community and community connections. Moreover, concerning lessons learned from the field, we noted that the gardening workshops became play sessions for children, and the initial phases of the gardening programme became mothers and children activities. This informality was also the ideal setting to further socialise and build trust with the research staff. Women who had smartphones started taking pictures and sharing them on their Facebook accounts.

Well-being can be attained through happiness and self-realisation (Ryan and Deci 2001). Despite their precarious situation and the short duration of our programme, displaced Syrian women considered gardening as an enjoyable occupation that brings meaning and purpose. Many found that the gardening programme gave them something fun to do, distracted them from their daily lives and struggles and provided them with a reason to leave their houses. Participating in positive occupations such as gardening mitigates the negative consequences of being a refugee (Whiteford 2004) and has a positive impact on the health and well-being of refugees (Bishop and Purcell 2013). This was evident through the findings on stress relief and some of the statements made by participants under the theme that related to joy and self-realisation.

Participants also referred to feelings of learning and self-development through gardening that may have contributed to their well-being as suggested by studies that found an association between improved well-being and the feeling of competence (Carver and Scheier 1999; Mcgregor and Little 1998). In the current study, participants stated that their involvement in the gardening programme helped improve their self-confidence through a sense of achievement. It also served as a learning experience through which the participants' need for exploration and curiosity was piqued. Indeed, several studies have shown that curiosity allows people to seek out novel experiences and is tied to increased well-being (Gallagher and Lopez 2007; Kashdan, Rose, and Fincham 2004; Kashdan and Steger 2007; Lydon-Staley, Zurn, and Bassett 2020). Most of our participants stated that their involvement in the gardening programme was something novel and new to them that excited them and stimulated their interest. These findings may partially explain the improved scores on the depression scale in the current study.

Many participants appreciated the aesthetic outcome of the gardening programme. Gardening is, among other things, the creation of a certain kind of beauty and necessitates spending significant time in this beauty. In the Al Za'atari camp for displaced Syrians in Jordan, many compensated for the lack of green recreation spaces by gardening their own small lots for private use in connection with their living space to make their surroundings livelier and to resemble their old homes in Syria (Leknes-Kilmork and Gillebo 2018). Similarly, in Iraq, displaced Syrians produced food and ornamental flowers to "beautify the house" or to create "beautiful scenery for the camp" – a tool also to establish a sense of ownership of their immediate space (46, Perkins, Adam-Bradford, and Tomkins 2017). In their study of the Community Conservation Project, an initiative that facilitates the creation of community gardens throughout Western Pennsylvania, Ohmer et al. (2009) found that for participants, the opportunity to beautify their neighbourhood was an influential motivator in their decision to participate in gardening. This motivator was most acute in those urban neighbourhoods that showed visible signs of distress, such as "crumbling buildings and urban flight" (Ohmer et al. 2009). While the living conditions of displaced Syrian communities in Lebanon differ from urban decay in the United States, there is parity to be found in the satisfaction gained from making one's surroundings more beautiful. That parity is reinforced by Certomà (2015), who directed the repurposing of unused urban land in New York for gardening as a radical means for marginalised communities to bring beauty and tranquillity into their neighbourhoods.

Our findings revealed that there is a need to take into consideration the background of the displaced; women that were familiar with farming and clustered as a cohesive community took on gardening readily and enjoyed it. Moreover, even among the women who were not familiar with gardening or did not have close ties with their community, many enjoyed the learning experience of vertical gardening and found it an exciting innovation.

It is important to point out that the positive effect of gardening may be due to the perception of time. In refugee populations, specifically for women, boredom and frustration stemming from a lack of employment opportunities are a daily reality, so effects related to the perception of time should not be understated (Egeland 2015).

Limitations

The current exploratory study does not give the same support for causal inference as provided by a randomised controlled trial (RCT) because there was no control group for the intervention. As indicated by other studies without a control group (e.g. Gonzalez et al. 2010), we cannot be sure that the measured changes are due to the gardening intervention alone. They may be due to the passage of time *per se*, seasonality in the period the study was conducted, attention from those delivering the intervention or change in circumstances unrelated to the intervention.

Future studies should assess improvements along the dimensions reported by participants in the current research. To optimise the development and delivery of the horticulture programme, studies should take into consideration the background of potential participants in terms of prior gardening experience. Future studies should also plan a gardening programme intervention that is one year long, allowing for at least two planting and harvesting events. This will shed light on the long-term involvement of participants and will help evaluate the sustainability of the programme beyond the funding cycle in terms of the supplies that can be reused and material that needs to be purchased again.

Conclusion and future recommendations

The current exploratory study has provided support and evidence that gardening has a positive impact on mental health, particularly in the reduction of depression, in Syrian refugee women. It has also shown that vertical gardening served as a stress relief activity and an opportunity to help with socialisation with other members of their community. Given the current findings and those from previous gardening research, aid organisations should consider vertical gardens as a complementary health resource for displaced Syrian women. Vertical gardening is a form of direct interaction with the "less wild" nature, offering the benefits of observing nature and its cycles, promoting relaxation, and generating self-esteem and self-efficacy by working with one's own hands and learning through challenges and experimentation. Creating green space for displaced communities, regardless of size and method, should also be considered by aid organisations as contributing to one dimension of human rights specifically offering these communities equitable access to environmental resources. Such gardening programmes may be needed and welcomed by displaced participants yet not normally considered by aid organisations.

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