



Research article

Survey on the factors and social perspectives to participate in home composting schemes in Palestine: Anabta case study

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Abstract: In this study, a survey was conducted to determine the public opinion regarding the acceptance of using home composters as an alternative approach for household organic waste management. This approach is introduced as a method to replace the landfilling of organic municipal solid waste, which is the main solid waste management currently employed in Palestine, considering Anabta town as a case study. The results showed that people in the target area are welcoming of the home composting idea, and about 99% of participants are interested in owning home composters at their properties, which is regarded as a good reference for implementing the proposed home composting scheme in this area. The results showed that people are interested in the new proposed scheme for organic household waste despite their minimal knowledge and understanding about the composting process's importance and effects. The survey tested the people's expectations and thoughts about the home composting concept and found that the main motives for home composting were reducing the cost of house gardening and using the produced compost in soil nutrition, besides being part of environmental sustainability. On the other side, obstacles were due to people's inexperience of the home composting method, as almost half of participants were expecting an exhausting, long process to produce compost, with the related bad smell and insects during composting progression. Hence, the study found that it is important to spread awareness about the right procedures to apply home composting among participants, in line with environmental awareness campaigns through social media, and provide personalized follow-up with participants.

Keywords: waste management; household organic waste; home composting; organic farming

1. Introduction

Solid wastes management represents a great challenge for developing countries. The problem is exacerbated due to the increasing population and the changes in lifestyles, which are normally associated with increases in the amounts of generated wastes [1,2]. Despite it being listed as the least preferable approach for waste management, landfilling is still the most commonly used practice for final disposal of municipal waste, including the organic fraction, in these developing countries [3,4]. Consequently, great efforts are needed to develop some sustainable methods to deal with this issue, including waste reduction, reuse, recycling and treatment. Among the different technologies which can be applied to deal with solid wastes and mainly the organic fraction of municipal solid wastes is the composting process [5]. This technology is gaining more popularity worldwide, as it is economical and environmentally friendly in the context of integrated municipal solid waste management. Actually, composting of organic wastes could be performed using various approaches, including centralized or decentralized systems [3,5]. However, establishing and operating centralized composting systems or units is considered expensive, especially in the case of developing countries [6]. Therefore, and due to the fact that these countries have many small and rural communities with independent yards among the houses, and they produce considerable amounts of organic waste (more than 50% of the generated municipal wastes), home composting as a recycling option appears to be an environmental solution at the household level to deal with these wastes while producing a valuable final end product, compost, that could be used for agricultural activities [6–9]. Additionally, this option would serve to reduce the collection and transporting costs for local communities. In this regard Mart ínez-Blanco et al. [6] concluded that home composting is an interesting alternative to central composting, especially in areas with low-density population.

In Palestine, the organic fraction represents more than 50% of the generated municipal solid waste [10]. Most of these wastes are sent to landfills, and humble efforts or initiatives are in practice for sustainable management of this fraction. Actually, there is a lack of information about home composting of organic waste, mainly food waste, and people also still do not have enough knowledge to carry out a successful composting process. Consequently, the current research work, which is part of the Decentralized Composting Systems in Small Towns (DECOST) project, aims at introducing home composting as an alternative approach to waste landfilling. In this regard, a survey using questionnaires as a research instrument was implemented in Anabta (target area in DECOST project) to determine the public opinion regarding their willingness to use home composters, knowledge about composting, motivations for using home composting and expected composting difficulties and obstacles.

2. Materials and methods

2.1. Study area

Anabta, which is a Palestinian town (Figure 1), part of Tulkarm Governorate, in the northern West Bank of Palestine, was selected as the study area, since this town is targeted to implement a home composting scheme through the DECOST project funded by the “Mediterranean Sea Basin Programme”, the largest Cross-Border Cooperation (CBC) initiative implemented by the EU under the European Neighbourhood Instrument (ENI CBCMED). Anabta has a population of 8000 inhabitants, including 1000 inhabitants in Kufr Rumman, according to the Palestinian Central Bureau of Statistics (PCBS) of the year 2017. The town is divided into two parts, the old town since the Ottoman era, located in the center, with 2000 inhabitants, and the new town, built 50–70 years ago, and inhabited by 6000 citizens.



Figure 1. Map shows the location of the study area (Anabta).

2.2. Data collection and analysis

To obtain the public opinion regarding using home composters in the study area, about 100 questionnaires were randomly distributed to anticipated participants (one representative perhousehold) who have the interest and capabilities to implement home composting in their backyards. The sample size was decided based on choosing 20% of the expected number of participants in a new home composting scheme. For data collection, a quantitative analysis methodology was applied, using a multiple-choice questionnaire type survey. During distribution of the questionnaire, all age groups and gender differences were taken into account from the people living in Anabta. The questionnaire forms were sent to people at their houses in hard copies or through awareness workshops. The project staff from Palestine Technical University-Kadoorie (PTUK), Anabta municipality staff and volunteers undertook the task of distributing the questionnaires to participants, in face-to-face interviews. The

questionnaire was divided into three parts; the first part included questions about characterizing the participants in terms of age, gender, level of education, family type, number of family members and house type. The second part was about the participant's backyard, interest in house gardening and previous knowledge about fertilizer types and benefits; then, detailed questions were asked about home composting. The third part tested the people's expectations about home composting, in regards to motivations and reasons for success, and the expected difficulties and obstacles when executing the project. To ensure the validity of the results and to avoid any potential bias, direct questions were used, and participants had to select from a range of potential choices; also, all questions were worded differently and were engaged thorough the questionnaire.

The obtained data was subjected to the Statistical Package for the Social Sciences program (SPSS), and descriptive analyses were also used to report the frequencies and percentages of different pointed subjects in the study. Validity of data was determined through Cronbach's alpha. The demographic characteristics (Table 1) and the reflections on community were revealed, and frequency analysis related to participants' ages, levels of education and family types was performed.

3. Results and discussion

As stated in the previous section, the questionnaire was designed and oriented to have a general and clear picture regarding the people's knowledge about the composting process and their willingness to participate in home composting when they receive the reactor (home composter). As the questionnaires were filled through personal meetings, a 100% response rate was obtained, and 100% of the participated people returned a valid response form. In this regard, and after data entry to SSPS, it was found that there was no item of non-response by using a frequency table, and all data entry was valid, meaning that all data entry was not out of the specified range.

3.1. Participants' demographic characterization

The results in Table 1 show that the highest percentage of participants was 36–55 year olds, while there was no contribution of people less than 18 years old. Results also showed that more than half of people questioned had a BSc degree or higher education, which is assumed to facilitate the understanding and acceptance of the composting concept by people, as education would encourage people to have more concern regarding sustainability issues, including recycling household wastes. In regards to family type, the majority of families were of 5–7 members, including youth, old people and children, which is considered as a normal family size in Palestine, so it is expected to have a continuous solid waste outcome on a daily basis. Moreover, it was noticed from the questionnaire results that 100% of people questioned have their own household gardens, with variable sizes, ranging from 100 m² to 2000 m²; accordingly, it is essential for them to have a continuous source of nutrients/fertilizers for their gardens.

3.2. Composting awareness and knowledge

People's knowledge about composting and its final end product are regarded as vital information; thereby, the first question of the survey was about the people's knowledge and experience in fertilizers used in house gardens. The majority of people (73%), regardless of their age or gender, described their

knowledge as weak or very weak and have a minimum knowledge about fertilizers. This is because most of the people in small cities in general work in the services sector (including internal trade activities), which is considered the most accommodating sector in the local market according to the PCBS results, which shows that the agricultural sector occupies only 6% of the labor force, while jobs in industry are 37%, and the highest percentage was in the service sector, at about 60% [11].

Table 1. Demographic characteristics according to gender, age, education and family type.

Demographic characteristics	%	
Gender	Male	42.9
	Female	57.1
Age	Less than 18	0
	19–35	28
	36–55	45
	More than 55	28
Education	High school or less	43
	BSc	51
	MSc	3
	Higher education	4%
Family type	Adults without kids	16
	Family including youth	39
	Family including old people	9
	Family including adults	36

The second question was about people's previous knowledge about compost types and manufacturing methods, and results showed that more than 80% of people had no information about composting. The analysis indicated that 83% of higher education people had minimal information about fertilizers and compost, as per Figure 2. Therefore, during the awareness campaigns, it is important to inform people about different fertilizer types available in the market and the related benefits and precautions of each type and to clarify the techniques and benefits of home composting and the relations between fertilizer technologies and the outputs of organic planting and healthy lifestyle. In a related study in Palestine [12], the results revealed that the understanding of differences between compost and chemical fertilizers, perception of compost's benefits and previously experiencing problems in compost use were significant factors affecting the farmers' attitudes toward the use of compost as an organic fertilizer. Furthermore, the obtained results in Anabta are in accordance with the results of Fadhullah et al. [13], as locality and education have shown negative relationships with people segregation activity. So, there should be increased educational activity on proper household waste practices and management related issues to minimize both the environmental and health impacts of household waste practices.

In the second part of people's expectations and knowledge about composting, people were asked if composting requires a long time to be produced. About 51% of people replied that they expect that compost may require a long time to be produced; therefore, most importantly, the training should emphasize the practicality and feasibility of composting, which is otherwise seen as a time-consuming and burdensome process [14]. Moreover, more than 80% of people agreed that the organic waste separation is easy and practical, while it requires cooperation and involvement from all family

members. Consequently, it is recommended to focus on mass media to increase social pressure to enhance consumer motivation for environmentally friendly behavior. Indeed, this was observed in similar previous studies, which showed that the more knowledge a person has about the stages of home composting, the higher his/her tendency to do home composting is [15,16]

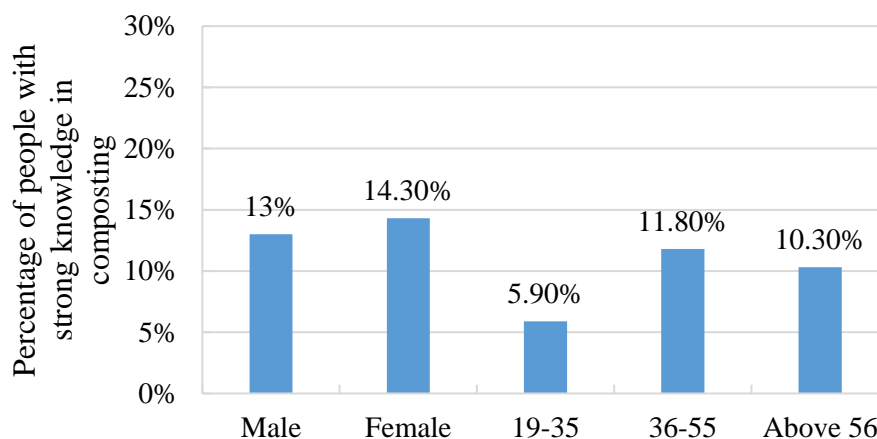


Figure 2. Percentages of people with previous knowledge about composting in regards to gender and age.

The survey results also showed that 80% of respondents think that the presence of a compost unit at their houses is essential for the success of compost production, as well as for the knowhow of techniques for compost production. The same results have been shown by Fadhullah et al. [13], which suggests that composting should be incorporated as one of the main approaches for appropriate waste management practices in the community by providing individual compost bins to households, coupled with training on simple compost technique. Also, they were asked if they think that a composting unit has an unaesthetic view and will collect insects and flies; 47% of people disagreed, while only 16% of people agreed that it will have an unaesthetic view. Accordingly, it is concluded that people are welcoming of the idea of home composting in their houses' backyards, although they have fears of insects and flies around the compost unit. Consequently, it is required to spread awareness and knowledge about the importance and results anticipated of composting for all family members and showcase previous success stories, so fears will be diminished.

3.3. Participants' environmental awareness measurements

People were questioned about their involvement in environmental practices; the most common practice is the reduction of using plastic bags, with the highest involvement of 16% in the ages of 19–35 years old. Other environmental activities are reusing old products, as results demonstrated that 73% of people usually practiced reusing different products, such as glass and plastic materials, but reusing organic food wastes was only through feeding pets if available at their households, as 81% of the participants have never been involved in home composting before. However, although people don't have enough knowledge about composting, 92% of people think that compost is beneficial to the soil and is better than chemical fertilizers.

According to the obtained results, the questionnaire proved that 78% of people questioned practice organic farming in their backyards. In detail, the results showed that 20% of participants of

19–35 years partially practice organic planting, while the participants of 36–55 years old always practice organic planting, as shown in Figure 3. The result of this study is consistent with the findings by Fadhullah et al. [13] that older individuals prefer to participate more in waste separation activities than young people in Malaysia and that those of 50–65 years old are those who segregated more than the rest. Moreover, it is noticed that both women and men have near percentages of interest in organic farming, with higher percentage from women, with 23% of interest in production of organic planting. This is due to the traditional gender roles in Palestinian society associated with females' household activities, so they have a closer engagement with waste management at the household level [17].

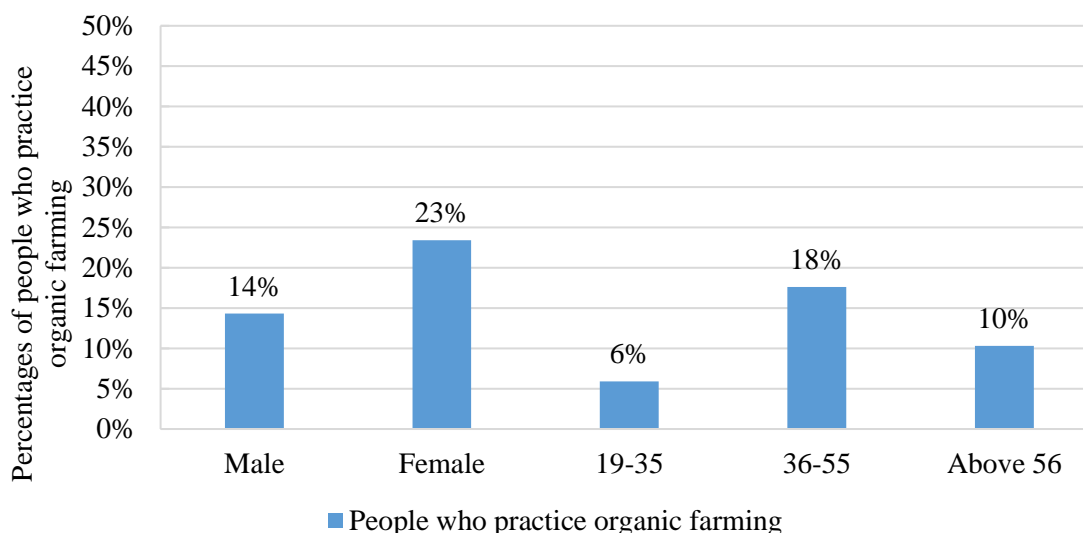


Figure 3. Percentages of people who practice organic farming.

It was interesting to know that almost over 50% of people questioned expected a percentage of organic household waste that was close to the official values, of more than 50% of household solid wastes. The results assure that food waste was the major type of waste being disposed of from the households, due to countryside people's lifestyles [13]. Hence, it is essential to highlight to the residents that when high-moisture food wastes are disposed in municipality waste containers and not collected on a daily basis, they cause smell. This subsequently attracts disease vectors, such as flies, mosquitoes and cockroaches and the proliferation of rodents, such as rats and mice, which pose threats to public health, so disposing organic wastes into home composting units will solve an environmental problem in an effective and feasible way [13,18].

As part of people's environmental awareness and involvement, people were asked about their willingness to use a smart phone application for managing their waste segregation and composting practices. The results showed that only 35% of females and 20% of male participants are willing to cooperate through the smart phone application. This is maybe because people would have concerns about how practical and efficient is the application and whether it will be easy to use or not. Additionally, it is important to point out that 92% of people are neutral in regards to willingness to transfer their experience gained from composting to other people when required. Reasons could include that they do not understand the importance of composting and its benefits to the environment. This gap between awareness and behavior change has to be bridged, as it is necessary for individuals

to understand the importance of their roles in the community and how to reflect them positively through transferring their knowledge to others. Apparently, more focused, detailed and continuous awareness and training programs should be emphasized on this aspect, specifically in the topics of environmental cleanliness, drainage systems, the recycling process in theory and practice and a proper way to dispose of wastes [19].

3.4. *Composting motivations and participants' requirements*

In the last part, people were questioned about motivations and how to make composting a continuous habit; on the other side, they were asked about difficulties expected and obstacles (Figure 4). It is worth it to mention that all of the questioned people answered that the most important motive to them is soil nutrition from the compost produced, besides being part of environmental sustainability, through waste reduction, reuse and recycling. In relation to the people's expectations, the composting approach is attaining attention due to its lower energy footprint, ease of operation, need for lesser resources and lower operation and maintenance costs, which give higher chances of public acceptance [20]. Likewise, Fadhullah et al. [13] revealed that people also think that composting is beneficial to the environment by reducing greenhouse gas emissions and improvement of soil quality when applied to land. The other two factors were also important to participants, as 84% of participants thought that reducing the cost of house gardening has a significant effect, which in turn can be used to fertilize their garden soil. Thereby, the training should emphasize on the practicality and feasibility of composting; other than that, composting will be perceived as a time-consuming and troublesome process [21]. Alternatively, the outcome of composting activities should be similarly emphasized and how waste minimization and composting at the source will benefit and improve the living standards and qualities of participating families [22].

In fact, there is a need for intensive, customized and sustained public awareness programs, coupled with supporting infrastructure, to change residents' perceptions toward improved waste separation to alleviate environmental problems in developing countries [23]. This was clearly demanded by 81% of people questioned, who requested adequate training and follow-up from the technical staff.

Composting has many advantages, as illustrated in the literature, and composting of municipal waste, especially food waste, has net advantages compared to landfilling or incineration, such as the production of harmless, stable and rich in nutrients soil and reduction of waste volume and weight [5,21,24–26]. Hence, people's opinions about such issues are considered of great importance. Actually, results of the questions of what would make composting a normal permanent behavior revealed that 88% of people believed that the main motivations are being part in solving the solid waste problem in the municipality; then, 83% of them thought that they need nutrients for their garden soil continuously. The least significant motive to them was having financial revenue from home composting, with a percentage of 39%. Figure 4 emphasizes the difference between peoples' initial motivators and their actual requirements. As is obvious, it is vital to participants to reduce the cost of house gardening, as their backyards are mainly decorative garden plants, which usually consume income, without actual financial revenue. For other aspects, results found close responses in regards to environmental awareness, soil nutrition and care and training.

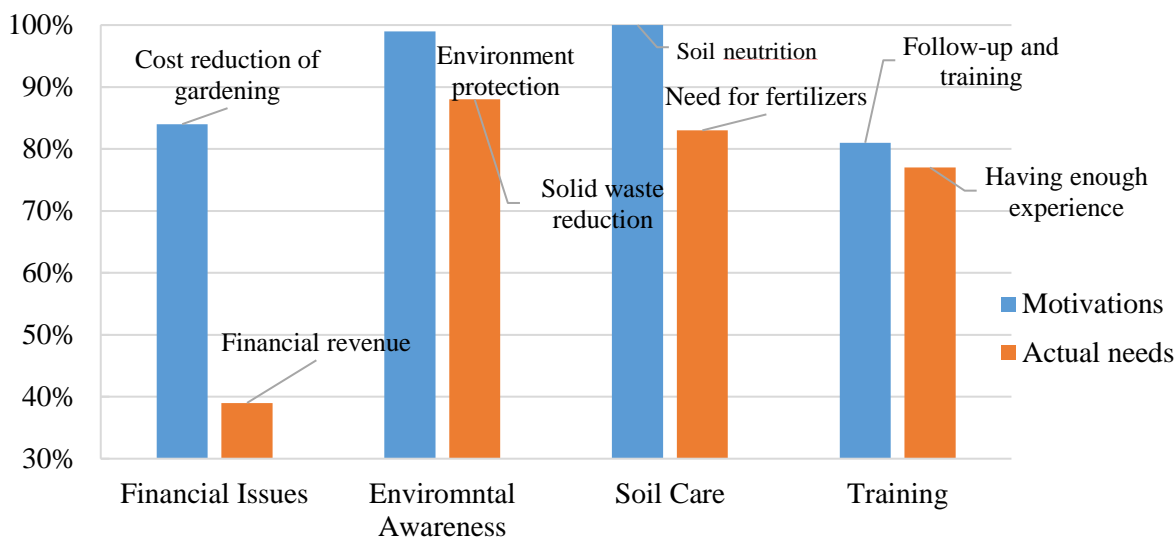


Figure 4. Comparison between motivations for home composting and actual needs in home composting.

3.5. Composting difficulties and obstacles

When people were asked about the expected difficulties that would hinder them from initiating home composting, about 45% of people answered that the composting process may require a long time to get results, and 39% of people thought that there will be a bad smell in the home composting area, while 36% of people thought that it will require a lot of effort and follow-up (Figure 5). While a majority of people answered that they have enough area for implementing home composting, with a percentage of 75%, less people (17%) thought that operating the unit is complicated and requires special techniques (Figure 5). On the other side, when participants were questioned about future obstacles that may arise during the composting process, the first question was if they expect that their family partners will cooperate in separating solid wastes, and 42% of people expected that family members would cooperate and will be part of separating wastes. The second question was about consuming organic household wastes for feeding pets, and 40% of people said that they feed their pets from their household organic solid wastes but can manage to process the home composting in parallel. The results didn't vary when compared according to the differences in age, education or gender, as percentages were close in all parameters.

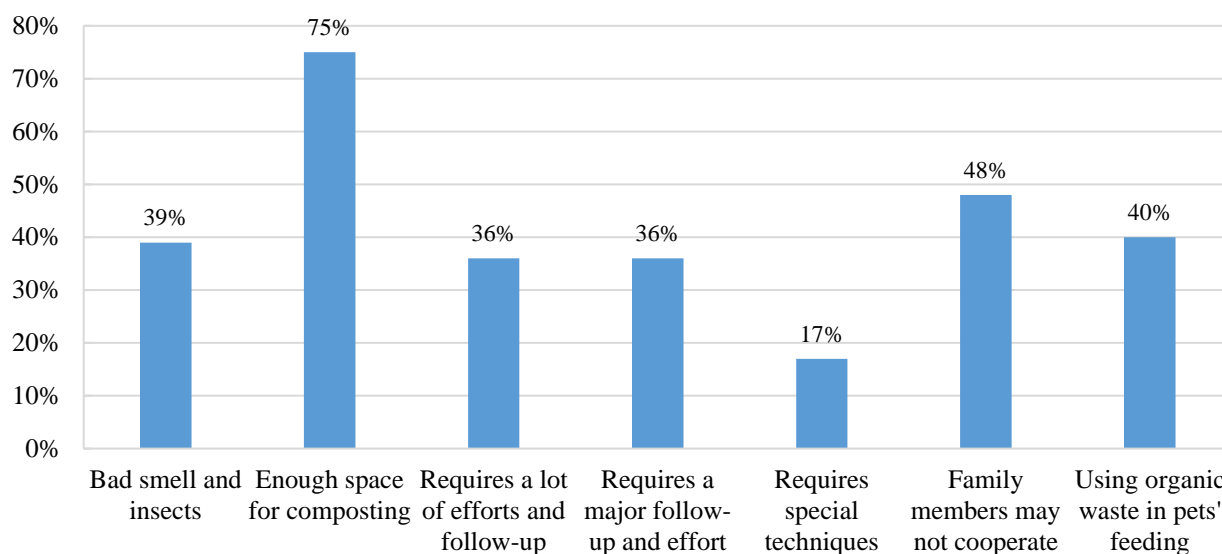


Figure 5. Obstacles that may arise during operation of home composter according to participants.

4. Conclusions

The survey showed that the public are welcoming of the home composting idea, although they have minimal knowledge and understanding of composting importance and effects; therefore, people are mostly concerned about composting being a time-consuming process and require follow-up and assistance for a long time. In addition, they are concerned about bad smell and insects that may arise in the home composting area. So, it is important to spread awareness on a large scale in the town, targeting all society segments; campaigns should cover environmental awareness, organic planting and production and fertilizer types and benefits. Therefore, institutional-administrative, technological, economic and social drivers are key drivers to the success of home composting. A strong policy provided by Anabta municipality that implements direct regulation and enforcement, provides economic motivations and assures interaction and engagement with the community is required.

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Conflict of interest

The authors declare no conflict of interest.

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