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RESEARCH ARTICLE

Home garden management practices and plant species diversity in Shager City, Oromia Regional State, Ethiopia: Implications for biodiversity conservation

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Abstract

Home gardens are long-established traditional farming systems that fulfill diverse community needs while supporting social well-being and ecological sustainability. This study aimed to assess the level of engagement, management practices and plant species diversity in home gardens of Shager City. About 180 households were sampled systematically from six sub-cities. Survey data were collected through garden tours and interviews with households and analysed using descriptive and inferential statistics. Plant species diversity was analysed using Shannon-Weiner and Simpson diversity indices. The scientific names of plant species were confirmed at the National Herbarium of Addis Ababa University. About 85 % of households surveyed in Shager City practise home gardening, showing the community's strong attachment to the practice. Majorly, home gardens are positioned in the front yard due to housing design. Ground-based planting space being practised in the city is incompatible with running land scarcity. The management of home gardens is primarily carried out by female household members. The survey recorded approximately 215 species, predominantly in the ornamental use category and with a herbaceous growth form. The home gardens exhibited high species diversity, implicating their potential in maintaining urban sustainability. *Ensete ventricosum* was the most frequent species due to its potential for multiple uses and adaptability to varying environments. Plant species richness in the studied home gardens is associated ($p < 0.005$) with most socioeconomic characteristics of households. The limited economic and nutritional benefits of home gardens require targeted policy and community interventions.

Keywords: diversity; home garden; management; Shager City

Introduction

Home gardens are a long-standing and extensive traditional farming system that integrates a variety of plant species, sometimes alongside domestic animals, around residential houses (1). The practice of home gardening is an integral part of family life and it is the family members who manage it and the produce is intended mainly for household use (2).

Home gardens are small areas that sustain agricultural biodiversity while directly supporting household well-being (1, 3). They generate income, provide nutritional security and essential resources like medicinal plants, construction materials and fodder (4, 5). In addition, home gardens serve as reservoirs of indigenous knowledge and skills related to plant cultivation and utilisation (6).

Home gardens serve as living reservoirs of diverse plant species that perform essential ecological functions (7). Their diversity enhances resource use efficiency through improved light capture, spatial design, soil stability, water retention and nutrient availability. Furthermore, the plants absorb CO_2, release oxygen and mitigate urban heat islands, which reduces local climate variability and contributes to ecological balance (1, 8, 9).

Rapid urbanisation and the consequential climate change, as well as the shrinking of farmland, pose significant challenges to food security, especially in cities of developing countries (10), representing among the most critical challenges of the 21st century. By 2050, urban populations are projected to reach 64 % in developing countries and 86 % in developed countries (11). The urban population in Ethiopia is growing at a rate of 3.98 % annually and is expected to increase from 25 % in 2024 to 38-48 % by 2037 (12). Similarly, Shager City is one of the Ethiopian cities experiencing rapid residential growth due to ongoing urbanisation (13).

This phenomenon leads to numerous environmental consequences. These include land tenure insecurity, deteriorating water quality, severe air pollution, altered precipitation patterns, increased energy demand, biodiversity depletion, noise pollution and waste management. Rapid urban expansion also caused the loss of local ecological knowledge systems and time-tested practices for sustainable resource management. This shift has increased reliance on external food supplies and disrupted local ecosystems, making urban sustainability more vulnerable (14).

Home gardens represent a holistic approach to addressing economic, social and ecological challenges, particularly in degraded and densely populated urban areas (3). However, their small size, non-commercial orientation and informal management contribute to their neglect (15). Consequently, their biodiversity is increasingly threatened by mono-cropping, the shift toward market-oriented plant species, climate change (16) and land-use conversion, particularly in urban landscapes. This deterioration leads to the loss of traditional knowledge and practices related to home gardening, including cultivating diverse plant species, seed saving and sustainable soil management (17).

In Ethiopia, home gardening is an ancient practice believed to have originated during the early agricultural period *(9, 18).* However, it remains poorly documented in a scientific and systematic manner among conservationists, planners and policymakers (18, 19). As a result, its full potential continues to be underutilized (20). Habitat alterations and the loss of traditional management knowledge pose critical threats to home gardening practices across the country, ultimately leading to genetic erosion (5). Moreover, in recent years, there has been a decline in both yields and household income from home gardens (21).

There is a lack of prior research on home gardening in Shager City, underscoring the critical need for the present study. This study seeks to answer the following question: What is the level of household engagement in home gardening, what are trends of common management attributes in home gardening, what is the floristic composition and diversity of home gardens and are there socioeconomic characteristics of home gardeners associated with plant species richness?

Thus, the objectives of this study are to determine the level of household engagement in home gardening in Shager City; to assess home garden management practices, including participation patterns, time spent on gardening, garden location, planting space and size and sources of planting materials; to document and analyze the floristic composition and species diversity of home gardens; and to examine the association between the socioeconomic characteristics of home gardeners and plant species richness.

Thus, this study will generate baseline information for interventions that enhance sustainable household livelihoods while maintaining both socioeconomic well-being and ecological sustainability in the areas.

Materials and Methods

Description of the study area

Shager City is situated in central Ethiopia within the Oromia Regional State, bordering the country's capital, Addis Ababa (Finfinnee). The City's altitude ranges from 1973 to 3385 m above sea level. The annual average temperature ranges from 10 °C to 20 °C, while the average rainfall varies between 900 mm and 1700 mm. The City comprises twelve sub-cities: Burayu, Eka Tafo, Furi, Gefersa Gujie, Galan, Galan Guda, Koye, Kara Gida, Mana Abichu, Melka Nono, Sebeta and Sululta (Fig. 1) (22).

Sampling techniques

Out of the twelve sub-cities, six (Sululta, Mana Abichu, Gefersa Gujie, Koye, Furi and Galan Guda) were purposively selected. The selection emphasized minimal boundary overlap among the chosen sub-cities. It included a mix of areas adjoining both Addis Ababa and neighbouring rural districts, ensuring representation of the environmental, cultural and socioeconomic diversity of the population.

From each of the six sub-cities, one representative district was selected. Within each district, two *Kebeles* (lower-level administrative units), representing both central and peri-urban areas, were chosen purposively. In total, 180 households were included in the study, based on the following procedure: six districts (one from each sub-city) × two Kebeles per district × fifteen households per Kebele. The sample size was determined using the approach described by Semu (23).

Methods of data collection

Approximately 180 household visits were conducted at 100-m intervals using systematic sampling (1), during which structured interviews with household heads were conducted to assess home garden management practise and related data.

Plant specimens were collected using plot demarcation and a complete plant inventory. Trees were sampled within 10 m × 10 m plots, shrubs within 5 m × 5 m plots and herbs within 1 m × 1 m plots. Scientific identification of the plant specimens was conducted using Flora of Ethiopia and Eritrea (Volumes 1-8) (24). For further confirmation of scientific name identification, the collected plant specimens were pressed and taken to the National Herbarium of Addis Ababa University (25).

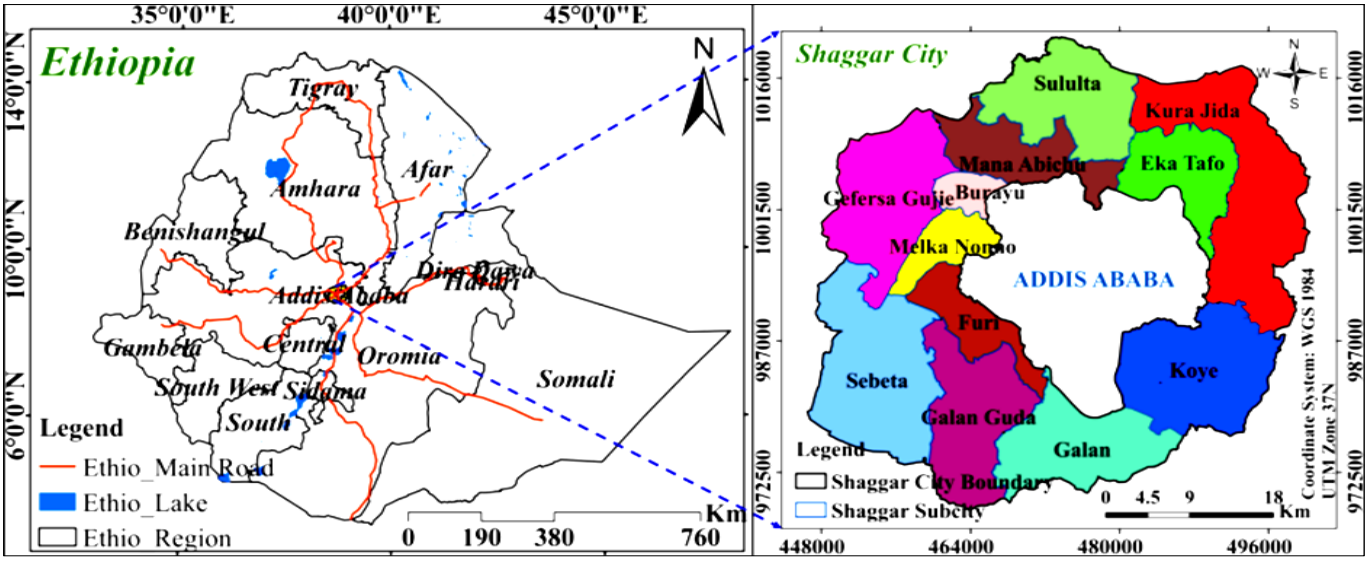

Fig. 1. Map of study area. Source: Oromia Regional State Administrative Office (2024) and modified using ArcGIS 10.7.

Methods of data analysis

Statistical data analysis

Data on home garden practices and management were analysed using descriptive statistics (percentages, means and standard deviations) and presented in tables and figures (26). Inferential statistics (chi-square test) were employed to examine the association between species richness and the socioeconomic characteristics of respondent households. All analyses were performed using SPSS version 25, with statistical significance determined at $p < 0.05$ and a 95 % confidence interval.

Species diversity indices, evenness and richness

Shannon–Wiener diversity (H′), Shannon evenness (E) and Simpson's diversity index (1 - D) were used to analyse plant species diversity.

Shannon–Wiener diversity index (H′)

The Shannon-Wiener diversity index was calculated as follows:

$$H' = -\sum_{i=1}^{s} Pi \ln Pi$$

Where H′ is Shannon-Wiener diversity index; *Pi* is the proportion of individuals found in the i^{th} species.

Shannon Species Evenness (E)

Shannon Species Evenness (E) was calculated using the formula:

$$E = \frac{H'}{H' \max} = \frac{H'}{\ln S}$$

Where, H′ max = S and S is the number of species.

Simpson's Index of Diversity (1 – D)

Simpson's Index of Diversity (1 - D) was computed using the formula:

$$1 - D = 1 - \sum \left(\frac{ni(ni-1)}{N(N-1)} \right)$$

$$1 - D = 1 - \sum$$

Where D is Simpson's diversity index; n_i = Number of individuals in species *i*; *N* = Total number of individuals in all species (27).

Results

Home garden ownership and community engagement in gardening in Shager City

The survey results indicate that, of the 180 households sampled from six sub-cities, approximately 153 (mean = 85 %) were engaged in home gardening. In contrast, around twenty-seven households (15 %) did not engage in gardening, most often citing a shortage of time, limited access to land and water as the main reasons. Focusing on the households involved in gardening, approximately 123 (80.4 %) were homeowners in Shager City and therefore had secure ownership of their home gardens, while the remaining 30 households (19.6 %) practiced gardening on rented properties or those belonging to relatives. Among these homeowners, 51.1 % had lived in their homes for more than 10 years, 16.7 % for 4-6 years and the remaining 32.2 % for three years or less.

Home garden planting space, location and size

Approximately 90.2 % of gardeners practised ground-based gardening. Approximately 3.9 % used containerized methods, including pots, sacks, plastic bottles, buckets and tires. The remaining 5.9 % used a combination of ground-based and containerized gardening. Relative to residential houses, most home gardens (76.47 %) were located in the front yard. The remaining 9.8 %, 7.84 % and 5.88 % were situated in mixed yards, backyards and side yards, respectively. Surveyed sub-cities had home garden sizes from 5 m^2 to 1000 m^2 (mean = 118.4 ± 135.62 m^2).

Household participation and time spent in home gardening

Survey results from Shager City indicate that 57.5 % of respondents identified mothers as the primary managers of home gardening activities. In comparison, fathers accounted for 33.3 % of reported participation (Fig. 2). In the study area, about three-fourths (75.1 %) of households spent less than 60 min per week on gardening. Meanwhile, 8.5 % spent 61-120 min, 4.6 % spent 121-180 min, 2.4% spent 181-240 min and 9.4 % devoted 241-300 min per week.

Where do Shager City home gardeners get their planting materials?

A survey conducted in Shager City revealed that 54.2 % of gardeners purchased seedlings from open local markets, 21.6 % from private nurseries and 15.7 % from public nursery sites. The remaining 8.5 % acquired seedlings free of charge, either from public nurseries or through relatives and neighbours. These results indicate that 91.5 % of gardeners obtained planting materials through purchase.

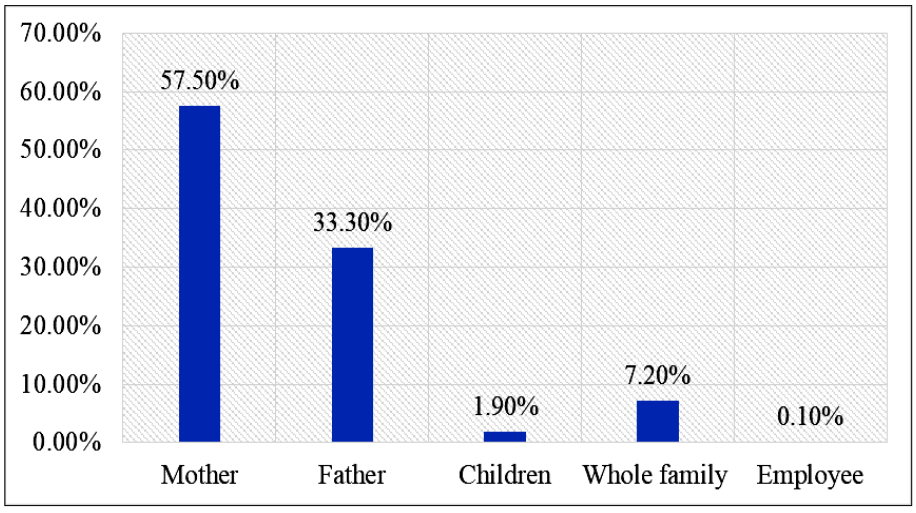

Fig. 2. Household participation in home gardening in Shager City.

Soil management practices

A survey conducted in Shager City revealed that the majority of gardeners (43.8 %) relied on home-produced organic waste, such as food leftovers, for soil enrichment. Additionally, 23.5 % utilised cow dung or droppings from goats and sheep, while 1.9 % used vermicomposting as a fertiliser. Conversely, 23.5 % of gardeners reported using neither natural nor artificial fertilisers (Fig. 3). Overall, 69.2 % of households used at least one form of natural fertiliser to maintain the soil fertility of their home gardens.

Plant species composition and diversity

From the 153 households surveyed engaged in home gardening in Shager City, a total of 215 plant species representing 169 genera and 75 families were recorded. These plant species were grouped based on their growth form: herbs made up the largest proportion (46.05 %), followed by trees (21.39 %), shrubs (20.93 %), succulents (8.84 %) and climbers (2.79 %) (Table 1).

Building upon these findings, the majority of plant species (82.33 %) were of introduced (exotic) origin. In comparison, 13.02 % were native and 4.65 % were endemic. Of the use categories, ornamental species accounted for 43.72 % of the total. Multi-use plants comprised 30.69 %, while food plants made up 14.42 % and medicinal plants accounted for 7.91 % (Fig. 4). The remaining 3.26 % included spices, shade-providing plants and culturally significant plants.

Regarding species diversity, the survey data (Table 2) revealed that species richness ranged from 77 in Mana Abichu to 108 in Furi, with an average of 90.5 species per study site. Species evenness (E) ranged between 0.74 and 0.88. The Shannon-Wiener diversity index (H') was highest in Furi (4.12) and lowest in Koye (3.23). Similarly, Simpson's index of diversity (1 - D) ranged from 0.92 to 0.97, with an average value of 0.95. The survey also showed that 61.1 % of home gardens contained more than 11 plant species.

Most frequent plant species

Among the plant species recorded in the survey, *Ensete ventricosum* was the most frequent, occurring in about 56.86 % of the surveyed home gardens. Other frequently recorded species included *Brassica carinata*, *Callistemon citrinus* and *Ruta chalepensis*, valued primarily as food, ornamental and multi-use plants, respectively (Table 3).

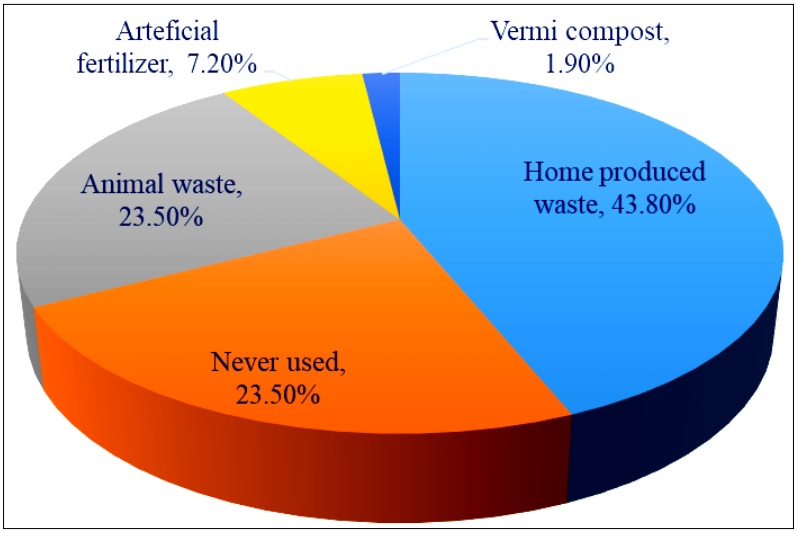

Fig. 3. Soil fertility management trends of gardeners in Shager City.

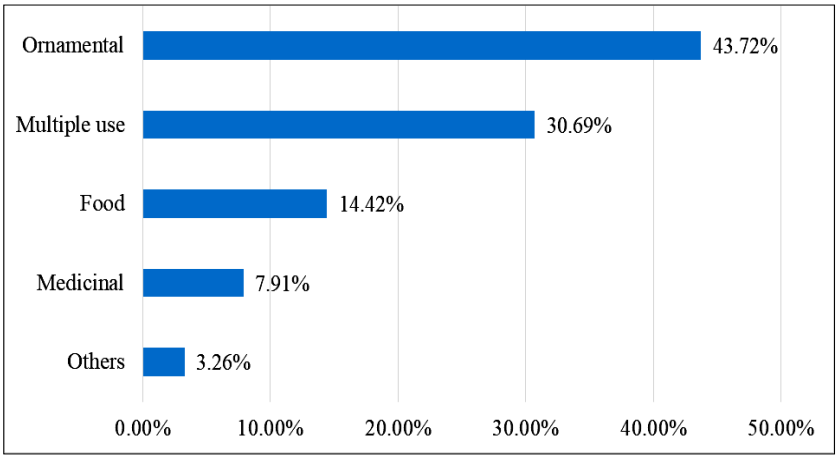

Fig. 4. Major use categories of plant species in home garden of Shager City.

Table 1. Comparison of plant growth forms in home gardens: Shager City vs. other home gardens in Ethiopia.

Study sites	Herbs (%)	Shrubs (%)	Trees (%)	Climbers (%)	Succulents(%)	References
Shager City	46.05	20.93	21.39	2.79	8.84	(Own survey, 2024)
Holeta Town	43.00	25.00	29.00	3.00	-	(25)
Hawassa City	44.57	27.13	24.81	6.21	-	(7)
Gozamin District	39.00	29.00	25.60	6.30	-	(16)
Arbamich Town	35.51	15.22	44.93	4.35		(1)

Table 2. Species richness, evenness and diversity indices across study sites in Shager City

Study sites	Species richness (R)	Species evenness (E)	Shannon–Wiener diversity index (H')	Simpson's index of diversity: 1 - D
Sululta	96.0	0.76	3.45	0.92
Mana Abichu	77.0	0.84	3.65	0.94
Gafarsa Gojie	91.0	0.77	3.45	0.95
Furi	108.0	0.88	4.12	0.97
Galan Guda	94.0	0.88	4.05	0.96
Koye	77.0	0.74	3.23	0.94
Mean	90.5	0.81	3.66	0.95

Table 3. Most frequently occurring plant species in the home gardens of Shager City

Scientific name	Identified uses	Frequency (%)
Ensete ventricosum (Welw.) Cheesman	Ornamental, Fodder, Food	56.86
Brassica carinata A. Braun	Food	47.71
Callistemon citrinus (Curtis) Seekls	Ornamental	44.44
Ruta chalepensis L.	Medicinal, Spices	42.48
Rosmarinus officinalis L.	Ornamental, Spices, Medicinal, Cosmetics	41.17
Vernonia amygdalina Del.	Cultural, Medicine, Fodder, Fuel	39.87
Duranta erecta	Ornamental	39.22
Cyperus artenifolius L.	Ornamental, Cultural	37.25
Brassica oleracea var.	Food	33.33
Casuarina equistifolia	Fuel, Ornamental	33.33
Ocimum basilicum L.	Medicinal, Spices, Fodder	33.33
Capsicum chinense	Food, Spices	31.37
Allium sativum L.	Medicinal, Food, Spice	29.41
Ocimum lamiifolum (Hochest ex Benth)	Medicinal	26.14
Zantedeschia aethiopica (L.)	Ornamental	23.53
Solanum lycopersicum L.	Food	21.57
Cymbopogon citratus L.	Cultural, Medicinal, Ornamental	20.26
Echeveria elegans	Ornamental	20.26
Grevillea robusta	Shade, Ornamental, fuel	19.61
Cupressus lusitanica	Ornamental, Construction, Fuel, Shade	18.95

Economic benefits of gardening in Shager City

In Shager City, about 74.50 % of respondents reported that home gardens provided an insignificant direct monetary or food value (less than 100 Ethiopian Birr per month) to their households. Additionally, 16.34 % stated that the gardens supplied ≤1 % of their annual income, while 9.16 % reported that supplementary food and income from gardening in Shager City accounted for less than 10 % of yearly revenue.

Association of species richness with gardeners' socioeconomic characteristics

The survey results revealed that species richness in the study area was significantly associated ($p < 0.005$) with key socioeconomic characteristics, including gender, age, marital status, family size, educational status and occupation. In contrast, no significant associations with household ownership or monthly income (Table 4).

Table 4. Association between socioeconomic characteristics of households and plant species richness.

Characteristics of households	*p*	Remark
Gender	0.002	$p < 0.05$, significant
Age	0.001	$p < 0.05$, significant
Marital status	0.000	$p < 0.05$, significant
Family size	0.010	$p < 0.05$, significant
Educational status	0.000	$p < 0.05$, significant
Occupation	0.000	$p < 0.05$, significant
Religion	0.000	$p < 0.05$, significant
Monthly income	0.106	$p > 0.05$, not significant
House/garden ownership	0.202	$p > 0.05$, not significant
Duration in the house	0.000	$p < 0.05$, significant
Area of home garden	0.002	$p < 0.05$, significant

Discussion

The survey results indicate that approximately 85.0 % of surveyed households in Shager City practice home gardening. When compared with other urban areas in Ethiopia, the level of engagement in Shager City was lower than the 100 % reported in Hawassa City (7), approximately 85.5 % in Holeta Town (26), but higher than the 71 % reported in Kombolcha Town (23). The observed moderate level of engagement in home gardening in Shager City is likely due to comparable socioeconomic and physiographic factors, as well as similar access to gardening inputs across these cities. The prevalent home gardening practice among urban residents demonstrates a strong, traditional practice that has been passed down for diverse uses of home-grown produce within the community.

Among the households engaged in gardening in the city, 80.4 % own their home gardens and more than half of these households have resided in the area for over 10 years. Relatively longer residence and cultivation on privately owned land confer several advantages. These include secure land tenure, management stability, efficient resource utilization and opportunities for intergenerational knowledge transfer. A longer residence also facilitates the cultivation of plant varieties well-adapted to local conditions and personal preferences. These circumstances, along with the species richness in the area, indicate a strong potential for further improvement in future gardening practices.

Home gardening in Shager City is primarily practised in available open spaces, while only 3.9 % of households use container-based methods. This finding is consistent with results from urban households in Kogi State, Nigeria, where 69.4 % of gardeners cultivate on bare land (levelled or terraced) to minimize the production costs of input containers (28). Ground-based gardening in the city is incompatible with rapid urbanisation and the intense

competition for land use. Addressing these challenges requires effective land management policies to protect gardening spaces, alongside the promotion of space-efficient techniques such as vertical farming and rooftop gardening.

The location of home gardens relative to residential houses varies due to factors such as space availability, light interception, ease of management, sociocultural factors and plant requirements. Consequently, gardens may be situated in front, back, side or mixed yards (29). In Shager City, 76.47 % of home gardens are located in the front yard. This is notably higher than the prevalence in Arba Minch Zuria and Chencha (14%) (29) and Sebeta-Awas Districts (8.3%) (30) in Ethiopia. In contrast, in Kogi State, Nigeria, the majority (53.5 %) of home gardens are found in the backyard (28).

The predominant location of home gardens in front yards throughout Shager City reflects both practical and aesthetic considerations. Front-yard placement allows gardeners to easily monitor and manage their plants, while also showcasing ornamental species to create welcoming entryways and provide daily visual enjoyment for household members. In another way, prevalent of front yard home garden location is likely due to typical housing designs in the city, which naturally provide more usable space at the front of houses compared to other areas.

The mean recorded home garden size in Shager City (118 m^2) is notably larger than Bahir Dar City, ranging from 10 to 60 m^2 (31), yet smaller than those documented in studies from other Ethiopian urban and rural settings (1, 16, 32, 33). This comparatively smaller size is likely attributable to rapid population growth and the escalating demand for housing and urban infrastructure, both of which encroach upon available gardening space. Such shrinkage of farmland, including home gardens, carries broader implications, potentially undermining household food security, income generation, ecological stability, biodiversity conservation and, ultimately, the pursuit of sustainable development.

Major home gardening practices, although varying according to the socio-economic characteristics of the community and the type of plant, generally include land clearing, digging, planting, mulching and hoeing. Other routine practices involve weeding, watering, fencing, pruning, harvesting, coppicing, lopping, composting and crop protection. Either family members mainly carry out these tasks *(5).* In Shager City, mothers are more involved (57.7 %) in home gardening (Fig. 2), a finding consistent with most previous studies (31, 34).

The high participation of mothers in home gardening is attributed to their traditional role in childcare (35), which involves ensuring quality food and maintaining family health through the use of medicinal plants. Women also perceive gardening as an opportunity to supplement household income, thereby enhancing their economic autonomy and social standing (36). Additionally, women possess valuable knowledge about the conditions suitable for cultivating various crops. Men, on the other hand, are primarily responsible for carrying out the labor-intensive activities of home gardening (37).

Studies revealed that engaging in home gardening provides physical activity and fosters social interaction. It enhances exposure to nature, promotes attention restoration and reduces stress and anxiety. Regular engagement in home gardening has been shown to improve mood, enhance self-confidence and cultivate a sense of pride and satisfaction (38). Notably, a large proportion (75.1%) of gardeners in the city spend less than 60 min per week on gardening, or approximately 8.6 min per day, which is much lower than that reported in Prato, Italy, where about 6.6 % of gardeners spend 10–20 hr per week on gardening (39).

The lower time investment in home gardening observed in Shager City could be attributed to smaller garden sizes, the prevalence of employees (43.3 %) among household members and the predominance of perennial plants (81.39 %), which require less frequent care. Expanding garden size through innovative approaches may encourage greater time spent in gardening, enhance harvest yields and amplify the associated physical and mental health benefits.

The primary source of planting materials for home gardeners in Shager City is commercial suppliers, accounting for 91.5 % of the total. This finding is consistent with studies conducted in Sebeta-Awas (30) and Goba Districts (5), where markets were also identified as the main source of planting materials.

In contrast to the above findings, seedling acquisition in the Burie District varies by socioeconomic status. Wealthier households source 70.89 % of their seedlings from government nurseries, compared to 61.4 % among middle-income households and 33.33 % among poorer households. Notably, 55.63 % of seedlings for poorer households are obtained through neighbour networks, indicating a greater reliance on informal channels than on institutional sources (40).

Reliance on market-based planting materials can impose a financial burden on gardeners and compromise the quality of their plants. Market-oriented vendors are often not plant specialists and improper handling of plants may negatively affect their survival and productivity. Furthermore, unsold seedlings may remain exposed to harsh sunlight or potential infections for several days, thereby increasing the risk of disease. These factors could contribute to the low productivity observed in home gardens in Shager City. Addressing this challenge requires government and agricultural agencies to ensure the regular and monitored distribution of scientifically selected, quality-assured planting materials to gardeners.

Soil fertility in the home gardens of Shager City is primarily maintained through the use of various organic fertilisers. This finding is similar to that of Nepal, where most gardeners use organic fertilisers (36); however, it differs from the situation in Bahir Dar City, Ethiopia (31), where the use of chemical fertilisers is more common.

The primary reason for the greater use of natural fertilisers over chemical ones in Shager City is the widespread practice of livestock rearing among households. Survey data indicate that approximately 38.6 % of households rear livestock, including goats, cattle and poultry. The reliance on organic fertilisers ensures food quality, provides ease of accessibility and enhances waste recycling, thereby contributing to urban sustainability.

The plant species composition of Shager City home gardens, with 215 species recorded from 153 households, is lower than that of Hawassa City (258 species from 120 households) (7) but exceeds that of Arba Minch (1) and Kombolcha (23) towns in Ethiopia. The cultural trend of incorporating diverse plant species into home gardens in urban settings presents significant opportunities for intensive urban food production, while simultaneously promoting biodiversity conservation and ecological stability.

The rich plant diversity in the city reflects long-preserved indigenous horticultural knowledge, which underpins the strong

cultural attachment to garden plants for diverse household needs. This finding also suggests that the city's favourable physiographic and climatic conditions are conducive to cultivation. The dominance of exotic ornamental plants in a food-insecure city raises essential economic and ecological concerns that warrant further investigation.

The dominance of herbaceous growth forms (46.05 %) in the home gardens of Shager City may be attributed to several advantageous characteristics, including ease of cultivation, minimal space requirements and their potential to enhance garden decorative diversification. The popularity of herbs may also reflect their versatile applications such as medicines and air fresheners. Additionally, larger plants require a relatively extended period to yield products. Following herbs, tree growth forms are the second most prevalent (20.93 %), valued for their multifunctional roles in providing shade, fuel, construction materials, food and medicinal resources.

Plant species diversity in a specific area can be determined using diversity indices such as the Shannon-Wiener diversity index (H′) and Simpson's index of diversity (1 - D). The value of H′ ranges from 1 to 5, while that of 1 - D ranges from 0 to 1. The higher the values of H′ and 1- D, indicate greater the species diversity (41). The study sites have similar species evenness (E), H′ and 1 - D (Table 2). This similarity may be attributed to comparable climatic conditions, access to seedlings, available space, soil type, water availability and cultural factors among the communities of the study sites.

The mean H′ value of Shager City is 3.66 and exceeds that of Hawassa City 3.43, (7), Holeta Town 3.18, (26) and Kombolcha Town 2.98, (23). These findings confirm that home gardens are traditional agricultural systems characterised by a high level of plant species diversity (42, 43).

The high floristic composition and species diversity recorded in Shager City have substantial socioeconomic and ecological implications. The presence of diverse plant species meets a wide range of human needs, including dietary requirements, medicinal uses, cultural practices and income generation. It reflects the broader human lifestyle (6). Moreover, it provides opportunities to preserve traditional knowledge and skills related to the management and utilisation of plant resources.

Home gardens with diverse flora around residential areas also serve as a living school, transmitting the values, practices and cultural heritage of home gardening to future generations. In addition, the existence of a large proportion of exotic plant species in the home gardens of Shager City reflects that the area serves as a site for the domestication of useful exotic plants, alongside native, rare, endangered and endemic species. Moreover, it contributes to the conservation of associated faunal biodiversity and supports the maintenance of essential physical resources.

The findings highlight the presence of diverse plant species that strengthen urban ecosystem resilience, lower urban heat through CO_2 sequestration, mitigate the impacts of climate change and support waste recycling, thereby enhancing overall urban sustainability.

The survey results reveal an uneven frequency distribution among the recorded plant species. The greater abundance of particular species is primarily determined by society's need-based conservation priorities, reflecting their dietary, medicinal, cultural and economic significance (44). Additionally, their strong adaptive capacity to diverse environmental conditions further contributes to their prevalence.

Among the recorded plants, *Ensete ventricosum* was the most frequent species in Shager City home gardens, occurring in 56.86 % of surveyed households (Table 3). This finding is consistent with other Ethiopian home gardens, where it ranked first in Holeta Town with 93.75 % (26) and in Essera District with 28 % (18).

Enset (*Ensete ventricosum*) is a keystone species in Ethiopian home garden agroforestry systems, providing more than twenty-five distinct benefits. Its contributions include essential uses such as human food and livestock feed. It also delivers critical ecological services, including climate regulation, soil enrichment and landscape beautification. In addition, it serves practical household functions such as bread baking (45).

Among the twenty most frequently recorded species, the majority were multi-purpose plants, including *Ruta chalepensis*, *Rosmarinus officinalis*, *Vernonia amygdalina* and *Allium sativum*, which provide medicine, spices and materials for religious and cultural practices. In contrast, species such as *Callistemon citrinus*, *Duranta erecta* and *Cyperus alternifolius* were cultivated primarily for ornamental purposes.

Plant species such as *Brassica carinata*, *Brassica oleracea and Solanum lycopersicum* were primarily cultivated as food crops. At the same time, *Ocimum lamiifolium* was the most frequently recorded medicinal plant in the home gardens of Shager City. Approximately 60 % of the frequently recorded plant species were herbaceous growth forms, which are more adaptable to varying environmental conditions.

Home gardens are recognised for supplying essential household products for direct family consumption (31, 46, 47) as well as serving as a source of income (28). In Ethiopia, research has demonstrated their substantial impact, with home gardens contributing up to 35 % of annual household income in Hawassa City (7). Similarly, studies in Nepal have reported that home gardens account for 64.4 % to 78.6 % of annual household income (36).

The relatively low monetary and nutritional values recorded in Shager City's home gardens are likely attributable to the community's strong preference for ornamental plants. This trend appears to be influenced by several factors, including the greater accessibility of ornamental planting materials and their relatively low maintenance requirements. Furthermore, the predominance of informal and traditional home gardening practices in Ethiopia, coupled with insufficient government support in the form of agricultural expertise and the provision of certified seeds for edible plants, has further constrained the potential contribution of home gardens to household nutrition and income (4).

Plant species richness in a given area is primarily influenced by physiographic conditions and the socioeconomic characteristics of gardeners (48). In Shager City, most socioeconomic characteristics of households exhibited a significant association ($p < 0.005$) with the richness of home garden species (Table 4). This pattern aligns with previous research which confirms similar associations between socioeconomic characteristics and species richness (28, 49, 50).

The association between socio-economic characteristics and plant species richness is context specific. For instance, in Burie District, Ethiopia, older householders with longer gardening experience were found to have higher species richness and diversity compared to younger householders (40). In contrast, a study in Benin reported no significant association between household age and plant species richness; instead, the age of the home garden itself found to have a substantial relationship with species richness (44).

The lack of association between garden ownership and monthly income with species richness in Shager City is likely due to the possibility that households without home gardens can still cultivate multiple species on small plots of land. Moreover, home gardening can be sustained using locally available resources and requires only minimal initial capital investment (18). The finding emphasises the importance of considering the socioeconomic characteristics of gardeners, in addition to inputs and technological innovations, when promoting home gardening practices.

Conclusion

Home gardening in Shager City is practised by a majority of residents. Female household members have the highest participation. The gardens feature a diverse array of plants, with a large percentage originating from exotic sources, being ornamental in use and having herbaceous growth form. The presence of diverse plants in home gardens suggests potential to meet various needs, conserve biodiversity and promote urban sustainability. Species richness at the study site is closely linked to demographic factors. Targeted policy and community interventions should enhance the limited economic and nutritional benefits of home gardens while maintaining species diversity and should consider these factors. Further research is needed to identify drivers of ornamental plant dominance and their ecological impacts.

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Authors' contributions

TB conceptualized the study, developed the methodology, conducted data collection, drafted the manuscript and contributed to reviewing and editing the article. SBP supervised the study and provided guidance and editorial support throughout the entire process, from conceptualization to the completion of the final draft. All authors read and approved the final manuscript.

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During the preparation of this work the authors used Chat GPT in order to improve some grammar. After using this tool/service, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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