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Yard Farming in the City of Lubumbashi: Resident Perceptions of Home Gardens in Their Community

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Abstract Home gardens are an integral part of urban agriculture as well as a part of local food systems in many cities all over the world. Survey and observations were conducted in January and March 2016 among urban households to determine the home garden sizes, the type of fertilizers used, the crops grown and the resident perceptions of home gardens in the city of Lubumbashi, southeastern Democratic Republic of Congo. Results showed that 72% of the households owned a home garden with the mean size of 11.5 ± 6.4 m^2. Crops grown included amaranth, okra, sorrel, sweet potato, corn as well as medicinal plants. All household members participated in gardening works but women played important roles by deciding and selecting the type of vegetables to grow. Home gardening is an expression of identity: - First, it contributes to household food security by providing a direct and permanent access to different type vegetables (83%), responding to the household food traditions.- Second, it strengthens the relationships between families and their neighbors by sharing vegetables. It helps also residents to save money spent for vegetables. -Third, a home garden is perceived as a place whereby agricultural traditions are conserved (14.7%) and where children are introduced to manual work (6.4%). Home gardens generate also few income used as a supplementary on household food budget. Crop intensification and good management can enable residential gardens contribute to food supply in the city of Lubumbashi where the demand for vegetables and fruits is important and increasing.

Keywords: *resident perceptions, home garden, vegetables, food security, Lubumbashi*

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1. Introduction

Studies conducted in many developing countries indicate that the share of vegetables is much higher among poor households to fulfill their dairy requirement of micronutrients, especially vitamins and minerals [1,2,3,4,5]. However, the production of vegetables in Africa is far behind the global average. According to [4], the annual per capita production is approximately 50 kg, which is less than half of the production in all other regions of the world. Very few countries are reaching the recommended intake of 400g of fruits and vegetables per capita and per day [6]. Consumption of vegetables is rooted in traditions and food habits of the Congolese people [7,8,9,10] but vegetable intake is still very low (< 140 g/day/capita) [6]. In the city of Lubumbashi, southeastern DR Congo, 72% of households consume vegetables 2 to 5 times a week [11]. However, vegetable production in terms of quantity and quality is actually threatened by the rapid urbanization and pollution from the mining activities. Urbanization has led to pressure on land and generated conflicts. Competition between urban developers and urban farmers to access land is not favorable for this latter category that observe the size of their farms (production sites) decreasing every year and being occupied by people habitations [12,13,14,15]. Impact of pollution on agricultural activities in and around the city of Lubumbashi includes the contamination of soil and vegetables grown with trace metals that can result in serious public health problems [16,17,18].

In that context, there is much attention towards home gardens as a strategy to control vegetable quality and to enhance household vegetable consumption in urban areas. Home gardens known also as backyard, farmyard, and kitchen or compound gardens are an integral part of local food systems and the agricultural landscape of cities all

over the world [19,20,21]. They can be described as a small-scall production system providing a diversity of fresh foods that improve the quantity and quality of nutrients available to the family [20,21]. Surveys from different countries show that households with home gardens typically obtain from them more than 50 percent of their supply of vegetables as well as medicinal plants [19,22]. In 1999, a survey conducted in the city of Lubumbashi by Action Against Hunger reported that 46% of families owned a vegetable garden. That survey attempted to associate the nutritional status of children as well as their mothers with the presence of gardens in residential yards [23]. In 2016, [24] showed that home gardening is a form of adaptation of urban agriculture in the actual context of land scarcity in growing cities. Gardens satisfy daily food subsistence, lowering every day spending and strengthening relationships between people and communities [25,26]. Home gardens provide at the same time to urban residents and new arrivals in the city a space for interaction, preservation of cultural identity and also a sense of belonging to the community [12,25,26,27]. Gardening for leisure has become quite popular in cities and provides relax and joy to members of community by spending meaningful time in well-designed gardens [28,29,30]. Furthermore, many studies confirm strongly that home gardening helps also children build an understanding of and respect for nature and environment and promote vegetable intake [31,32]. Although the benefits and roles of home gardening are recognized and wildly documented, home gardens are still neglected because of their small sizes [33,34] and their outputs are not even taken into account in agricultural production statistics. In Congolese cities, especially in Lubumbashi, most of research identified related to the urban farming have focused on agricultural activities in the well-known sites and open space around the city [15,18,35,36,37]. However, few is still known about farming in the residential areas (fence, front, back, side yard gardens) as well as the perception of urban residents. This study was initiated to describe the characteristics of home gardens and their perceived roles and benefits among urban residents in the city of Lubumbashi.

2 Material and Methods

2.1. Study Area

This study was conducted in the city of Lubumbashi located in the Upper Katanga, southeastern DR Congo (11°39'S and 27°28'E). The city is currently composed of 42 districts within 7 communes [38]: Lubumbashi, Kenya, Kampemba, Katuba, Kamalondo, Ruashi and Annex. The city benefits of a Cw6 climate according to Köppen classification system. The mean annual rainfall is 1270 mm, with a rainy season that lasts 118 days on average from November to March. The mean annual temperature is about 20°C; the coolest month is July (15.6°C), and the warmest month is October (23°C) [39]. Lubumbashi is among the fast growing city in Africa with annual population growth rate of 5% resulting in human pressure on resources (land, forest) [40]. That population growth can be explained by the natural birth rate, the massive rural exodus due to the armed conflicts in neighboring provinces and to the internal and international migratory flows attracted by the investments and the jobs opportunities in the mining sector [41].

2.2. Methods

Data presented in this study come from the first phase of the survey conducted in residential areas throughout 10 quarters (districts) of the city of Lubumbashi. A random sample of 170 households was interviewed on roles and benefits of their home gardens (Table 1). The choice of the selected sites (districts) was motivated by the diversified farming systems observed in the compounds (residential areas) during the rainy season. This survey was supported by observations and narrative stories to help understand respondent perceptions of home gardens. A questionnaire facilitated the collection of informations between January and March 2016. Data collected were related to the presence of the home garden in the compound, gardening motivations, the size of garden, the crops grown, access to seeds, garden maintenance, and type of fertilizers used as well as the perception of households of the gardens in their community. Data collected were encoded in Excel and crosschecked to clean errors before being transferred to Statistical Package for Social Scientists (SPSS.16.0) for analysis. Descriptive statistic elements such as frequencies, percentages, means and standard deviations) were calculated. The comparison of sites and home garden size was performed by the analysis of variance (ANOVA). The currency is expressed in Congolese Francs (CDF) where 920 CDF were 1 US dollar the period of data collection. The social roles and the benefits of home gardening can be apprehended throughout the motivation, the consideration and the households' perceptions [19,29,30].

Table 1. Distribution of home gardens according to the sites (*n= 170)*

Sites	Number of respondents	Absence of home garden	Presence of home garden
Belair I	11	0	11
Camp Maramba	18	4	14
Quartier CRAA	17	10	7
Quartier GambelaI	16	2	14
Quartier GambelaII	38	8	30
Quartier Golf	12	5	7
Quartier HewaBora	18	8	10
Quartier II Ruashi	12	1	11
Quartier Kiwele	17	6	11
Quartier Makutano	11	4	7
Number of respondents	170	48	122
Pourcentage	100	28	72

3. Results and Discussion

3.1. Sites and Variability of Home Garden Size

Important variability was observed between the sites (quartiers) and garden sizes (Figure 1). Indeed, new quarters and those far from the city center had relatively large space dedicated to the residential gardens.

A study conducted by [19] showed that home gardens can be set up on small plots and everywhere land is available. The average size of home garden was 11.5 ± 6.4 m². This size was smaller compared to the large surface dedicated to vegetable production in the public sites. Analysis of variance carried out revealed significant difference (p = 0.000) between the sites and home garden sizes. This is probably explained by the sizes of the residential plots that are not equally distributed in Lubumbashi. Observations made in Austria show that gardens sizes differ regarding their location and their design [42]. The Table 1 shows that 72% households owned a home garden. This rate is high compared to results of Action Against Hunger (46%). The large gardens were respectively observed in Bel-Air Mukala (17,4 m^2), Hewa Bora and Gambela I (14 m^2) and the smallest in Camp Maramba (7m^2). As for Rwashi II (12,6m^2) and Hewa Bora, they belong to municipalities with urban and rural characteristics where agricultural activities are very privileged [38]. However, the sizes home gardens observed can be taken or considered with caution because the calculations were based on respondent's estimates and declarations.

3.2. Tools Owned and Used in Home Gardens

Working in home gardens does not require sophisticated equipment. Tools owned and used to maintain the home gardens are presented bellow (Figure 2).

Most of the respondents (72.2%) owned and used hoe, 46.0% used machetes and spades as well as watering can (14.7%). Those tools were used simultaneously for the maintenance of the compound and were held at an average of one unit per category. The same tools were identified among vegetable farmers in Lubumbashi [18,37]. It is also important to note that households exchange production tools between themselves. The exchange (mutual aid) of agricultural inputs and equipment was previously described in the previous research in Lubumbashi [43].

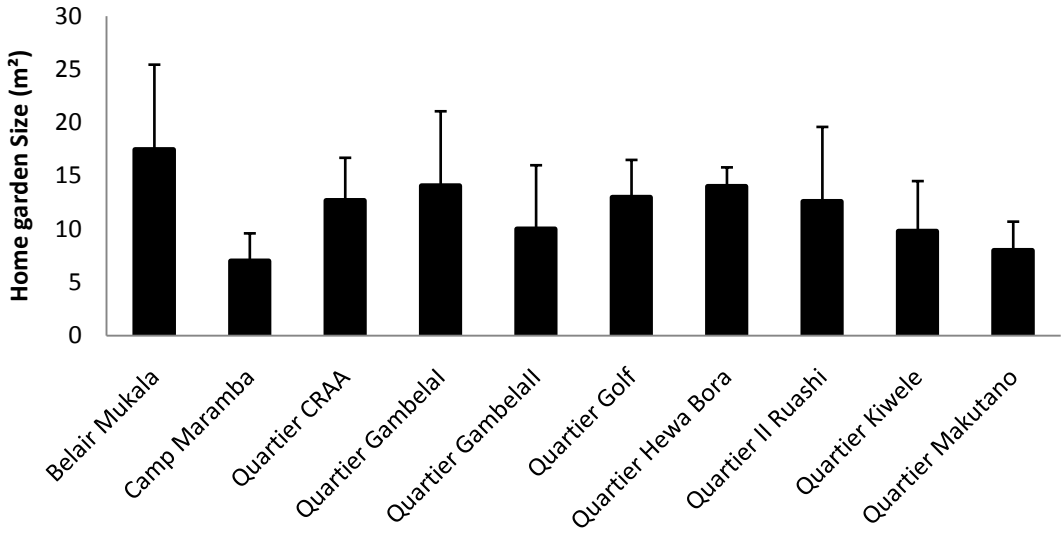


Figure 1. Sites and variability of home garden sizes

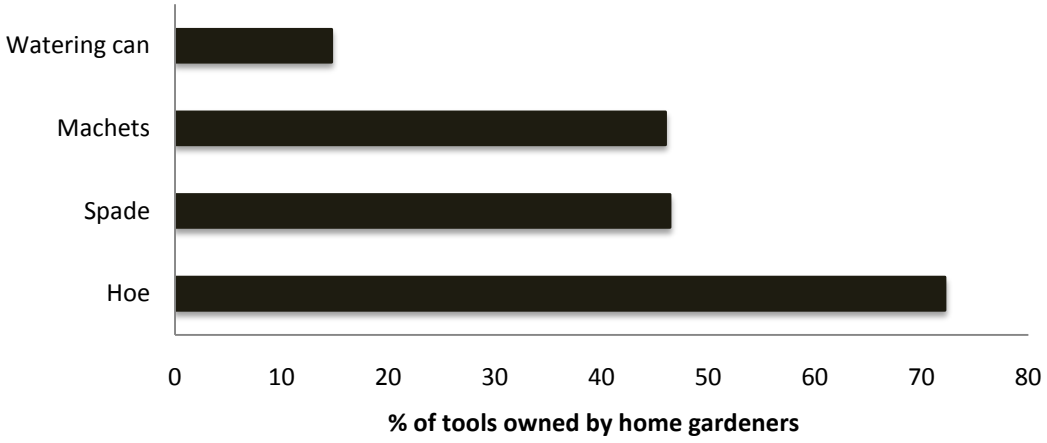


Figure 2. Distribution of tools owned by home gardeners (n=170)

3.3. Source of Seeds

Accessing on vegetable seeds included purchase, self-production and donation from relative and fellow gardeners as reported in Table 2.

Table 2. Source of seeds for gardeners (n=120)

Access modes	Frequency	Percentage
Purchase	73	61
Self -production	32	27
Donation	15	12
Total	120	100

A good proportion among respondents (61%) purchased seeds, 27% sowed the ones saved from the previous production (self - production) and 12% obtained the seeds in terms of donation from fellow gardeners, relatives or neighbors involved in home gardening. Self-production of seeds concerned traditional vegetables species (Okra, sorrel and amaranth and squash). Purchase and self -production are the common ways to access agricultural inputs and this is consistent with [24,33,37] who showed that gardeners purchase seeds and fertilizers from agribusiness shops and produce local seeds themselves.

3.4. Purchasing Price of Local Vegetable Seeds Grown in Home Gardens

Local vegetable seeds are affordable and available on local market. Nearly half of the respondents (49%) bought amaranth seed at a price ranging from 500 to 1000 CDF, 41% purchased squash seed at the same price while 65% spent between 500 and 1500 CDF for okra seeds (Figure 3).

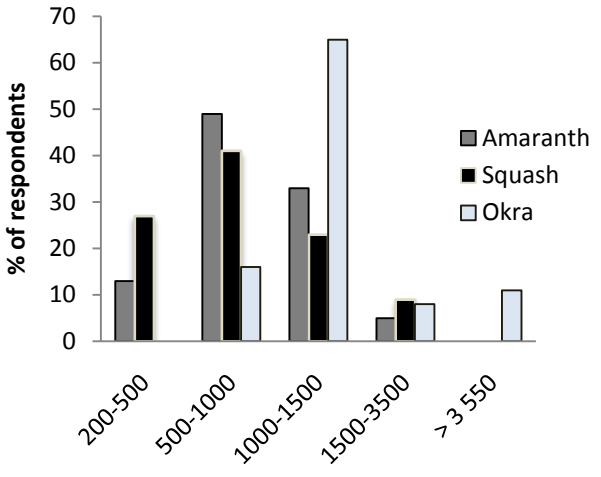


Figure 3. Purchasing price (Congolese francs: CDF) of local vegetable seeds

Previous research in the study area indicates that seeds are affordable and do not count for much in the production cost incurred by vegetable farmers [15].

3.5. Use of Fertilizers in Home Gardens

Animal dejections and household waste combined with low quantity of chemical inputs (urea, NPK) included the fertilizer used in home gardens as shown in Table 3. Selected and composted waste can improve ecological and socio-economic sustainability by reducing production cost for gardeners [44]. A study conducted in Austria on 181 gardens proved that organic fertilizers from households improve the soil proprieties and help grow healthy vegetable [42].

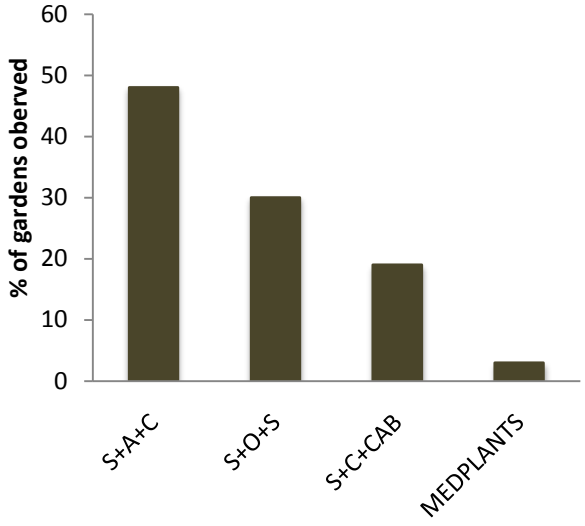
Table 3. Type of fertilizers used by respondents

Type of fertilizers	Frequency	Percentage
Household waste + chimicals inputs	13	11
Household waste onely	54	45
Animal waste	26	21
Chemical inputs (Urea and NPK)	10	8
None	18	15

Results indicate that 45% of households used only household waste, animal waste (21%), 11% combined household waste with mineral fertilizers (NPK 17-17-17, urea 46% N), 15% did not apply any fertilizer. The use of various organic amendments presents an interesting and sustainable solution for the contaminated soil in Lubumbashi. It has been demonstrated that organic matter can restrict the transfer of trace metals from the soil to plant edible organs [16,17]. This also helps reduce health risks associated with the use of chemical inputs among gardeners [45]. Through these results, it should be noted that home gardens fulfill simultaneously an environmental function because they allow the recycling of household waste [46].

3.6. Main Crops Grown

Home gardens observed were characterized by crop diversification (Figure 4). Diversification of vegetables in gardens helps access to varied food products for 60% of households in Africa [20,33,47].



Legend: S+A+C= Squash+ amaranth+ corn, **S+O+S**= Sweet patatoe + Okra + Sorrel; **S+C+CAB**=Sweet potatoes+ cassava+ Chinese cabbage, **MEDPLANTS**= medical and ornamental plants.

Figure 4. Crops grown in gardens observed

Nearly half of gardens observed (48%) were occupied with squash associated with amaranth and corn, 30% were covered by sweet potatoes, okra and sorrel. Sweet potato, cassava and Chinese cabbage were found on 19% of the gardens, while ornamental and medicinal plants counted for 3%. Amber identified 112 plant species cultivated in home gardens in Ethiopia and those species were used for food and medicinal purpose [48]. The choice of crops to produce is motivated by the food habits of the population in the study area. This is in line with a survey conducted by [10] showing that food habits guide the choice of crops to be grown by agricultural households. Home gardens are also an expression of identity. Indeed, households grow herbs, vegetables and crops that respond to their food tradition and habits. Moreover, home gardeners choose crops because they are well adapted to local microclimates and maintained with minimum of purchased inputs [19]. The choice is also motivated by good yields obtained with less labor and minimal maintenance [19,20]. A survey conducted by [49] reveals that the higher the number of crops, the more likely the production is to be maximized on small areas. This is not consistent with [50] who highlighted that the diversification of vegetable crops is difficult to manage effectively on small space.

3.7. Maintenance of Home Gardens

All household members participated in home garden maintenance as reported in Table 4. Home garden maintenance included weeding, watering and investigation of pest infestation.

Table 4. Household 'members involved in home garden works

Members	Frequency	Percentage
Children	19	15
Women	68	56
Men	35	29

The maintenance of the gardens is provided mainly by women (56%), men (29%) and finally children account for 15%. Results from this survey are in agreement with a study conducted in Bangladesh showing that women spend between 6 to 8 hours a week tending crops. Authors explain that female gardeners have good knowledge of vegetables to grow and are more likely to assign importance to home gardens than men do [51]. Women water (65%), apply fertilizer (52%), weed gardens (56%) and collect vegetables for their families [51]. Results found are also consistent with [52] saying that women play an important role in management vegetable and ornamental species in backyard gardens.

The proportion of women in home gardening in our study is high compared to the situation in South Africa where women represent only 36.2% [53]. By their contiguity to residence, gardens offer the possibility to involve the whole family in the production and garden maintenance [54].

3.8. Motivations and Social Role of Home Gardens

Even if few households can sale vegetables collected from their gardens, yet most of respondents (83%) gardened to access on vegetables and fruits with high nutritive value (Table 5). According to [19,55] products from gardens can be sold or shared with neighbors and relatives. Respondents reported collecting from their garden almost of their vegetable supply during rainy season.

Table 5. Motivation of home gardening among urban residents

Motivations	Frequency	Percentage
Regular access to food	101	83
Share-sale- self-consumption	21	17

Permanent access to vegetables (self-consumption) is the primary raison of gardening in the residential yards within the city of Lubumbashi. This is consistent with [19,20,21,53]. Home gardening helps households grow vegetables of their own preferences and that meet their food traditions. The same home gardening motivations identified in this study have been reported also in the United States of America where 91% of households own gardens in order to produce good quality vegetables for their consumption and generate income [56]. A 35 years old female gardener met in Kiwele talked "*I farm my yard to access to healthy and tasteful vegetables. Some vegetables I grow in my garden, I cannot find them actually on market. My garden helps out my hoousehold save money from vegetable purchase. It is also amaising to see friends and relatives coming home to collect vegetables in my small garden*". According to [26,53], gardens also offer a range of varied vegetables, harvested at different times. They help households save money spent for vegetables and reduce the costs associated with food purchase.

3.9. Urban Resident' Perceptions of Home Gardens

Although perceptions of home gardens diverge among people met, food motivations come first and very few consider the home garden as a source of income (Figure 5).

A large proportion of respondents (68.2%) considered the garden as a source of vegetables (food), a place to preserve agricultural knowledge and traditions (14.7%), a place of leisure and enjoyment (9.4 %) and a place to initiate children on manual work (6.4%). Agricultural traditions and initiation of children to manual work are perceived as part of the identity of people surveyed. A female respondent met in Hewa Bora said:" *before coming in this city 5 years ago from my Village, I was a farmer, and like farming. My wish is to keep trough this front yard garden my farming traditions and transmit them to my children*".

Gardening in residential yards offers benefit to residents and plays important roles: A place of leisure and expression of welfare [28,29,30]. Home gardening contributes to household food security, a place for conservation *in situ* of various edible and medicinal plant resources [19,22, 33,48,55]. Gardens help control the quality of vegetables and promote vegetable intake for whole the family [30,38]. Results from this survey are also in agreement with [56] who reported that the quality of food (54%) is the main reason for owning a home garden. The same study indicates that 58% of Americans believe that vegetables from their backyard gardens are tasteful and nutritious compared to that from large farms [56].

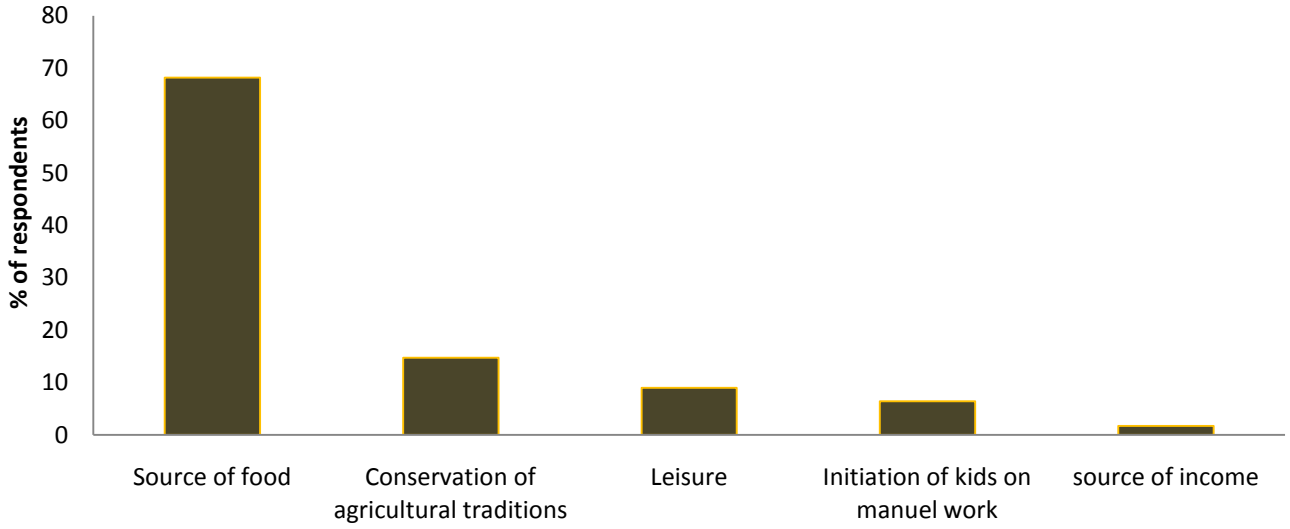


Figure 5. Urban resident' perceptions of home garden in Lubumbashi (n=169)

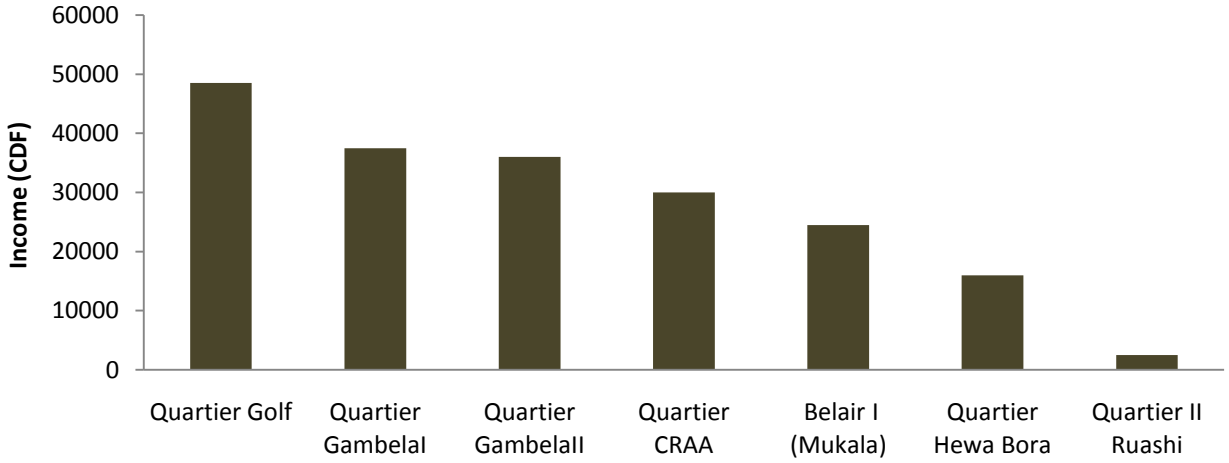


Figure 6. Sites and distribution of home gardening income in Congolese francs (n=32)

3.12. Income from Gardens

Income generated from home gardening varied from a site to another (Figure 6). Home gardening income was high in Golf district (48 500 CDF) and low in Quartier II Ruashi (2500 CDF) and the average for all the sites investigated was 33 950 ± 19 600 CDF. However, income from home gardening was ten times lower compared to that made by vegetable farmers in different market gardening sites [15].

High income recorded in Golf and Gambela can be explained by the presence of a part of the population employed, well-educated and willing to pay attention on their food. A part of this category of population purchase, order vegetables from gardeners or supermarkets. A female respondent explained *"Since I noticed the market was far from our neighborhood, I agreed with a gardener to bring me vegetables at home twice a week. He produces good vegetables in his compound (front and side yard) without chemical inputs. Although he sets the price twice higher compared to the regular price on market, I still feel satisfied with the quality of his vegetables"*. These comments confirm that home gardening plays an important role in term of food security and strengthening social relations between families and neighbors [20,21,25,26].

3.10. Use of Income from Home Gardening

Income from home gardens is considered as a supplement to the household food budget and helps to respond to household regular needs (Table 6). A female gardener met in Quartier CRAA reported:" *Sometimes I harvest lot , I sale extra vegetables to neighbors just for few money that helps me to buy cooking oil and charcoal''*

Almost respondents (91%) considered income from home gardening as a supplement to the household food budget (purchase of cooking oil, water, food seasoning, and charcoal), supplement to children school fees (6%) and purchasing over counter medications (3%). Our results are consistent with [57] who reported that income generated by urban horticulture helps several families in Lubumbashi to cope with or face regular household expenses. In view of the socioeconomic role of vegetable production in Congolese cities, the National Service of Urban and Periurban Horticulture (SENAHUP) in DR Congo has promoted last decade sustainable techniques and encourages urban gardeners to minimize the use of chemical inputs [58].

Table 6. Use of home gardening income by respondents (n=32)

Utilization of income	Frequency	Percentage
Supplement to food budget	29	91
Supplement to school fees	2	6
Purchasing medication	1	3

4. Conclusion

This study examined the characteristics of home gardens and highlighted the benefits and social roles perceived by the residents of the city of Lubumbashi. Home gardens are set up back, front and side yards whereby households grow different type of crops. Crops grown included amaranth, squash, sweet potatoes, corn and ornamental as well as medicinal plants conserved *in situ* with minimum maintenance. Fertilizer matters included household waste coupled with mineral fertilizers and excrement of domestic animals. The choice of crops to produce was determined by their short cycle to be harvested and the food tradition of the households. All household members, especially women were involved in home gardening works. Respondents had positive perceptions of home gardens in their community: - Home gardens contribute to household food security by providing direct access to different type of vegetables for households and their relatives. – Home gardens help preserve agricultural traditions and initiate children to manual works. A good proportion of respondents reported also having fun, leisure and enjoyment in their home gardens after coming from work or during days off. Home gardening is likely a form of urban agriculture adaptation in the actual context of land scarcity in the city where the competition on land between urban developers and vegetable farmers is real. In this study, the sizes of gardens can be considered with caution because the calculation was based on respondent declaration and not on the precise measurements. Further studies are needed to identify the problems faced by home gardeners and assess the vegetable consumption patterns in the city of Lubumbashi.

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Conflict of Interest

The authors have no conflict of interest to declare.

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