

# Interactive effects of HIV/AIDS and household headship determine home garden diversity in the Eastern Region of Ghana

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## Abstract

Home gardens are important for enhancing food and nutritional security for HIV/AIDS-afflicted rural households through dietary diversity. Female-headed households may depend on home gardens more than average households to supply and supplement the household's diet when labour is constrained for field cropping. This paper compares household characteristics, dietary diversity, labour allocated to crop husbandry and home garden biodiversity amongst 22 HIV/AIDS-afflicted female-headed households, 15 non-HIV/AIDS-afflicted female-headed, 10 HIV/AIDS-afflicted dual-headed and 33 non-HIV/AIDS-afflicted dual-headed households in rural communities in the Eastern Region of Ghana. Information on household characteristics and labour allocation to home garden management was obtained through a cross-sectional survey and in-depth interviews. Dietary diversity score was estimated for each household based on a 24-hour qualitative dietary recall. Plant species in each home garden were recorded. HIV/AIDS affliction did not affect home garden diversity but afflicted households had more on-farm sources of income and a higher dietary diversity and allocated more adult labour to home garden activities than non-afflicted households. Dual-headed households had more diversity in the home garden and allocated more adult male labour to the home garden than female-headed households. Statistically significant interactions between HIV/AIDS affliction and headship were observed for Shannon–Wiener index, number of crop species, number of annual crop species and number of root and tuber crop species in the home gardens: there were no headship effects when households were afflicted whereas dual-headed households had higher values than female-headed households in non-afflicted households. HIV/AIDS-afflicted households had significantly more annual crop species and more root and tuber crop species than non-afflicted households for female-headed households, whereas there were no significant differences for dual-headed households. Faced with confinement to the homestead in caregiving and by the obligation to ensure household food and nutritional security, HIV/AIDS-afflicted households spent more (female) labour on home garden management than non-afflicted households to produce crops for sustenance and dietary diversity.

*Additional keywords:* biodiversity, dietary diversity, dual-headed households, female-headed households, household HIV/AIDS status

## Introduction

Agricultural tasks of men and women in many farming communities in Africa differ due to the customary division of labour between gender (Stainer, 1982). Men are often responsible for land preparation and planting, whereas women perform most weeding, harvesting, post-harvest processing and storage tasks (Malena, 1995). Studies from West Africa showed that men are needed for land preparation and that lack of male labour results in a decline in crop production (Sillitoe, 1999). The impacts of labour constraints on crop production in HIV/AIDS-afflicted households and the subsequent limitation on food availability have been widely discussed (Balyamujura *et al.*, 2000; Page, 2001; Drimie, 2002; Barnett & Whiteside, 2003). HIV/AIDS illness reduces available labour for on-farm activities; land preparation, planting, weeding and harvesting of crops are delayed, which subsequently reduces crop yields. Household food availability becomes threatened since rural households obtain the bulk of the food they consume through their own production (Du Guerny, 2002; Barnett & Whiteside, 2003). Labour constraints in HIV/AIDS-afflicted households can result in a decrease in the diversity of field crops cultivated and in abandoning the more labour-demanding yet more nutritional crops (De Waal & Tumushabe, 2003; Gari, 2003). A number of authors have emphasized the potential importance of home gardens for enhancing food and nutritional security for HIV/AIDS-afflicted households through dietary diversity (Gari, 2002; 2003; Abukutsa-Onyango, 2007; Faber & Van Jaarsveld, 2007). Evidence from across several countries indicates that women contribute significant amounts of labour to the production of subsistence food crops, more so than for non-food cash crops (Malena, 1995). Women therefore devote much of their time to care and management of the home garden (Asfaw, 2002; Trinh *et al.*, 2003) and play a prime role in ensuring food security and nutritional needs of their household members (Brown *et al.*, 1995).

The impacts of HIV/AIDS on agriculture are not gender-neutral because land rights, labour allocation and entitlements are along gender lines in farming communities (Drimie & Mbaya 2001; Mbaya, 2002; Loevinsohn & Gillespie, 2003). Müller (2004) asserts that gender is the decisive factor in the impact of HIV/AIDS on agricultural production and food security. HIV/AIDS-afflicted female-headed households are expected to be among the poorest and most vulnerable for many reasons including the loss of male labour, loss of land or entitlements and additional burdens of providing care for the sick or dying and for displaced children, given that women are society's traditional caregivers (D'Cruz, 2004). These female-headed households face conflicts regarding the allocation of their scarce resources. For example, they often face the decision of either allocating time to care for a sick household member or to farming activities such as weeding. Death of male members can also mean a loss of labour, particularly for agricultural tasks, such as land preparation (Balyamujura *et al.*, 2000; Haddad & Gillespie, 2001; Page, 2001; Drimie, 2002; De Waal & Tumushabe, 2003). Salick (1997) observed that female-headed house-

holds depend on home gardens much more than the average household to produce crops to supply and supplement a significant proportion of the household's diet when labour is constrained for field cropping.

In this study we hypothesize that demands of caregiving limit labour for field cropping in HIV/AIDS-afflicted households, especially the female-headed ones. The reduced labour for field cropping will result in an increase in labour allocated to home garden cultivation resulting in greater plant species diversity in the home garden and a higher household dietary diversity.

This paper draws on the results of a study in which we investigated home garden species diversity in the context of HIV/AIDS in selected rural areas in the Eastern Region of Ghana between 2005 and 2006 to verify the above hypothesis. We compared household characteristics, dietary diversity, labour allocated to home garden management practices and home garden biodiversity in HIV/AIDS-afflicted female-headed households with those of non-afflicted female-headed households and HIV/AIDS-afflicted and non-afflicted dual-headed households (i.e., a household with a male and female head as married couple).

## General methodology

### The study area

The study was conducted in the Eastern Region of Ghana where the HIV/AIDS prevalence rate is the highest in the country (6.5% compared with 3.1% nationally) (Anon., 2004a), with 67% of the population being rural (Anon., 2002) and with 53% of the households being headed by females (Leite *et al.*, 2000). The region is the sixth largest in Ghana in terms of land area, covering 19,323 km<sup>2</sup> (8.1%) of the total land area of the country. The region lies within the moist semi-deciduous forest and the dry semi-deciduous forest zones of Ghana and is characterized by a bimodal rainfall pattern. The soils are suitable for the cultivation of staples such as cassava, yam, cocoyam, taro, maize and rice, vegetables like tomato, pepper, and eggplant, and a variety of tree crops including cocoa, kola, oil palm, citrus and mango (Benneh, 1973).

### Definitions

A household is defined as a group of persons who live together in the same house or compound and share the same house-keeping arrangement and are catered for as one unit (Anon., 2002). A dual-headed household represents a household with a married adult male and female who together are responsible for the upkeep and maintenance of the household members. A female-headed household refers to a household where an unmarried/widowed/divorced woman carries these responsibilities (Duncan *et al.*, 1998; Anon., 2002). An HIV/AIDS-afflicted household in this study refers to a household where at least one member suffered from confirmed HIV/AIDS infection, whereas a non-HIV/AIDS-afflicted household is one in which no member was known to have HIV/AIDS infection (Barnett & Blaikie, 1992). The home garden in this study represents a small-scale supplementary food production system (Hoogerbrugge & Fresco, 1993) located within

the homestead or within a 10-minute walk from the homestead, continuously cultivated by and for household members, and comprising a complex and diverse mixture of annual and perennial plants and livestock (Fernandes & Nair, 1986).

## Research approach

The data on which this paper is based were collected between October 2005 and September 2006 through household and home garden surveys that aimed to gather information on home garden species diversity in the context of HIV/AIDS in 17 selected rural communities in the Eastern Region of Ghana. In addition, in-depth interviews with selected case households were carried out after the survey. The study sample consisted of purposive samples of 10 HIV/AIDS-afflicted dual-headed and 22 HIV/AIDS-afflicted female-headed households and random samples of 33 non-HIV/AIDS-afflicted dual-headed and 15 non-HIV/AIDS-afflicted female-headed households selected from the communities. HIV/AIDS-afflicted households were recruited purposively owing to the difficulty in locating HIV/AIDS-infected individuals as a result of stigmatization (Safo, 1993). HIV/AIDS-afflicted households were identified through the association of People Living with HIV/AIDS (PLWHA) in three district hospitals of the Eastern Region of Ghana. The members of the association were individuals from different parts of the country who tested positive for HIV infection. A sample of three non-HIV/AIDS-afflicted households was randomly selected from each of the communities with selected HIV/AIDS-afflicted households based on a list of households with home gardens obtained from the community leader. All HIV/AIDS-infected individuals and household heads were asked for verbal consent from their households to participate in the study.

## Study methods

### Survey

Socio-economic information was collected from households in the survey through interviews using a questionnaire administered by the researcher in the local language (*Twi*). The information comprised age and sex of household members, household size, type of household headship, sources of household income, and household farming characteristics (area of crop land cultivated, field crops grown). Dependency ratio was computed as the ratio of number of household members younger than 15 or older than 65 years to number of household members aged between 15 and 65 years (Anon., 2004b). Household dietary diversity score was estimated based on a 24-hour qualitative dietary recall of the food consumed by the households prior to the survey, using the method of Hatløy *et al.* (1998). Methods for the dietary diversity scoring and the full results are available in Akrofi *et al.* (2008). Information gathered on home gardens included area of home garden, number of adult male and adult female household members (aged between 15 and 65 years) who contributed to cultivating, planting, weeding and harvesting crops in the home garden and of those who contributed to animal husbandry work. The names of the cultivated plant species in each home garden were established and the number of

individual plants of each species recorded. The species diversity in each home garden was quantified using the Shannon–Wiener index,  $H' = -\sum (\rho_i \log \rho_i)$ , where  $\rho_i$  is the relative abundance of occurrence of the  $i$ th species in the home garden calculated as the proportion of the number of individuals of the  $i$ th species to the total number of individuals (Kent & Cocker, 1992). The plant species were categorized into perennials and annuals. Each plant species was then assigned to one of the following four categories: vegetables, roots and tubers, fruits, and other species (spices, medicine, and fodder). The different kinds of domestic livestock reared in each home garden were recorded and their respective numbers assessed.

### Case studies

After the survey, case studies were conducted in 12 purposively selected households to understand how home gardens are managed by the different household types. This information further guided the analysis and interpretation of the data collected in the survey. The interview guide focused on field and home garden cultural practices and gender-specific tasks.

### Statistical analysis

Data were analysed by two-way ANOVA and, where necessary, were log-transformed before analysis in order to stabilize variances. When this was the case, the averages presented in Table 1 are based on back-transformed values (Philip & Cook, 2000). We present coefficients of variation (in %) for all variables as this statistical parameter is recommended to provide insight into variation of back-transformed values. Fisher's protected LSD-tests at  $P < 0.05$  were used to establish statistically significant differences amongst averages of home garden characteristics when the interaction between HIV/AIDS affliction and headship was statistically significant at  $P < 0.05$ , using the Statistical Package for Social Sciences (SPSS) version 15.0.

## Results

### Variables showing a statistically significant effect of household HIV/AIDS affliction

Effects of HIV/AIDS status on household characteristics, labour allocated to home garden management practices and home garden biodiversity are summarized in Table 1. HIV/AIDS-afflicted households had a higher dependency ratio (0.9 vs. 0.6) and consumed a diet with a higher dietary diversity score (6.7 vs. 5.9). HIV/AIDS-afflicted households were engaged in more on-farm (1.8 vs. 1.4) but fewer off-farm income-generating activities (1.2 vs. 1.6) compared with non-HIV/AIDS-afflicted households. HIV/AIDS-afflicted households had more adult household members who contributed to cultivating the home garden (2.7 vs. 2.0), specifically in planting crops (2.7 vs. 2.0) and weeding (2.3 vs. 1.9), and had significantly more adult female household members who participated in planting home garden crops (1.6 vs. 1.1) compared with non-afflicted households (Table 1). In

Table 1. Characteristics of female-headed and dual-headed HIV/AIDS-afflicted and non-afflicted households. Values are averages with coefficients of variation (%) in parentheses. *P* values < 0.05 are marked in bold.

Variable	HIV/AIDS-afflicted		Non-HV/AIDS-afflicted		<i>P</i> value		
	Female-headed households (n = 22)	Dual-headed households (n = 10)	Female-headed households (n = 15)	Dual-headed households (n = 33)	HIV/AIDS (A)	Headship (B)	Interaction A × B
<i>Household characteristics</i>							
Household size (persons)	6.4 (36)	6.2 (42)	5.1 (49)	5.9 (42)	0.20	0.64	0.42
Dependency ratio	1.0 (41)	0.7 (26)	0.6 (39)	0.6 (41)	<b>0.04</b>	0.38	0.18
Field crop area (ha)	0.6 (33)	0.6 (26)	0.4 (34)	0.8 (31)	0.81	<b>0.02</b>	0.06
No. of field crops	2.3 (70)	2.4 (49)	1.4 (77)	2.8 (60)	0.43	0.08	0.12
Home garden area (ha)	0.1 (9)	0.2 (15)	0.1 (9)	0.2 (11)	0.32	0.06	0.49
On-farm sources of income (nr.)	1.5 (44)	2.1 (23)	1.0 (27)	1.7 (26)	<b>0.01</b>	<b>0.00</b>	0.73
Off-farm sources of income (nr.)	1.0 (32)	1.3 (42)	1.8 (26)	1.4 (47)	<b>0.03</b>	0.77	0.08
Dietary diversity score	6.6 (20)	6.8 (16)	6.0 (20)	5.8 (14)	<b>0.00</b>	0.60	0.46
Kinds of domestic livestock (nr.)	1.5 (58)	1.4 (52)	1.0 (54)	1.7 (51)	0.59	0.27	0.11
Domestic livestock (nr.)	2.4 (70)	3.9 (89)	0.9 (72)	2.6 (78)	0.06	<b>0.04</b>	0.58
Poultry (nr.)	5.4 (83)	4.9 (94)	4.9 (88)	9.8 (86)	0.39	0.37	0.26
<i>Labour allocation adult household members</i>							
Adult household members contributing to cultivating home garden (nr.)	2.6 (20)	2.8 (41)	1.7 (26)	2.3 (37)	<b>0.01</b>	0.37	0.34
Adult household members contributing to planting crops in home garden (nr.)	2.6 (19)	2.8 (47)	1.7 (28)	2.2 (34)	<b>0.00</b>	0.16	0.39

Adult household members contributing to weeding home garden (nr.)	2.0 (32)	2.5 (54)	1.9 (28)	1.8 (35)	<b>0.02</b>	0.63	0.35
Adult household members harvesting home garden crops (nr.)	2.1 (26)	2.2 (24)	2.4 (25)	2.4 (28)	0.12	0.68	0.77
Adult household members contributing to animal husbandry work (nr.)	1.7 (65)	2.0 (58)	0.7 (62)	1.6 (51)	<b>0.02</b>	<b>0.03</b>	0.25
<i>Labour allocation adult male household members</i>							
Adult male household members contributing to cultivating home garden (nr.)	0.9 (61)	1.4 (47)	0.6 (40)	1.3 (37)	0.23	<b>0.00</b>	0.44
Adult male household members contributing to planting crops in home garden (nr.)	0.8 (53)	1.4 (47)	0.4 (43)	1.1 (38)	0.07	<b>0.00</b>	0.74
Adult male household members contributing to weeding home garden (nr.)	0.7 (60)	1.4 (47)	0.6 (40)	1.1 (45)	0.36	<b>0.00</b>	0.74
Adult male household members harvesting home garden crops (nr.)	0.5 (50)	1.1 (38)	0.8 (49)	0.8 (55)	0.93	0.10	0.11
Adult male household members contributing to animal husbandry work (nr.)	0.4 (58)	1.0 (53)	0.3 (46)	0.8 (54)	0.10	<b>0.00</b>	0.87
<i>Labour allocation adult female household members</i>							
Adult female household members contributing to cultivating home garden (nr.)	1.6 (21)	1.3 (42)	1.2 (49)	1.1 (42)	0.10	0.16	0.73
Adult female household members contributing to planting crops in home garden (nr.)	1.7 (27)	1.4 (47)	1.2 (44)	1.0 (40)	<b>0.02</b>	0.25	0.59
Adult female household members contributing to weeding home garden (nr.)	1.2 (63)	1.1 (58)	1.1 (55)	0.5 (60)	0.11	0.13	0.21
Adult female household members harvesting home garden crops (nr.)	1.5 (28)	1.0 (49)	1.5 (27)	1.5 (30)	0.07	0.07	0.15

Table 1. (cont'd)

Variable	HIV/AIDS-afflicted		Non-HV/AIDS-afflicted		P value		
	Female-headed households	Dual-headed households	Female-headed households	Dual-headed households	HIV/AIDS (A)	Headship (B)	Interaction A × B
	(n = 22)	(n = 10)	(n = 15)	(n = 33)			
Adult female household members contributing to animal husbandry work	1.3 (50)	1.1 (38)	0.6 (59)	0.8 (44)	<b>0.02</b>	0.96	0.40
<i>Biodiversity in home garden</i> <sup>1</sup>							
Crop categories (nr.)	3.1 (23)	3.5 (20)	2.8 (32)	3.6 (19)	0.49	<b>0.00</b>	0.27
Shannon–Wiener index	1.1 (32) bc <sup>1</sup>	1.2 (12) b	1.0 (31) c	1.5 (24) a	0.21	<b>0.01</b>	<b>0.01</b>
Crop species (nr.)	7.9 (48) ab	7.8 (31) ab	5.8 (50) b	9.7 (39) a	0.91	<b>0.04</b>	<b>0.03</b>
Perennial crop species (nr.)	3.6 (70)	4.0 (52)	3.4 (70)	6.0 (60)	0.62	0.10	0.33
Annual crop species (nr.)	3.2 (54) a	3.1 (52) a	1.4 (80) b	3.5 (66) a	0.06	<b>0.01</b>	<b>0.01</b>
Root and tuber crop species (nr.)	1.3 (46) a	1.2 (60) ab	0.5 (65) b	1.5 (50) a	0.23	<b>0.03</b>	<b>0.01</b>
Vegetable species (nr.)	2.5 (67)	2.2 (44)	2.0 (45)	2.6 (58)	0.67	0.52	0.11
Fruit species (nr.)	1.9 (80)	2.6 (47)	1.5 (75)	2.8 (69)	0.80	<b>0.02</b>	0.48
Other crop species (nr.)	0.7 (61)	0.6 (66)	0.4 (49)	1.0 (80)	0.81	0.16	0.19

<sup>1</sup> Means in the same row, followed by the same letter are not statistically different ( $P < 0.05$ ).



HIV/AIDS-afflicted households, more adult members contributed to animal husbandry work (1.9 vs. 1.2), especially adult female household members (1.2 vs. 0.7). HIV/AIDS affliction did not affect home garden diversity (Table 1).

The household members who contributed to cultivating home gardens or to animal husbandry work in HIV/AIDS-afflicted households comprised relations such as sons, sisters and daughters-in-law of the household head, or the sick household member. The availability of different food crops such as staples, green vegetables and fruits in the home garden enabled HIV/AIDS-afflicted households to obtain diversity in their diet even when the household was short of money to purchase these food items. Small livestock production of sheep, goats and chickens was reported to be a major source of income that allowed households to satisfy their unforeseen financial needs. This enterprise, however, is threatened by the prevalence of livestock diseases such as diarrhea and Newcastle disease due to lack of veterinary care in the rural areas. Women indicated that rearing poultry served as a readily available source of eggs and meat for the household. Generally, poultry were kept free range whereas sheep and goats were tethered to graze around the homestead or kept in pens or enclosures. Poultry was mainly cared for by women, children and the elderly, whereas sheep and goats were the responsibility of mature boys (10 to 14 years) and adult male household members. Male household members contributed to male tasks such as cutting and carrying fodder for the animals, tethering the animals to graze in areas around the homestead, and building or repairing a pen or enclosure for the animals.

HIV/AIDS-afflicted households engaged in on-farm income-generating activities that were less labour-demanding, less time-consuming and that involved a relatively short-distance travel from the home due to the demand of household members having to look after a sick household member. These included raising small livestock, collecting fuel wood for sale, and selling agricultural produce within the village or at a weekly market not far from the village. HIV/AIDS-afflicted households did not engage in off-farm income activities that involved a big capital investment due to financial constraint. Petty trading and retailing items of everyday use such as cooked food and food items, post-harvest food processing and remittances were their main off-farm income sources. The business activities were physically located in and around the homestead and were conducted simultaneously with caregiving. Some HIV/AIDS-afflicted households had given up income-generating activities that involved cooked food, due to social stigmatization and discrimination shown by others.

### **Variables showing statistically significant effects of household headship**

Effects of household headship on household characteristics, labour allocated to home garden management practices and home garden biodiversity are summarized in Table 1. Female-headed households cultivated a smaller field (0.5 vs. 0.7 ha) and had significantly fewer on-farm sources of income (1.3 vs. 1.9) than dual-headed households. Furthermore, in female-headed households significantly fewer adult male household members contributed to cultivating the home garden (0.8 vs. 1.4), specifically to planting (0.6 vs. 1.3) and weeding crops (0.7 vs. 1.3), and to animal husbandry work (0.4 vs. 0.9) than in dual-headed households. Dual-headed households planted more categories of crop species in

the home garden (3.6 vs. 2.9) and had more diversity in the home garden than female-headed households (Table 1).

The majority of the female-headed households (70%) lived in extended family homesteads and shared ownership of the home garden area with other members of the extended family, creating limitation in space available for cultivation (as in the case of subdividing the garden area). This puts restrictions on the categories of crop species that could be grown in the home garden. Female-headed households cultivated significantly fewer fruit species (1.7 vs. 2.7) in home gardens, especially perennial fruits due to the financial and labour requirements. Fruit species with a relatively short growing cycle such as pineapples and papaya were preferred for ease of management and regular availability of produce. Female-headed households engaged in relatively less tedious on-farm sources of income such as providing wage labour in planting, weeding, applying fertilizer and pesticides, harvesting, threshing and shelling of grains. On the other hand, dual-headed households were involved in strenuous activities like land preparation and head portorage of harvested farm produce. Both, female- and dual-headed households engaged their children in on-farm income activities; female-headed households, however, tended to work relatively longer and more often with their children than dual-headed households. Limited access to land and lack of male labour to perform traditional male tasks such as land preparation, fence construction or planting hedges in the home garden to protect its crops from stray animals, and lack of financial resources to pay for these services and to buy planting materials were the problems reported by the female-headed households in home garden cultivation.

### **Variables showing statistically significant interactions between HIV/AIDS affliction and household headship**

Statistically significant interaction was found between HIV/AIDS affliction and household headship for variables related to biodiversity in the home garden (Table 1). Significant interactions between HIV/AIDS affliction and headship were observed for Shannon–Wiener index, number of crop species, number of annual crop species and number of root and tuber crop species in the home gardens: there were no headship effects when households were afflicted whereas dual-headed households had higher values than female-headed households in non-afflicted households. HIV/AIDS-afflicted households had significantly more annual crop species and more root and tuber crop species than non-afflicted households for female-headed households, whereas there were no significant differences for dual-headed households. Annual crops cultivated in the home garden included vegetables, fruits, spices and root and tuber species, the staples cassava, cocoyam, yams and taro. Cultivation of cassava was staggered to ensure continuous production throughout the year and also to avoid the problem of storage and post-harvest losses.

### **Variables not affected by HIV/AIDS affliction, household headship or their interaction**

The results show that HIV/AIDS-afflicted female-headed households did not differ significantly from non-afflicted female-headed households or from dual-headed households

whether afflicted or not, with regard to household size, number of field crops cultivated, home garden area cultivated, number of perennial crop species, vegetable species and other crop species in the home garden. Moreover, the kinds of domestic livestock and number of poultry raised in the home garden, the number of female household members who contributed to weeding the home garden, adult household members who contributed to harvesting home garden produce specifically both male and female household members were not significantly different from those of the other households types (Table 1).

## Discussion

The study compares HIV/AIDS-afflicted female-headed households in terms of socioeconomic characteristics, home garden biodiversity and labour allocated to management practices with those of non-HIV/AIDS-afflicted female-headed, HIV/AIDS-afflicted and non-afflicted dual-headed households, and portrays the link between home garden biodiversity and dietary diversity for these households.

The major objectives of the household survey were quantifying the household characteristics, home garden biodiversity and labour allocated to home garden management practices. As a result, closed questions were asked, which made it difficult to probe into the questions of why and how. For this reason complementary qualitative in-depth interviews were held with selected case households, addressing the inherent weakness of the household survey.

The results of the study show that a lower endowment of productive resources such as land, labour and cash income in female-headed households hampers subsistence production in fields and home gardens. In Ghana, women have limited ability to acquire cropland through inheritance, purchases, renting or sharecropping. Women also lack financial resources to purchase cropland and certain customary laws linked to traditional and cultural norms often tend to discriminate against women. Local practices give males precedence in sharecropping contracts by land owners, as this often involves cash crop cultivation, which is considered a task too strenuous for women (Asenso-Okyere *et al.*, 1993; Benneh *et al.*, 1995; Woodman, 1996; Quisumbing, 2001). In our study, 12% of the female-headed households owned their cropland and 18% cultivated fields by sharecropping, against 12% and 20%, respectively for dual-headed households. The government of Ghana and non-governmental organizations have introduced interventions such as laws regarding inheritance and micro-credit facilities to reduce these limitations. Unfortunately these interventions are yet to be implemented in most rural areas due to the non-enforcement of the legal provisions and limited access to the interventions (Rünger, 2006).

Female-headed households are constrained in male labour and consequently relatively fewer adult male household members contributed to planting and weeding home garden crops and to animal husbandry work than in dual-headed households. Extensive migration of males from rural to urban areas in search of employment and other income-generating opportunities (Mba, 2004; Coast, 2006) leaves few adult male household members in female-headed households to perform traditional male tasks in agriculture. Female-headed households engaged in the additional responsibility of taking on-farm sources of income besides managing traditional household tasks, although relatively less than

dual-headed households. This supports findings by Ellis (2000) and Horell & Krishman (2006) that female-headed households have fewer productive members to engage in remuneration activities. In this study, female-headed households had a higher dependency ratio (0.8) than dual-headed households (0.7), which implies that female-headed households had relatively fewer productive household members (number of household members aged between 15 and 65 years) for on-farm income activities compared with dual-headed households.

HIV/AIDS-afflicted households accessed the extended family network in situations of sickness through the incorporation of adult members for assistance in caregiving and other household tasks including home garden cultivation. This finding confirms earlier reports by Ankrah *et al.* (1993), Booysen (2001) and Desmond *et al.* (2005). It is likely that some of these family members may come in with younger children and therefore increase the dependency ratio of HIV/AIDS-afflicted households. More adult household members participated in cultivating the home garden and in animal husbandry work in HIV/AIDS-afflicted households, which indicates the importance given to home garden cultivation and raising small livestock. Women were able to combine their traditional household tasks to weeding the home garden due to the proximity of the home garden to the homestead (Okigbo, 1990; Gari, 2003). More women contributed to weeding and more men to animal husbandry work, the productive tasks in agriculture associated with these gender groups (Malena, 1995). Home garden cultivation and rearing small livestock and poultry requires low labour and capital input (Marsh, 1998) and was therefore suitable for HIV/AIDS-afflicted households where these resources were constrained. Lack of time, labour and financial constraints hinder HIV/AIDS-afflicted household engagement in on-farm and off-farm income activities. In this study HIV/AIDS-afflicted households engaged mainly in on-farm sources of income generation that were relatively less strenuous and were limited in off-farm income activities by the lack of capital input. This is consistent with the report of Loevinsohn & Gillespie (2003) who indicated that HIV/AIDS-afflicted households are frequently forced to reduce their reliance on labour and to focus on activities that are of reduced scale but that also have lower output or provide less income. However, it contradicts reports by Haddad & Gillespie (2001) that the changes in available labour in HIV/AIDS-afflicted households leads to more off-farm income activities. Nutrition counseling received by participants at the regular meeting of PLWHA informed HIV/AIDS-afflicted households about the benefits of diversity in the diet. The biodiversity in home gardens played a significant role in contributing to the dietary diversity of HIV/AIDS-afflicted households. This reinforces the point that the home garden is a potential for household food security and dietary diversity in HIV/AIDS affliction (Gari, 2002; 2003, Abukutsa-Onyango, 2007; Faber & Van Jaarsveld, 2007).

Faced with confinement to the homestead due to caregiving and the obligation to ensure food security and nutrition needs of their household members (Brown *et al.*, 1995), HIV/AIDS-afflicted female-headed households appear to depend on home gardens much more than non-afflicted female-headed households to produce crops for sustenance and dietary diversity. This was expressed in the cultivation of significantly more annual crops in home gardens, for example more staple crops such as root and tuber species than in non-afflicted households to ensure regular availability of home garden produce. The annual crops were relatively early maturing and tended to be regularly

available. Root and tuber crops were cultivated by vegetative propagation and planting materials were relatively easily available, cultivation was relatively less labour-demanding since management practices like weeding and harvesting did not require strict timing, and could be extended over time (Gari, 2003) and therefore better adapted to the labour constrained conditions of the HIV/AIDS-afflicted households. The absence of significant differences in the number of annual crops, for example root and tuber species cultivated in home gardens in HIV/AIDS-afflicted female-headed households compared with dual-headed households whether afflicted or not, disagrees with the report of Salick (1997) that female-headed households depend on home gardens much more than the average household when labour is constrained for field cropping. This may be due to relatively less male labour contribution to home garden cultivation in HIV/AIDS-afflicted female-headed households. A higher labour allocation in home garden cultivation in HIV/AIDS-afflicted female-headed households and consequently significantly higher plant species diversity in home gardens and a higher dietary diversity score was anticipated in the study. The findings of the study indicated significantly lower species diversity in home gardens cultivated in HIV/AIDS-afflicted female-headed households compared with HIV/AIDS-afflicted dual-headed households, and no statistically significant difference was observed with HIV/AIDS-afflicted dual-headed and non-afflicted female-headed households, which opposes our working hypothesis. This implies that the greater number of annual crops cultivated in home gardens in HIV/AIDS-afflicted female-headed households, for example more root and tuber species, was not reflected in a higher species diversity and could be attributed to lack of male labour in traditional male tasks in home garden cultivation or relatively less time spent in home garden cultivation due to caregiving in HIV/AIDS-afflicted female-headed households. The results of the study were also not reflected in the dietary diversity scores of the households as expected. It is uncertain whether the single 24-hour qualitative dietary recall used in the study was adequate in assessing the dietary intake of the study sample.

## Conclusions

Although the study is not representative and cannot be generalized due to the purposive selection of HIV/AIDS-afflicted households and the small sample size as a result of stigmatization of persons infected with HIV/AIDS, important conclusions can be drawn from our study. The results show that female-headed households cultivated a smaller field, had fewer on-farm sources of income, planted fewer categories of crop species in the home garden, and had fewer adult male household members who contribute to planting and weeding of home garden crops and to animal husbandry work compared with the dual-headed households. This suggests that poor endowment of productive resources such as land, labour and cash income reduces subsistence production in fields and home gardens in female-headed households.

In HIV/AIDS-afflicted households more adult household members contribute to cultivating the home garden, specifically to planting and weeding home garden crops and to animal husbandry work than in non-HIV/AIDS-afflicted households, which indicates the importance given to home garden cultivation and small livestock rearing. HIV/AIDS-

afflicted households consume a diet that has a higher dietary diversity score due to the availability of home garden produce, which confirms the potential of the home garden to enhance food and nutritional security.

HIV/AIDS-afflicted female-headed households cultivate significantly more annual crop species than non-afflicted female-headed households, for example more staple crops like root and tuber species, in home gardens to ensure regular availability of home garden produce. However, the number is not significantly different from that of dual-headed households whether HIV/AIDS-afflicted or not due to relatively lower male labour contribution to home garden cultivation in afflicted female-headed households. Faced with confinement to the homestead in care giving and the obligation to ensure household food and nutrition security, HIV/AIDS-afflicted female-headed households depend on home gardens much more than afflicted households to produce crops for sustenance and dietary diversity. Species diversity in home gardens cultivated in HIV/AIDS-afflicted female-headed households was either significantly lower or no significant difference was observed compared with the other three household types due to lack of male labour for traditional male tasks in home garden cultivation or relatively less time spent in home garden cultivation due to caregiving in HIV/AIDS-afflicted female-headed households. A multiple 24-hour qualitative dietary recall is suggested in further studies to ensure reliable dietary diversity scores. Assessment of the species diversity within the categories of crops cultivated in the home garden may be necessary to investigate the changes in species composition in HIV/AIDS-afflicted households.

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