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Traditional gender inequalities limit pastoral women's opportunities for adaptation to climate change: Evidence from the Afar pastoralists of Ethiopia

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Abstract

Climate change affects different demographic groups differently. Pastoral women, being among the poorest of the poor, are expected to be highly vulnerable to climate change. However, empirical evidence on gender-differentiated vulnerability and adaptive capacity is limited. A triangulation of different techniques including focused group discussions, individual interviews, case studies and structured observations was used to see if there is a difference in factors that determine the level of vulnerability and adaptive capacity between Afar men and women. Gender inequality inherent in the Afar customary tradition (*Adda*) acts as a risk multiplying factor, resulting in women being more vulnerable than men to climate change-induced food insecurity and related risks. Moreover, men have better scores in different variables determining vulnerability and adaptive capacity, including wealth ownership, wealth inheritance, household-level decision power, opportunities for community-level participation, household burdens and health or body mass index (BMI). Despite their limited scores in many of these factors, Afar pastoral women make higher contributions to household-level adaptation to recurrent drought and weather variability. A gendered approach that recognizes the difference in potentials, limitations and vulnerabilities of pastoral women and men is required for successful implementation of adaptation measures.

Keywords: Climate change, Adaptation limits, Gender, Afar, Pastoralism

Introduction

Though climate change is a global problem, it affects different communities, individuals and ecosystems differently, because of the inherent difference in their vulnerability to climate change (Denton et al. 2002). The effect of climate change among the global poor is extensively documented (Schmidhuber and Tubiello 2007). Rural women, being the poorest of the poor, are more vulnerable to the ills of climate change, and the traditional inequalities with men are exacerbated by the consequences of climate change (Dhanashri 2010). Women and children are 14 times more likely to die than men during climate change-induced disasters (Araujo et al. 2007) and exposed to sexual and other forms of violence during social chaos that follow climate-induced disasters (Reuveny 2007).

Climate change gives the traditional labour division a new dimension and increases the household burdens of women (Nagar 2001). In pastoral areas, during extreme droughts when livestock losses have impoverished households, it is the women who feed the family by gathering wild foods (Homewood 2008). Drought also results in reduced amounts of available water, and women and girls will have to walk longer distances to fetch water (Balehegn and Kelemework 2013). Furthermore, when households experience food shortages, due to droughts or extreme weather variability, women tend to push themselves to the limits for instance by going without food so that their children may eat at great cost to their own health (Ongoro and Ogara 2012). On the other hand, women are not only victims of climate change but also contribute considerably to adaptation. Women's close dependence on

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natural resources has positioned them well to understand and innovate livelihood strategies adapted to climate change and resulting food insecurity (Aoyagi et al. 2011). For instance, rural women and girls are the first to learn about declining water quality and quantity (Denton 2002).

Cognizant of the gendered nature of the issue of climate change, it is now recognized that successful adaptation to climate change will require an acknowledgement of the gender dimension of climate change (Gurung and Mwanundu 2006). A gendered approach to climate change requires more than a set of disaggregated data showing that climate change has differential impact on women and men; also required is an understanding of existing inequalities between men and women and of the ways in which climate change can exacerbate these inequalities (Alyson et al. 2008). A gendered approach also requires taking into consideration such inequalities in developing climate change adaptation and mitigation policies (Homewood 2008), identifying the gendered inequality in vulnerability to climate (Carvajal-Escobar et al. 2008), and gender mainstreaming of any strategy or plan of action implemented to improve adaptation to climate change.

The Afar pastoral areas in northern Ethiopia have been continuously under threat from climate change, as manifested by increased reoccurrence of drought and extreme weather variability (Meze-Hausken 2004) and Afar communities' description of decades of reduced livestock productivity (Balehegn and Kelemework 2013), and drying up of perennial and ephemeral water sources (Balehegn 2016). Such changes, coupled with many pastoral non-friendly policies (Balehegn 2016), have plagued the Afar traditional pastoral production system. The Afar pastoralists have been practising different forms of adaptation including changing livelihoods, involvement in the formal workforce and increasing interaction and trade with other production systems (Balehegn and Kelemework 2013). However, despite such adaptations, women continue to be the most affected and most vulnerable compared to men and we hypothesize that their vulnerability stems from culturally inherent gender inequalities which in turn exacerbate vulnerability to climate change. In this study, therefore, we tried to understand gender-differentiated factors that result in gender-based difference in vulnerability to climate change.

Study area

The study was carried out in *Ab'alá* district of the Afar Regional State of Ethiopia which is located at 13° 00′ to 13° 45′ N and 39° 40′ to 40′ 12′ E (Figure 1). The total population in the district is 35,443 with 2,683 pastoral households and 3,226 pastoral and mixed farming households (Boprd 2008). The area is characterized by an arid and semi-arid climate with vegetation groups identified as desert and semi-desert scrub land (Friis et al. 2010).

The Afar, who are pastoralists and agro-pastoralists, and the Tigrians who practise mixed farming of crops and livestock, are the two dominant ethnic groups in the study area. The Afar have strong customary or traditional governance called *Adda* where elderly men, selected for their wisdom in various aspect of pastoral life, regularly gather to make important societal decisions (Hailu et al. 2008). The *Adda* has unwritten rules and regulations, transmitted between generations through word of mouth, pertaining to various aspects of pastoral life such as grazing land management, conflict resolution, weather forecasting and many pastoral decisions such as migration, livestock selling and marriage arrangements (Balehegn and Kelemework 2013).

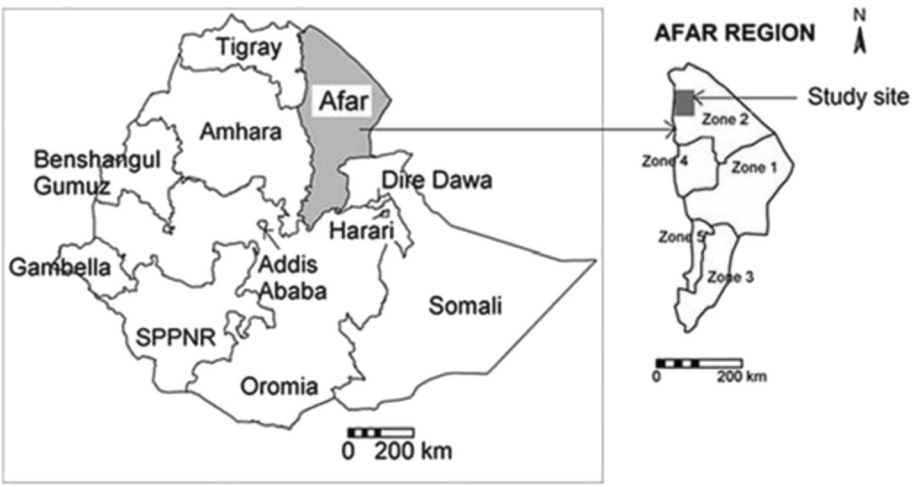

Figure 1 Map of Ethiopia and Afar regional state showing the study district. Aba'ala District

Methods

Sampling and data collection methods

Communities were first stratified into three livelihood groups, namely, pastoral, agro-pastoral and agrarian communities. These three categories of communities displayed distinct characteristics in terms of many variables, and their differences are detailed in Table 1. Three villages were selected from each of the livelihood categories. Three focused group discussions (FGD) were held with each of the three different livelihood groups. Each group comprised of clan leaders, community elders, elderly women and representatives of the district bureau of women affairs.

Individual interviews

Individual questionnaires were administered to 150 individuals purposively selected to include reasonably the same number of individuals in the three livelihood categories. Therefore, out of the 150 respondents, 38 were agrarian, 49 agro-pastoral and 61 pastoral. Moreover, in each category, the percentage of female-headed households was 26, 44 and 48% respectively. The percentage of woman-headed households was lower in all cases, because it was difficult to find as many female-headed households as there are male-headed households. Eight villages were sampled: *Hidmo*, *Aba'ala*, *Milazat*, *Asangola*, *Gelaeso*, *Kala*, *Arkudi and Dinemeli*, representing the three different livelihood categories. The individual questionnaires were used to collect empirical data to test our hypothesis of gender- and livelihood-differentiated vulnerability and adaptation mechanisms. During the individual interviews, we also collected measurements of height, weight, sex and age of all members of a household. Height was measured using simple portable measuring tape, and weight was measured using a digital balance. Age of adults was directly recorded from their answers and that of children obtained from asking parents. The body mass index (BMI) was calculated by dividing the weight (W) in kilograms of individuals by their height (h) squared (i.e. $BMI=W/h^2$). All the data collected from the individual interviewees is provided as supplementary material (Additional file 1).

Data analysis

Analysis of variance (ANOVA) was used to analyse differences in quantitative variables such as household income and expenditure, body weight, height and BMI. Descriptive statistics were also used to categorize and present differences among household members and livelihood categories in terms of participation in decision-making, community participation, sharing of household work load and choice of adaptation strategies.

Results and discussion

Inherent gender inequalities that affect climate change vulnerability and adaptation capacity

According to Afar tradition (*Adda*), women are subject to unfavourable treatments in society, due to numerous restrictions and prohibitions. Their participation in community affairs is limited. Afar women are considered "unclean", and their interactions with people (and animals) are sometimes restricted. Their access to good quality and quantity food is also generally at stake as priority is always given to men and boys. This is further complicated during drought where resource scarcity squeezes women's share even further. Though the Afar *Adda* still continues to be an important governance apparatus, its gradual replacement by formal government governance structure is said to be opening new opportunities to Afar women for community engagement and thereby improving their status (Pearson and Schmidt 2018).

The traditional asset inheritance (*Warsa*) practice is one reason why women tend to have limited access to wealth. Women in Afar are not entitled to any kind of wealth, apparently even what they have earned and produced. The inequality in wealth acquisition starts at birth. Although there is a long-standing tradition of assigning animals to

Table 1 Difference between three categories of livelihoods in Aba'ala district, Afar regional state, Ethiopia

Characteristics	Livelihood groups		
	Agrarian	Pastoral	Agro-pastoral
Housing	*Hidmo* or earthen roofed houses	Mobile houses made of shrubs and grasses t	*Hidmo* and modern iron sheet houses
Ethnicity	Tigray	Afar	Afar
Mobility	Sedentary	Seasonal or opportunistic mobility	Sedentary
Main livelihood	Farming	Herding	Herding with considerable income from farming
Dominant type of livestock	Cattle and sheep	Camel and goat	Sheep, cattle, goats and camel
Village structure	> 100 households residing together	10 to 30 households residing in one village	> 100 households residing in one village
Main type of food	Grains/bread and Injera	Milk, bread and meat	Grains/bread and injera
Selected villages	*Hidmo*, *Aba'ala* and *Milazat*	*Asangola*, *Gelaeso*, *Kala*	*Arkudi*, *Aba'ala*, *Dinemeli*

children at birth, female children are either totally excluded or they receive only half that of their male siblings. Such differential treatment of men and women in inheritance rights continue into adult life too. During divorce, women are not traditionally entitled to a share of the household asset, although such practices are now gradually being diluted by Sharia laws which allow women to take only a third of the household assets during separation (Boyden et al. 2012). This inequality in the inheritance pattern and wealth distribution has a profound effect on women's ability to survive drought and related stress (Hailu et al. 2008; Balehegn and Kelemework 2013).

Besides the stated tradition of wealth inheritance, there is the tradition of widow inheritance (*Hixu*), where following the death of a husband, with the aim of supporting the widow and children, a close relative of the deceased marries the widow (Balehegn and Kelemework 2013, Boyden et al. 2012). Such a culture also contributes negatively to the wellbeing and adaptive capacity of women. Often, a widowed woman and her young children will be left to survive almost on nothing as the new husband, usually an older male, and the sons of the widow scramble for the animals in the household, often making the widow physically and morally too weak to cope with drought.

Another tradition, a marriage pattern widely exercised among the Afar, is *Absuma* which gives older uncles the full right to claim marriage with their nieces (Balehegn and Kelemework 2013). If a girl refuses to get married to her uncle, the man requesting marriage will put a prohibition (*Aqdi*) preventing the girl from marrying another. Even more problematic is that even if the uncle who put the *Aqdi* dies, the girl will not be free of the prohibitions, unless the dying man speaks of dropping the *Aqdi* to a respected elder before he dies. Therefore, even after the death of the uncle, no one will dare to ask the girl for marriage for fear of offending the clan and family members of the deceased uncle. The problem with the tradition of *Absuma* and *Aqdi* is not only that the girl is forced to marry against her will but also that most of the time the uncles are older than the girls by about 20 to 50 years. This big age difference means that the man already has another household to care for and that he is marrying the new wife only to produce more children. Most women who are married to their old *Absuma*, are by far highly exposed to the negative effects of drought than those who married a young man in the usual way (Balehegn and Kelemework 2013).

Under-age marriages are also common in Afar. The average age at marriage of the interviewed women was 14.36, which is lower than the 18 years of legal age for marriage in Ethiopia (Marshall et al. 2016). Under-age marriage by itself may not directly affect the vulnerability of women to drought or their capacity to adapt; however, it does mean that women give birth to many children at a young age, which in turn restricts their capacity to stay active in extra domestic activities to support their household. Of the interviewed women, 85% had three children within five years after marriage. Under-age marriage is obviously a problem for the girl being married; however, it is difficult to convince parents against this, because they justify under-age or early marriage as a way for avoiding pre-marital sex and pregnancy outside wedlock (Boyden et al. 2012).

Difference in wealth ownership among household members

Personal wealth ownership, financial and material opportunities available for individuals are directly related to individuals' vulnerability to the negative consequences of climate change (Adger et al. 2005) and individuals' capacity to adapt to climate change (Kelly and Adger 2000). For instance, Posner and Weisbach (2011) found that the poor are 80% more vulnerable than the well-to-do to the negative consequences of climate change. Even with in the same households, the amount of wealth owned or directly belonging to household members directly affects their capacity to individually resist, adapt and create opportunities for survival during disasters and other risks (Kelly and Adger 2000).

In the Afar pastoral communities, animals are allotted to children starting from birth, and though the household manages all the animals in common, their ownership will strictly belong to the child to whom they were allotted at birth. For example, whenever children want to buy school accessories or get a phone, etc., they sell the animals given to them at birth. They cannot particularly sell animals that belong to other children. In cases when a young man marries, he will acquire only animals that were his, unless the parents are generous enough to share their own.

As indicated in Table 2, women and girls have significantly lower livestock and land ownership, compared to men and boys. This is very common in many African societies which are usually patriarchal and men control household wealth (Brockington 2001). The disproportionate wealth distribution between men and women in Afar starts at birth, where daughters are usually assigned wealth half than that of sons (Balehegn and Kelemework 2013). According to both the religious administration, based on the holy Quran, and the *Adda* or the customary administration, the worth of women and girls during wealth inheritance, divorce sharing and compensation payment was at most one half of that of men (Hailu et al. 2008). According to the Afar customary practice, the owners of the animals, who are the husbands and sons, will have the final say about selling or slaughtering the animals, which they usually sell and spend the proceeds

Table 2 Difference among households in terms of livestock and farm holding (values are mean ± standard deviation)

Possession	Livelihood category			Household members			
	Agrarian	Pastoral	Agro-pastoral	Husbands	Wives	Sons	Daughters
Camel	0 ± 0.00	3.63 ± 4.02*	0.18 ± 0.89	1.46 ± 2.78*	0.02 ± 0.18	0.16 ± 0.72	0.03 ± 0.21
Goats	0 ± 0.00	15.66 ± 16.21*	2.98 ± 10.27	7.24 ± 13.05*	0.4 ± 1.61	0.49 ± 2.49	0.08 ± 0.57
Sheep	0.47 ± 1.39	4.16 ± 7.50	1.12 ± 3.40	1.84 ± 4.51	0.05 ± 0.47	0 ± 0.00	0 ± 0.00
Cattle	4.11 ± 4.04	2.18 ± 12.74	3.52 ± 3.52*	2.92 ± 7.95	0.09 ± 0.83	0.09 ± 0.86	0.01 ± 0.1
Chicken	3.66 ± 3.49*	0.19 ± 1.29	1.32 ± 2.39	0.85 ± 0.91	0.05 ± 0.24	0 ± 0.00	0 ± 0.00
Donkeys	1.16 ± 0.89	0.53 ± 0.78	1.12 ± 0.87	0.57 ± 1.6	0.65 ± 2.01	0 ± 0.00	0 ± 0.00
Farm size (tsimad)**	4.04 ± 2.9	3.44 ± 1.85	3.07 ± 1.53	2.38 ± 2.24	0.05 ± 0.37	0.04 ± 0.51	0 ± 0.00

*Values across rows are significantly different ($P<0.01$)
**a local unit of area of cultivated land which is a day's work of pair of oxen (tsimad), approximately equal to a quarter of a hectare

for their personal consumption such as food, tobacco or clothing which they buy when they go to towns. Wives and girls have little or no say on such expenditure and thus will not be able to spend money on their personal expenses, creating a lot of challenges for women to access sanitary resources and food, which are especially in high demand during drought.

Difference in livestock inheritance among household members

In rural pastoral areas, where formal credit and other ways of acquiring wealth are lacking, inheritance is the best source of finance for household to survive during droughts and extreme weather (Scoones 1994). In many African pastoral communities, the first inherited cattle are the source of breeding stock for a new family for the rest of its life (De Vries et al. 2006). Therefore, inheritance has a strong economic implication for the economic feasibility of the new family, and indirectly on the family's ability to adapt to challenges induced by climate change.

As indicated in Table 3, livestock inheritance was significantly higher among the pastoral livelihoods than the agrarian and agro-pastoral livelihoods. This is because, unlike in the agrarian and to lower extent in the agro-pastoral livelihoods, where children have other opportunities for obtaining wealth such as formal employment and income from charities (De Vries et al. 2006), in the pastoral households, inheriting livestock plays the major role in supporting children and newly-established families in their pursuit of wealth accumulation (De Vries et al. 2006). Acquiring livestock in the form of inheritance, bride price, blood price and gifts is a very common way of supporting children and new families across pastoral communities in sub-Saharan Africa (Butt 2010).

However, as can be seen from Table 3, in all livelihood categories, especially in the pastoral ones, the amount of livestock inherited from families or parents by wives and daughters is significantly lower than that of men and sons. This is again directly a result of religious and customary beliefs which prescribe a lower status of women than men (Hailu et al. 2008; Dupire 1963), or a way to achieve dominance over women through wealth deprivation (Dupire 1963). This is specifically true with the Afar pastoralists, where according to the group discussants, it is believed that a woman is not supposed to have excess wealth. All discussants agreed that the women's place is inside the house to feed children, her husband and perhaps home-staying animals. Therefore, it is customarily believed that women do not need money or wealth, as they will be provided for by their husbands. As a result, some women who independently try to earn money through new activities such as petty trading are usually discouraged by other

Table 3 Difference in wealth ownership among livelihood categories and members of households (values are mean ± standard deviation)

Possession	Livelihood category			Household members			
	Agrarian	Pastoral	Agro-pastoral	Husbands	Wives	Sons	Daughters
Camel	0 ± 0.00	3.63 ± 4.02*	0.18 ± 0.89	1.46 ± 2.78*	0.02 ± 0.18	0.16 ± 0.72	0.03 ± 0.21
Goats	0 ± 0.00	15.66 ± 16.21*	2.98 ± 10.27	7.24 ± 13.05*	0.4 ± 1.61	0.49 ± 2.49	0.08 ± 0.57
Sheep	0.47 ± 1.39	4.16 ± 7.50*	1.12 ± 3.40	1.84 ± 4.51	0.05 ± 0.47	0 ± 0.00	0 ± 0.00
Cattle	4.11 ± 4.04*	2.18 ± 12.74	3.52 ± 3.52	2.92 ± 7.95	0.09 ± 0.83	0.09 ± 0.86	0.01 ± 0.1
Chicken	3.66 ± 3.49*	0.19 ± 1.29	1.32 ± 2.39	0.85 ± 0.91	0.05 ± 0.24	0 ± 0.00	0 ± 0.00
Donkeys	1.16 ± 0.89	0.53 ± 0.78	1.12 ± 0.87	0.57 ± 1.6	0.65 ± 2.01	0 ± 0.00	0 ± 0.00
Farm size (tsimad)**	4.04 ± 2.9	3.44 ± 1.85	3.07 ± 1.53	2.38 ± 2.24	0.05 ± 0.37	0.04 ± 0.51	0 ± 0.00

*Values across rows are significantly different ($P<0.01$)
**a local unit of area of cultivated land which is a day's work of pair of oxen (tsimad), approximately equal to a quarter of a hectare

people (Balehegn and Kelemework 2013), further limiting pastoral women's opportunities of wealth ownership.

Difference in income and expenditure

Similar to livestock ownership and inheritance, income of different members of household is also a determinant of the capability of individuals to adapt to climate change-induced food insecurity and other challenges (Bryan et al. 2009). Those with higher income have the capability to more easily create opportunities for adaptation (Deressa et al. 2009). It is also important to note that where the income of the wives or mothers is higher, the capability of households to adapt to climate change and other climatic hazards increases, compared to when men are the main bread owners (Denton 2002).

As indicated in Table 4, the income of wives and daughters in all livelihood categories of our Afar sample is significantly lower than that of husbands and sons. Not only is income of the wives and daughters lower, but also the part of the households' expenditure spent on daughters and wives is also significantly lower than that spent on husbands and sons (Table 4). This is a direct result of the general traditional subordination of women and girls and the customary and religious restrictions on women's ability to accumulate wealth (Brockington 2001).

The income and expenditure gap between the different members of a household for all livelihood categories, especially the pastoral ones (Table 4), will have higher implications for the capacity of each individual household members on climate change adaptation and escaping its risks. For instance, well-to-do households where women had higher incomes were capable of escaping natural tsunami-related disasters than poor households (Wood et al. 2010).

As indicated in Table 5, not only the amount of expenditure and income by the female and male members of the households varied for all the livelihood categories, but also the type of expenditure was also different. For instance, women and girls had their highest expenditure for medical and food bills, while men and boys had higher expenditure for clothes and food. This is an indication of the difference in status and living conditions of female and male members of the household, and those women and girls are continuously affected by nutrition- and sanitation-related health problems. This is not surprising, owing to the fact that Afar women are considered very low in the hierarchy of status within the household, so that they are not even allowed to eat together with men and sons, always consuming what is left by husbands and sons (Boyden et al. 2012, Balehegn and Kelemework 2013). Higher prevalence of nutrition- and sanitation-related problems for women and girls compared to men and boys is very common and has been reported in different pastoral communities across Africa (Nyaruhucha et al. 2006).

On the other hand, higher expenditure by men and boys on "luxury" items such as clothes and entertainment such as tobacco, tea and coffee, is an indication that men and boys pamper themselves with comfort at the expense of challenges faced by women and girls. This is again not surprising, owing to the deep-rooted traditional gender-based subordination. There are many reports from many African pastoral and agrarian communities, where women's place in a society or household is considered to be providing services to men and sons, at the expense of their own wellbeing (Rivers 1982). Women even sometimes go hungry and sick to feed husbands and children (Simon et al. 2002). During the worst of droughts and associated famine, women also collect, cook and process wild fruits and plants to save children and men, while the women are starving or sick (Homewood 2008).

Difference in household decision-making

Individuals' participation and role in household decision-making affects their adaptive capacity (Deressa et al. 2009). Those who participate in household economic decision-making have the ability to influence the choice of adaptation strategies and other decisions to their liking (Adger et al. 2005). When women are allowed to decide, then they can choose options that directly empower them and help them escape the negative consequences of droughts and other natural hazards (Denton 2002).

As indicated in Table 6, women and daughters in the entire three livelihood sampled categories have the lowest capacity to decide in the participation of selling animals, buying animals, buying grains and mobility decisions. The lowest decision-making options and capabilities of

Table 4 Livestock inheritance by livelihood categories and members of households (values are mean ± standard deviation)

Livestock Types inherited	Livelihood category			Household members			
	Agrarian	Pastoral	Agro-pastoral	Husbands	Wives	Sons	Daughters
Camel	0 ± 0.00	0.38 ± 1.38*	0 ± 0.00	0.54 ± 1.70*	0.03 ± 0.20	0.04 ± 0.38	0 ± 0.00
Goat	0.31 ± 2.77	1.85 ± 6.24*	0.30 ± 2.66	2.82 ± 8.4*	0.59 ± 2.58	0.18 ± 1.74	0 ± 0.00
Sheep	0 ± 0.00	0.04 ± 0.46	0.03 ± 0.44	0.075 ± 0.64	0.03 ± 0.38	0 ± 0.00	0 ± 0.00
Cattle	0.43 ± 1.36*	0.11 ± 1.05	0.41 ± 2.39*	0.92 ± 3.05*	0.17 ± 0.98	0.01 ± 0.09	0.01 ± 0.09
Donkey	0.04 ± 0.20	0.05 ± 0.29	0.02 ± 0.18	0.12 ± 0.41	0.03 ± 0.17	0 ± 0.00	0 ± 0.00

*Values across rows are significantly different ($P<0.01$)

Table 5 Difference in income and expenditure among livelihood categories and household members (values are mean ± standard deviation)

Annual income and expenditure	Livelihood category			Household members			
	Agrarian	Pastoral	Agro-pastoral	Daughter	Husband	Son	Wives
Income	979.17 ± 4868.69	1739.75 ± 5364.77*	1681.36 ± 6616.11*	59.46 ± 442.80	5398.36 ± 1058.92*	25.26 ± 218.12	272 ± 117.62
Expenditure	2872.45 ± 1648.36	3415.71 ± 1941.94*	4762.13 ± 1489.55*	2644.50 ± 1349	4641.43 ± 2377*	3785.72 ± 1728	3470.30 ± 1354
Expenditure for clothes	784.93 ± 494.44	908.73 ± 615.77*	908.91 ± 408.53*	760.2 ± 470	780.83 ± 389	872.20 ± 529	1036.14 ± 624
Expenditure for food	1720.83 ± 899.64	1864.88 ± 1452.36	3522.41 ± 2599.11*	1635.47 ± 1075	2974.73 ± 1640*	2743.32 ± 3132*	1973.32 ± 1021
Expense for health	273.19 ± 810.04	620.17 ± 1141.88*	415 ± 832.02	194.41 ± 408	950.85 ± 1462*	224.81 ± 568	405.02 ± 180.12
Expenditure for entertainment	8.51 ± 84.88	65.09 ± 265.98*	4.07 ± 40.98	2.20 ± 20	48.28 ± 233*	3.68 ± 43	56.40 ± 24
Expenditure for education	69.02 ± 154.94*	44.97 ± 131.20	71.02 ± 196.36*	153.26 ± 188.56*	0 ± 0.00	262.19 ± 272.52*	0 ± 0.00

*Values across rows are significantly different ($P<0.01$)

Table 6 Participation in household decision making by livelihood categories and household members (values are mean ± standard deviation)

	Livelihood categories			Household members			
	Agrarian (%)	Pastoral (%)	Agro-pastoral (%)	Daughter (%)	Husband (%)	Son (%)	Wives (%)
Selling livestock	34.7	40.9	40.7	5.5	99.3	14.4	28.0
Buying livestock	34.0	37.8	36.9	3.7	98.6	12.9	21.3
Buying grain	46.9	49.1	53.3	8.3	90.5	8.7	78.0
Migration	31.3	40.9	34.7	8.3	94.6	14.5	20.0
Slaughtering animals	35.4	41.7	36.5	4.6	98.6	28.3	13.3

women are also result of the traditional subordination of women, where according to the *Adda* of Afar, women should follow what is decided by men with submission, regardless of whether it affects them positively or negatively (Hailu et al. 2008).

This means that options followed by the household sometimes compromise the health and wellbeing of women. For instance, women in Afar normally contribute to household income through their contribution by making hand-made products such as floor mats, ropes and sacks (Balehegn and Kelemework 2013). Women spend that money towards their own and their daughters' nutrition and sanitary expenses. However, during drought times, when the household is pressured to spend more on grains and other food expenses, because milk and meat are not available, women's limited income from selling hand craft works (Figure 2) is the only source of meaningful household income (Balehegn and Kelemework 2013). In those instances, wives are forced to spend their own personal earnings on things that are not solely benefiting women such as men's entertainment and transport.

Figure 2 Afar women preparing different hand works for selling and supplementing their household's income. From top left to right, an Afar woman showing a traditional bed she prepares and an Afar woman preparing traditional broom; bottom left, an Afar woman showing traditional milk churner she prepared and uses and bottom right, an Afar woman preparing traditional mat for selling at nearby market

Difference in community participation among household members

Community participation of household members reflects the power of household members in influencing community-level decisions and the status that individual household members have within a community (Cleaver 2005). This involves the ability of household members to make decisions that directly or indirectly benefit their households or themselves. Especially in pastoral societies, where clan and community-level decisions are usually strictly adhered by community members (Hailu et al. 2008), participation of household members will have a serious ramification on their family's livelihoods.

In pastoral societies, a group's decision-making such as migration to different locations, destocking or selling of animals, marriage and other personal decisions have life-changing consequences at an individual level. Among the Afar, for instance, marriages are arranged by council of elders, without direct consultation of the young people whose fate is decided (Hailu et al. 2008), and girls are usually forced to marry older men without their consent (Balehegn and Kelemework 2013). As indicated in Table 7, women and girls have the lowest level of community participation. This is expected, because the patriarchal nature of the Afar traditional administration (*Adda*) tends to value women's participation less and discourages it (Hailu et al. 2008). For instance, no women participated in *Edo* (rangeland scouting) as compared to the 100% of husbands in the pastoral communities. *Edo* is a traditional rangeland surveillance and assessment of rangeland condition (availability of grass and water) to study or assess the condition of a distantly located rangeland before the whole community and herds have to move. As any other social activity among the Afars, *Edo* is also organized through the *Adda* institution. The people undertaking *Edo* are usually selected to be young and strong males and who have relatively better experience with livestock and rangelands. Similar systems of traditional range scouts also exist in among the Borana pastoralists in Ethiopia, but these also exclude women (Solomon et al. 2007). The problem with the exclusion of women from community decision- making is that the male scouts usually look for factors that are relevant with regard to their livestock, mainly availability of grass, absence of livestock diseases, parasites and predators. However, factors which are very critical to women, such as proximity to water and health centres, are not even considered and women suffer from a lot of health and sanitation issues during migration to areas which were selected by male scouts (Hailu et al. 2008). Women also have very low participation in other important community-level decision making such as the customary administration (*Adda*) with important household-level ramifications (Hailu et al. 2008).

Difference in household work share among household members

Gender disparity in many pastoral areas, among other issues, is expressed in the common culturally assigned gender-based difference in the share of roles and responsibilities (Weisner et al. 1994). Because of their lower status, women tend to take the largest burden of household work across many of the pastoral communities in Africa. In the Afar pastoral communities, a study by Balehegn and Kelemework (2013) indicated that women are responsible for more than 60% of household chores. Current investigation (Table 8) also indicated that the majority of household chores are taken care of by women. The larger domestic burden creates pressure on the time women spend on their personal needs such as attending to their personal sanitation, health, education and other intellectual needs, creating health challenges to women (Balehegn and Kelemework 2013). Recent development such as sedentarization is also said to exacerbate the already higher work load of Afar women, as women usually become engaged in emerging petty trading activities, while continuing to take their traditional burdens from the pastoral system (Inkermann 2015). This disproportionately higher physical engagment of women than men, common across many pastoral areas, is probably why there is higher prevalence of wasting (Fentaw et al. 2013) illiteracy and sickness (Coppock et al. 2011), in women than in men in many pastoral areas in Africa.

It is also important to note that women's contribution to household also increases during drought times (Balehegn and Kelemework 2013). During

Table 7 Community participation among livelihood categories and members of households (values are mean ± standard deviation)

	Livelihood categories			Household members			
	Agrarian (%)	Pastoral (%)	Agro-pastoral (%)	Husband (%)	Wife (%)	Son (%)	Daughter (%)
Adda	22.4	28.3	33.7	91.2	10.7	1.4	1.9
Keble	40.8	34.3	38.0	86.5	41.3	5.0	5.6
Edo	19.0	29.6	24.1	72.3	3.3	16.4	1.9
School	27.9	23.2	25.9	66.9	23.3	1.4	1.9

Table 8 Differences in household work sharing among household members in different livelihood categories (values are mean ± standard deviation)

Type of work	Agrarian				Pastoral				Agro-pastoral			
	Daughter (%)	Husband (%)	Son (%)	Wives (%)	Daughter (%)	Husband (%)	Son (%)	Wives (%)	Daughter (%)	Husband (%)	Son (%)	Wives (%)
House construction	0.0	100.0	8.3	5.3	6.5	60.7	10.0	67.7	10.0	88.0	23.3	16.0
Milking shoat	0.0	19.4	11.1	5.3	23.9	60.7	50.0	53.2	5.0	50.0	20.9	6.0
Milking camel	0.0	5.6	0.0	2.6	0.0	73.8	23.7	1.6	0.0	28.0	14.0	2.0
Baby seating	75.0	2.7	2.8	92.1	89.1	6.5	3.3	98.4	75.0	8.0	7.0	90.0*
Fetching water	77.8	13.5	2.8	94.7	89.1	8.1	6.7	100.0	85.0	16.0	14.0	94.0*
Preparation of food	83.3	5.4	2.8	94.7	89.1	8.1	1.7	98.4	85.0*	8.0	14.0	90.0*
Herding Shoat	2.8	13.5	50.0	5.3	21.7	25.8	81.7	14.5	5.0	32.0	44.2	8.0
Herding camel	0.0	2.7	5.6	2.6	4.3	50.0	70.0	0.0	0.0	28.0	18.6	6.0
Fetching fodder for young animals	0.0	62.2	41.7	23.7	10.9	75.8	61.7	33.9	25.0	68.0	53.5	42.0
Cleaning barns	77.8*	24.3	30.6	89.5	89.1	8.1	35.0	83.9	75.0	34.0	25.6	90.0
Milk processing	44.4	10.8	2.8	78.9	73.3	3.2	3.3	93.5	61.9	14.0	0.0	90.0
Making handcrafts	5.6	0.0	2.8	7.9	60.9	4.8	3.3	93.4	30.0	8.0	4.7	88.0
Collection and preparation of famine food	19.4	63.9	5.6	89.5	32.6	48.4	1.7	90.3	45.0	70.0	2.4	96.0
Transporting grain from miller to house	13.9	2.7	2.8	97.4	13.0	17.7	3.3	98.4	38.1	28.0	0.0	100.0

droughts and concomitant famines, when people are hard hit by food shortages, women collect famine foods to feed the whole family and travel longer distances to fetch water (Balehegn 2016). Therefore, it creates double jeopardy on the health and condition of women, where they are given lower nutritional attention, but have to contribute more to household wellbeing. This also causes a decline in the health and body condition of women (Marshall and Weissbrod 2009) and exposes them to sexual harassment and violence (Reuveny 2007).

Difference in anthropometric variables

Anthropometric variables are important indicators of the food security situation or status among household members (Fratkin and Roth 2006). Especially since the year of the study (2016) has been recorded as a drought year and most Afar needed food aid (UNICEF 2017), it was important and interesting to observe anthropometric indicators of food security among the different household members. As indicated in Table 9, there was significant difference in height among livelihood categories, with the pastoralists being taller than both the agrarian and transitional groups. The Afar traditionally eat animal products such as milk and meat, while the Tigrians, being agrarians, depend on grains and other crops. Coupled with differences in genetics, differences in traditional food habits cause the problems faced by the two groups to be wasting in Afar and stunting in Tigrians. Problems of wasting among pastoral and stunting among agrarian are also reported elsewhere (Fratkin and Roth 2006).

Men had significantly higher BMI (close to normal), compared to the below normal BMI for wives, sons and daughters (Table 9). This could be because of the traditional difference in food intake where women eat the lower quality food after husbands and children (Balehegn and Kelemework 2013). In Afar tradition, women are not allowed to drink camel milk during their menstrual period and during delivery. In fact, Afar women are considered too unclean during their menstruation and birth that they are not allowed to touch milking utensils, or even looking a lactating camel in the eyes. Such kinds of factors definitely contributed to the lower intake of nutritious food by women compared to men, ultimately resulting in lower BMI for women. The difference could also be due to the fact that men have the freedom to travel to towns and purchase or consume better nutritious foods at restaurants, as is common in many African pastoral communities, making men better nourished than women (Mitchell et al. 2007).

The body mass index (BMI) measures among the three livelihood categories are not significantly different. However, in all the three cases, the value is lower than the range of 23 to 25 for a normal healthy person (Fratkin and Roth 2006). This again may be due to the drought during the study period, significantly affecting the body condition of the agrarian as well as the pastoral groups. A reduced BMI due to drought and other natural disasters is very common among pastoral and agrarian groups elsewhere in Africa (Fratkin and Roth 2006).

Gender-differentiated adaptation strategies among different livelihood categories

Understanding the choices of climate change adaptations is important to provide pertinent support to those who are trying to adapt (Deressa et al. 2009). The choice of climate change adaption options depends on availability of opportunities, knowledge of the effectiveness of different opportunities and other social factors (Deressa et al. 2009). Different livelihood groups, owing to their dependence on different natural resources, have different adaptation strategies (Adger et al. 2005). Similarly, members of a household, due to their inherent difference in wealth, status within household and decision-making power, choose different adaption strategies (Mitchell et al. 2007). For instance, women, being responsible for collecting and fetching water for household use, have more ideas on how to solve water and food problems during droughts compared to men (Mitchell et al. 2007).

The most commonly practised adaptation strategy by all livelihood categories is fetching and storing of

Table 9 Difference in anthropometric variables among livelihood categories and members of households (values are mean ± standard deviation)

	Livelihood Category			Household members			
	Agrarian	Pastoral	Agro-pastoral	Husband	Wife	Son	Daughter
Age	21.93 ± 16.81	19.20 ± 18.14	23.14 ± 16.48*	45.36 ± 13.77**	33.93 ± 11.99*	2.7 ± 6.6	8.19 ± 4.82
Height	1.49 ± 1.41	2.77 ± 13.62**	1.49 ± 1.11	1.61 ± 0.14	2.83 ± 13.51*	1.28 ± 1.18	2.32 ± 10.29
Weight	36.72 ± 16.20	33.38 ± 20.05	36.51 ± 16.91	56.75 ± 6.45*	46.33 ± 6.30	22.94 ± 17.18	23.55 ± 11.88
BMI	18.31 ± 4.07	17.75 ± 10.01	18.51 ± 8.38	22.66 ± 8.54**	19.30 ± 4.05*	16.61 ± 11.27	15.70 ± 4.41

*,**Values across rows are significantly different ($P < 0.01$) and ($P < 0.001$) respectively

Table 10 Drought or climate change adaptation strategies employed by different livelihood categories and members of (values are mean ± standard deviation) households

Adaptation strategies	Livelihood categories			Sex of household head		Family members			
	Agrarian (%)	Pastoral (%)	Agro-pastoral (%)	Female (%)	Male (%)	Daughters (%)	Husbands (%)	Sons (%)	Wives (%)
Collection of wild fruits	14.2	39.4	27.7	27.2	30.2	2.8	45.3	11.3	48.0
Fetching and storing water	52.7	50.9	54.8	50.7	53.8	72.4	29.1	24.8	88.0
Labor work	31.1	31.4	27.7	31.9	29.1	1.9	64.2	27.7	18.7
Fetching livestock fodder	33.1	45.4	35.5	40.3	38.2	9.6	67.6	37.6	32.7
Migration to other areas	24.3	43.2	28.9	36.6	31.8	6.7	66.9	25.5	27.3
Storing meat	18.2	31.0	27.7	25.5	27.2	7.7	16.9	3.5	70.7
Selling animals	26.4	27.9	28.3	28.7	26.9	0.0	89.2	3.5	8.7
Purchasing grain	39.9	44.1	50.0	47.2	43.1	2.9	75.0	3.5	82.7
Livestock raids	8.1	15.3	15.1	17.6	10.4	1.0	41.2	3.5	3.3
Formal employment	25.0	24.0	18.7	22.7	22.6	1.0	56.1	14.9	12.0
Herd splitting	12.2	17.5	18.1	19.0	14.4	1.0	48.6	0.7	9.3
Child splitting	7.4	12.2	8.4	11.6	8.6	1.0	17.6	0.0	17.3
Going to Fikur	5.4	10.5	13.3	10.6	9.5	1.0	28.4	0.0	7.3
Borrowing money	14.2	22.7	25.3	22.2	20.5	1.0	64.2	0.7	12.0

Figure 3 Traditional water storage in Afar. An Afar girl showing traditional water storage made from goat skin used for storing water for use in dry season

water (Table 10) (Figure 3). Comparison of the choice and practice of adaptation strategies between different livelihood categories, of household heads and household members, revealed that there are differences in the choice of some of the adaptation strategies. For example, storing meat is practised more frequently by pastoral households than the others (Table 10). Milk processing and meat conservation as a means for adaptation or escaping drought have also been reported for other pastoral groups in Africa (Fassil et al. 2001).

Conclusions

In this research, we have provided empirical evidence of the differences between pastoral men and women on variables that have important implications for their climate change vulnerability and adaptive capacity. Women, generally, have lower household- and community- level descision power; own less amount of wealth, with less amount of household expenditure devoted to them than men; and have lower body mass index than men. All these variations make women more vulnerable to climate change-induced food insecurity and other challenges, compared to men. Moreover, male-dominated patriarchal institutions such as the *Adda* customary administration system serve as risk multipliers to women, contributing to their increased vulnerability and reduced adaptive capacity. In pastoral areas like the Afar, recognition of gender-based differences in vulnerability and adaptive capacity is important for the development and implementation of gender-sensitive adaptation measures.

Additional file

Additional file 1: Raw data collected on gender differentiated vulnerability to climate change in Aba'ala district, Afar Regional State, Ethiopia. (RAR 27 kb)

Abbreviations

BMI: Body mass index; BoPRD: Afar bureau of pastoralists and rural development; FGD: Focused group discussions

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Availability of data and materials

Data, available in SPSS format, is shared as supplementary material to this submission.

Authors' contributions

SB developed the proposal for this research, did the field work for data collection through questionnaires and focused group discussions, analysed the data and wrote the report and ultimately this manuscript. GT was a main advisor of the first author's MA research, for which this study was done. He directed all activities including courses the first author needed to take, and provided inputs during proposal development and manuscript write-up. MB reviewed the proposal with substantial input, designed the data collection format and questionnaire, helped in the data analysis, provided inputs to the field report and finally provided substantial inputs to the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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