Vulnerability and impact of the climate change assessment on the pastoralist community in south central Somalia based on gender and level of education.

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Abstract

Climate change is considered one of the global challenges that threatens the future existence of mankind. Some of the world problems that have been associated with climate change include: food and nutrition insecurity, scarcity of water, starvation and internal conflicts. Factors such as gender and level of education has been found to play a role especially in the third world countries like Somalia, where the women have been tasked with greater responsibility of taking care of the house chores, the children and walk long distances in search of water. This study sought to assess the vulnerability and impact of climate change by gender and level of education of individuals in selected regions of South Central Somali. The number of participants was 400 and the data was collected through structured questionnaires, individual interview and focus group discussions (FGD). The values of the different indicators were used to calculate the vulnerability status based on gender and level of education. The individuals with higher education level were found to be the least vulnerable compared to those of the dugsi and other lower education levels. The female gender was also found to be more vulnerable compared to the male gender. The information provided in this study, can be used by the stake holders to formulate policies that can help in reducing the vulnerability of the different groups to climate change.

Keywords: Vulnerability, impact of climate change, gender, education level, pastoralist

Introduction

Global weather patterns have changed significantly over the years, with the highest variation recorded in the last 50 years (WHO, 2018). One of the key evidence of global climate change, is the remarkable rise in global surface temperature, causing an increase in number of hot days and nights in most regions around the world. The high temperatures, have resulted in melting of ice and glaciers, which have in turn increased the water levels in seas and oceans. The surface temperature in Africa, has experienced a dramatic increase over the last century, along with the global surface temperature. The average increase in surface temperature in the 20th century was found to increase by 0.7^{o}C, the value is higher compared to that of the 19th century, which was found to increase by 0.5^{o}C. From 1970 to 2010, the average increase in annual surface temperature had increased from 0.5 to 0.8oC (Collins, 2011). It is further projected that the continent will experience an average rise in temperature of up to 6oC by the year 2100 (Amwata, 2013). The changes in climate are consistent with those experienced in other parts of the word, because the world's temperature has generally, been found to increase. However in Africa, the trend in temperature rise is relatively higher than that experienced in most parts of the world (Opiyo et al., 2014).

Most regions in Africa are generally classified as tropical regions and the equator cuts across half of the continent. The levels of rainfall and humidity, have very high variation in most region, though most parts of the continent generally experiences hot climate. The rainfall weather patterns are significantly different compared to the warm weather. However in most regions, the amount of rainfall has significantly decreased since 1960s. The rainfall reduction in the 20th century alone, is estimated to be up to 40% in some regions and a minimum of 20% in other areas (Dai et al., 2004). Between the years 1960 to 1998, the annual decrease of precipitation in the rain forest zones of Congo and West Africa were 3 and 4% respectively. In the Southern Africa, higher anomalies in rainfall have been experienced since 1970 and the drought periods have become widespread and more intense (Fauchereau et al., 2003).

The Somali climate has been characterised by inconsistent climate patterns in the last 20 years. The levels of rainfall in Somali have been found to vary significantly over the years and the periods of drought have also been found to extend for a number of years after which, they are then followed by periods of very high rainfalls that result in flooding. The levels of rainfall have been found to vary significantly over the years from 57mm to 660mm (UNDP/ICPAC, 2013). The high variation of rainfall in Somali has been attributed to the change in global sea surface temperature. The flooding normally results from the anomalies in sea temperature values, experienced by the Indian Ocean basins and equatorial Pacific (Lasco and Boer 2006). For instance severe droughts that have

been experienced in the region occurred in the year 2011, 2010, 2008, 2004 and 2000, while severe floods were last experienced in 1997/1998 (NAPA, 2013).

The Somalis mostly belong to the Islamic religion and they speak the same language. They are subdivided into six major clans. Four of the six clans consists of pastoralists and they account for 70% of the population, while the other ones are mostly farmers. Somalia has the largest number of pastoralists in Africa, who consist of at least 60% of the population and most of them are either nomadic or semi nomadic. Climate change has greatly affected the Somali community and made them more vulnerable. There is always threat of loss of livestock as a result of either famine or drought. The pastoralists are also more vulnerable to food insecurity, as they heavily rely on the livestock products for food. The death of a big herd of cattle as a result of drought or floods, also affects the culture of pastoralism (NAPA, 2013). There is therefore need to assess the vulnerability of the pastoralist community in order to implement the appropriate adaptive or precautionary measures.

Methodology

Vulnerability assessment

The concept of vulnerability

The concept of vulnerability is dependent on the level of one's physical exposure to a certain risks. The study by Amwata et al. (2013) describes vulnerability as a measure of access to resources and one's socioeconomic status. A different study by Cuter et al. (1996) defines vulnerability as the potential of various groups to withstand harsh environment and recover from it. Gabor and Griffith on the other hand, explained that vulnerability is the risk that a community is exposed to. Cuter et al. (1993) describes vulnerability as the possibility of a group of people or an individual, being exposed to a hazard that can adversely affect them. The concept of variability has been defined in different ways by different organizations based on their field of interest and their role.

A vulnerability study conducted in (1999), examined variability in terms of food security. The study defined vulnerability as the possibility of an acute decrease in food security or consumption to levels that are below the one that is required for survival. The study further highlights the risk of vulnerability by examining the risk factors such as high prices of basic commodities, conflict and drought. A different study, highlighted two considerations that can be used to examine vulnerability. A distinction was first made between ecological fragility and economic vulnerability. The vulnerability concept is when one is susceptible ecologically and economically to external shocks. They further defined structural vulnerability as susceptibility that does not result from political will or economic policies (Opiyo, 2014). The IPCC (2014) on the hand, defined vulnerability as the extent to

which a system, is not able to cope with the negative effects of climate change. The report outlines that variability is made up of three factors namely: exposure to hazard, sensitivity and capacity to adapt.

Approach used in assessing vulnerability

The assessment of vulnerability in any region is important for making future plans and informed decisions. The information provided by the assessment enables the relevant bodies such as the government, NGOs and donor agencies take appropriate measures based on the findings of the assessment. Vulnerability to climate change, can be analysed based on three main approaches namely: the socioeconomic approach, the biophysical approach (impact assessment) and the integrated approach (Opiyo, 2014).

The biophysical approach (impact assessment) analyses the damage caused by the extreme climatic incident to both social and biological systems. The socio-economic approach of assessment for focusses on the status of individuals or social groups, in terms of their ability to overcome external forces that threatens the source of their livelihood. The integrated system on the other hand, combines both the biophysical and socio-economic approach in assessing the vulnerability (Bobadoye, 2016). This study used the integrated system approach where both the biophysical and socioeconomic approaches were used to assess the vulnerability of the pastoralist in Gedo and Galgudad regions of central Somalia by gender and income. The determination of vulnerability status was carried out using formula one below. Where I represents the impact of climate change, which comprises of both exposure and sensitivity. The data normalization was done using the UNDP's Human Development Index (HDI) approach (UNDP, 2006). The indicators that had a positive relationship with vulnerability were normalised using formula (2) and the ones that had a negative relationship with vulnerability, were calculated using formulae (3).

$$V = f(I - AC) \qquad (1)$$

$$Xij = \frac{Xij - Min\{Xij\}}{Max\{Xij\} - Min\{Xij\}} \qquad (2)$$

$$Yij = \frac{Max\{Xij\} - Xij}{Max\{Xij\} - Min\{Xij\}} \qquad (3)$$

Data collection and sampling

The target population of the study was the pastoralist community in South Central Somalia. The data was collected from two regions namely, Gedo and Galguduud and they were selected because of their importance, their location, and their community's type of livelihood. Qualitative and quantitative cross-sectional and retrospective

community based study was conducted through an in-depth community assessment using structured questionnaire, individual interview and focus group discussions (FGD). The sample size was calculated through estimation of unknown proportion and the formula used was as shown in equation 4 below and a total of 400 individuals / households were used in the study.

$$n = \frac{(N * (P * (1 - p)}{(N - 1) * (e^2 / z^2) + (p * (1 - p))} \quad (4)$$

4 Data Analysis

The association between gender and level of education with climate caused vulnerability outcomes or impact (health impacts, drought, lack of drink water etc. and its various subcategories) was analyzed using SPSS statistical package software version 19 and 24 (statistical package for social science v.19 and 24) and Microsoft excel 13. Test results were considered significant at P=0.05 using crosstabs chi square analysis.

Results

Main problems experienced in the last 2 years

Level of education

The dugsi individuals were moderately affected by insufficient water (62.1%), compared to the higher education level individuals (100%). The individuals who attained primary level and secondary level of education also experienced insufficient water as the major problem, as they had 100% and 85.7% affected individuals respectively. The problem of inadequate food was also experienced by the dugsi but was not experienced by the rest of the individuals in other levels of education. Poor health of livestock, was also experienced to a lesser extent by the dugsi and those who attained secondary education. The chi square test showed that there was no significant relationship between the main problem encountered in the last two years and the level of education as shown in Figure 1 below.

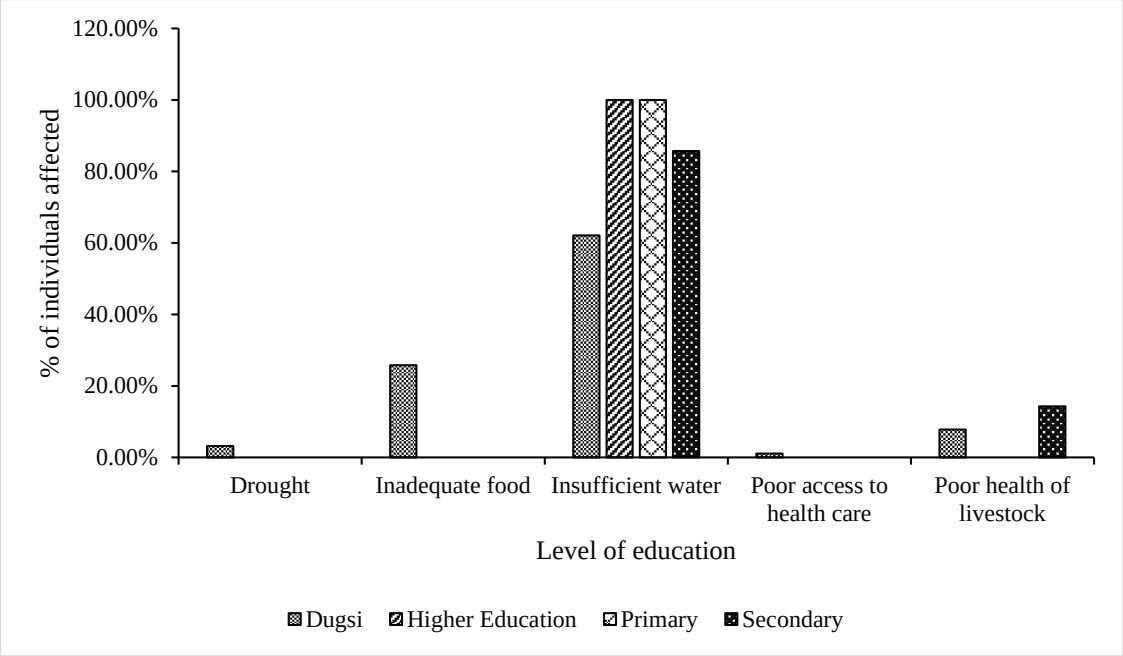

Figure 1: shows the percentage of individuals affected by the main problem in all levels of education

Gender

Insufficient water was the major problem in both genders, however the number of females affected by insufficient water, was 67% while that of men was 58%. Inadequate food was the other problem that affected many individuals in both genders. The males were more affected than the females as they had 31%, while the females had 20%. Poor access to healthcare and poor access to health of livestock were also experienced by a small number of individuals. The females were more affected with poor access to health care of livestock compared to men and they were 9% compared to the males, who were 6%. Poor access to health care was the least problem as both males and females had 1% of individuals affected. The chi square test showed that there is a significant relationship between gender and the problem experienced in the last 2 years.

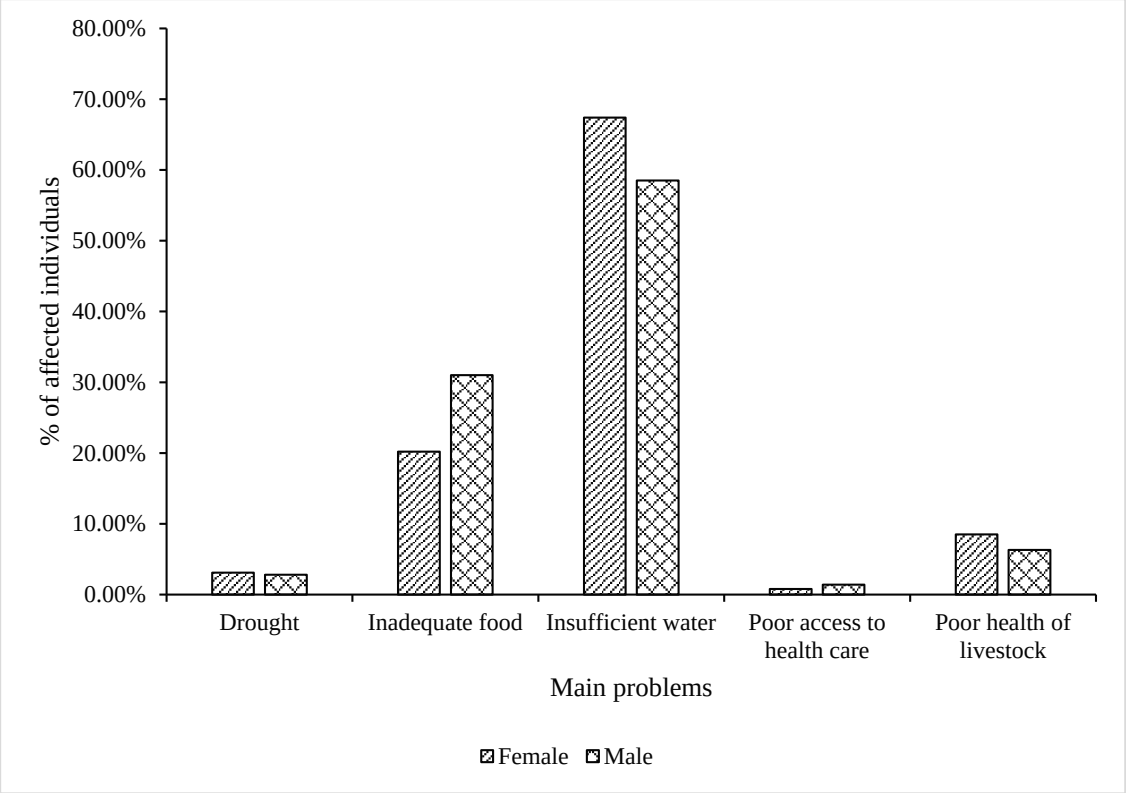

Table 2: shows the percentage of individuals affected by the main problem in each gender

Drought

Level of education

Majority of the individuals who attained dugsi level of education suffered from two shocks of drought, where 37.8% of the individuals were affected and 20.8%, were affected by one drought shock. The number of dugsi level who had four shocks were 19.7% and 8.9% had 5 shocks. The individuals who had higher education all suffered from 5 shocks. As for primary and secondary, 54 and 57.1% respectively suffered from the two drought shocks in the last 10 years. In general 38.7% of the individuals suffered from 2 drought shocks, while 19.1% suffered from 3 shocks. Individuals who suffered from 5 shocks were 9.8%. The chi square test showed that there was a significant relationship between the drought shocks experienced in the last 10 years as shown in Figure 2.

The year 2011, recorded the highest number of worst drought cases for all individuals. The individuals from higher education and primary were the most affected as they all registered 100% in the number of people who had the worst drought shocks. The dugsi on the other hand registered 65.7%, while secondary level recorded 14.3%. The year 2014, had the second highest number of affected individuals, where the dugsi level was 15.1% and the secondary level was 42.9%. In the year 2016, the affected number of the dugsi level, was 17.3%, while

the secondary level was 21.4%. In general, 2.5% of people were affected in 2010, 65.1% were affected in 2011, 15.6% were affected in 2014 and 16.8% were affected in 2016 as shown in table 7 below. The chi-square test revealed that there is a relationship between the year of worst drought and level of education.

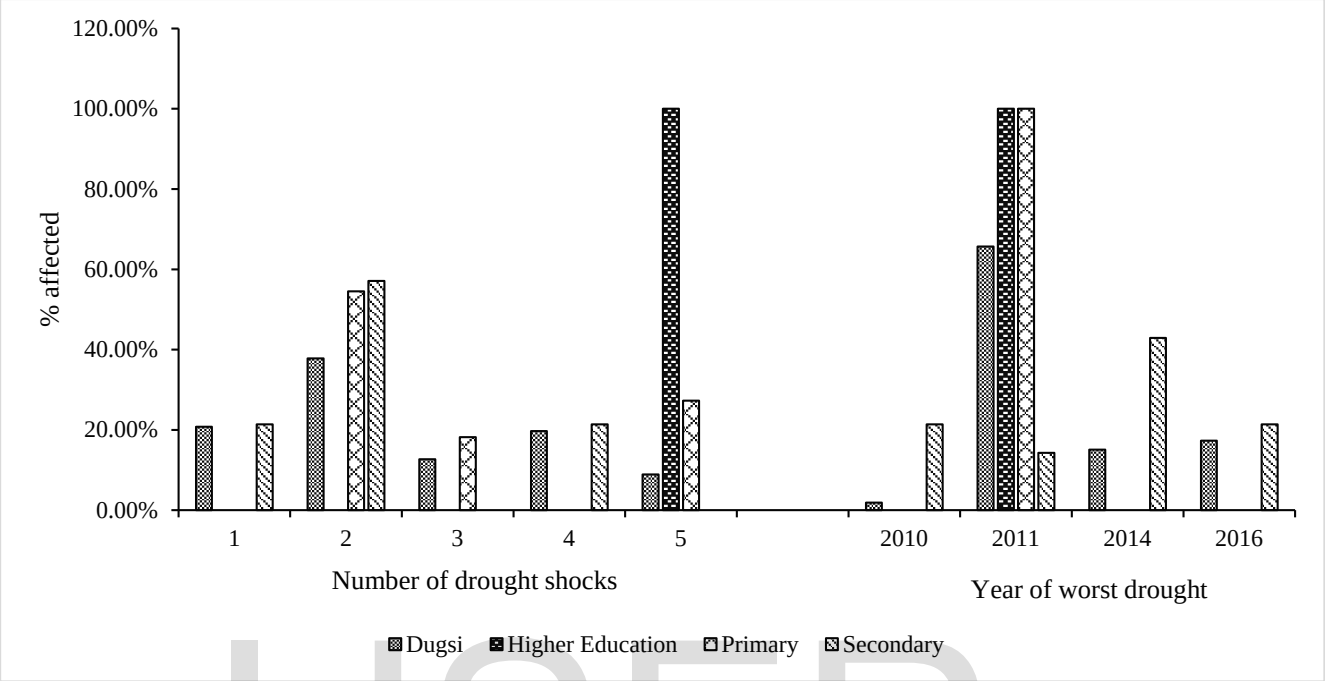

Table 3: The level of education versus drought shocks and year of worst drought

Gender

The females were the most affected by five drought shocks in 10 years as they had 11% of individuals affected, while the males had 9%. The chi square test showed no significant relationship between the gender and the drought shocks. In the year of worst drought, most of the males and females were still highly affected in 2011. The number of females affected was 64%, which was less than the number of males that were affected (67%). In all the other years, the number of females who were affected was almost similar to that of the males affected. For instance in 2016, which was the second highest, 17% of the females were affected, while the affected were also 17%. The year when both males and females were least affected was 2010, where 3% of the females were affected and 1% of the males were affected. The chi square test on the other hand, showed that there was no significance relationship between the year of worst drought in both males and females.

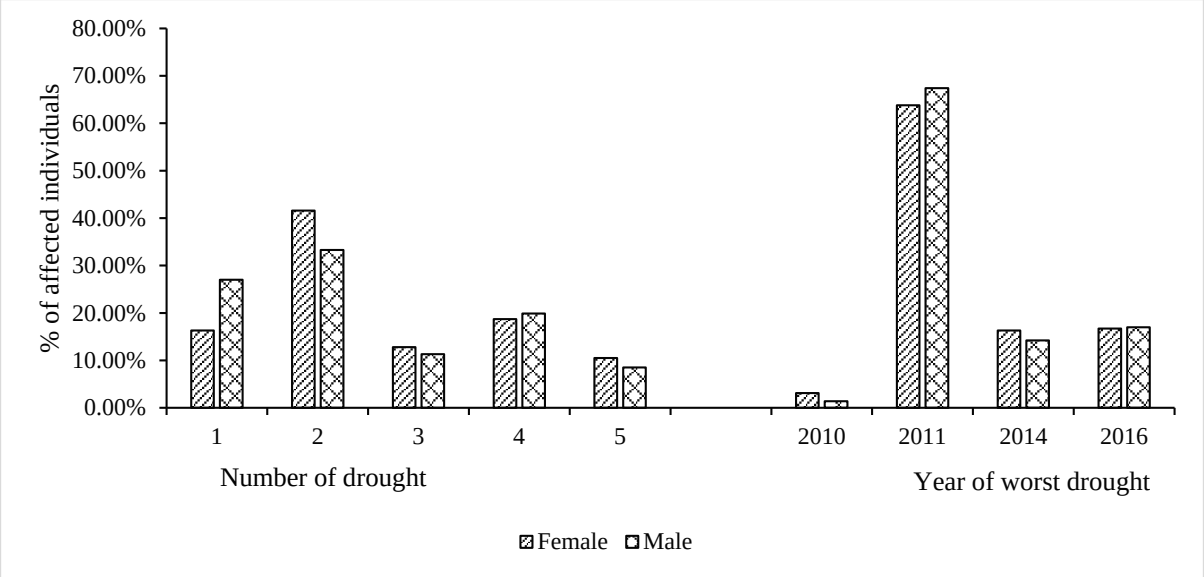

Table 4: Gender versus drought shocks and year of worst drought

Number of animals lost

Level of education

In the 51-60 category of animals lost the individuals who had attained primary education (27.3%), had the highest proportion of affected individuals. In the 41-50 category, the secondary school (42.9%), had the highest number of affected individuals. The individuals with higher education only lost 11 to 20 animals. The dugsi were the second most affected at 40.5%. The primary (45.5%) and the dugsi (21.9 %) were also the most affected in the 1-10 lost animals category as shown in Figure 3.

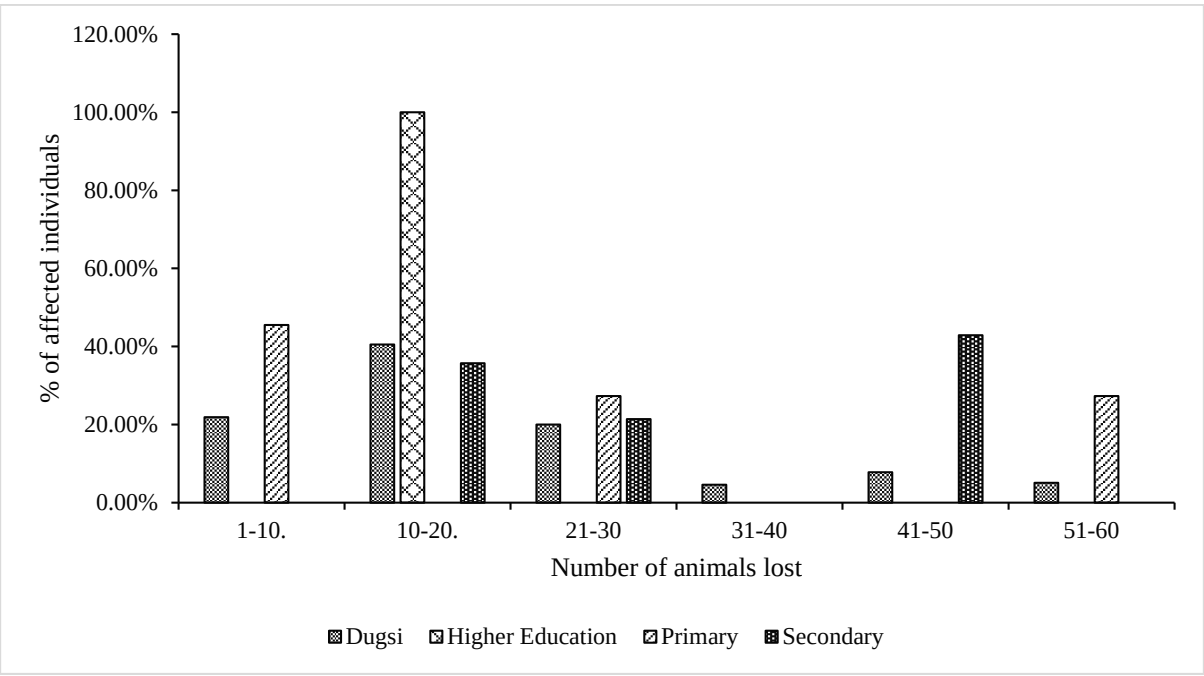

Figure 5: The percentage of people affected in the different levels of education and the number of animals they lost

Gender

A higher percentage of females lost between 51 to 60 and 40 to 50 animals compared to men. The number of females who lost 51-60 animals were the majority, who were 6.2%, while the males were 4.3%.The same proportion of males and females lost between 31-40 animals and they were 4.3%, while those who lost 1-10 and 10 to 20 animals were '23.3% and 39.3%' females and '18.4% and 40.4%' males as shown in Figure 6. The chi square test showed no significant relationship between the number of animals lost and the gender.

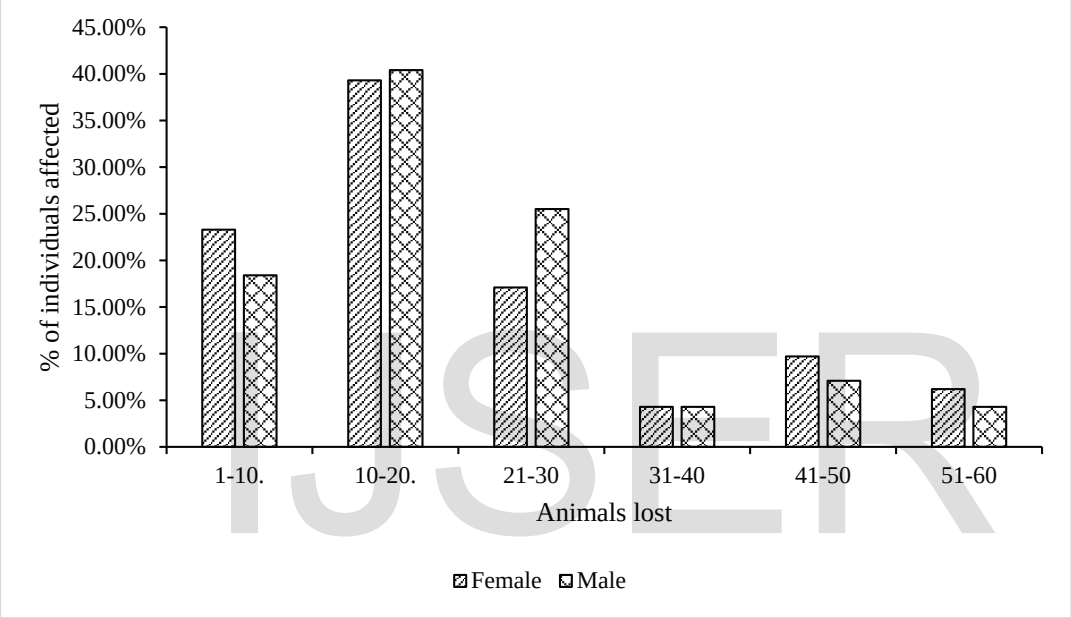

Figure 6: The percentage of people affected by gender and the number of animals they lost

Diseases

Level of education

Most individuals were found to have contracted illnesses in the last three months. The malaria disease was found to affect all the individuals, the most affected were the higher education and primary level, who all had 100% infection. The dugsi had 93.3%, while secondary had 78.6%. The cases of diarrhoea were generally low but were highest in individuals that had higher education (100%) and least in secondary school. The chi square test showed that there is no correlation between the level of education and both malaria and diarrhoea. The individuals with higher education were the most affected by typhoid, as they had 100%. The other levels of education had percentage values that were less than 50%, which implies that the the disease did not greatly affect the individuals as shown in Figure 4. Chi square test shows that there is no correlation the diseases and level of education.

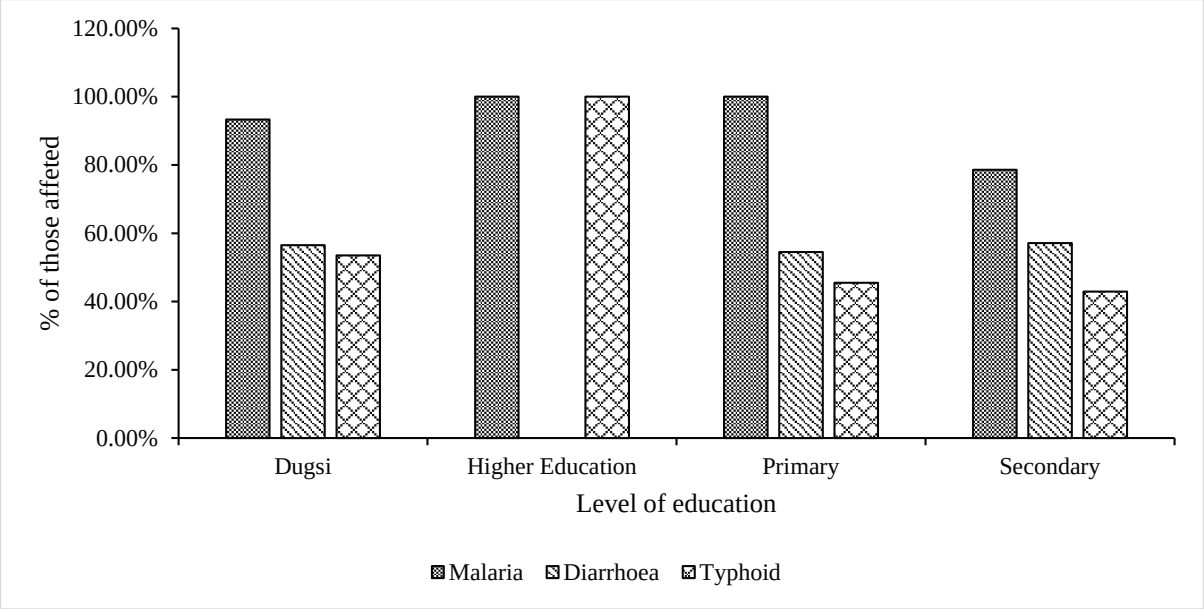

Figure 7: The diseases versus levels of education

Gender

Generally the number of females that had illness in the last 3 months was higher in males than in females. The proportion of males and females affected by malaria was 92.6% and 93.7% respectively). The proportion of the females affected by diarrhoea was 45%, while that of men was 42%. The proportion of those affected by typhoid was 45.2% for the males and 52.7% for the females. There was no significant relationship that was found between all the diseases and gender.

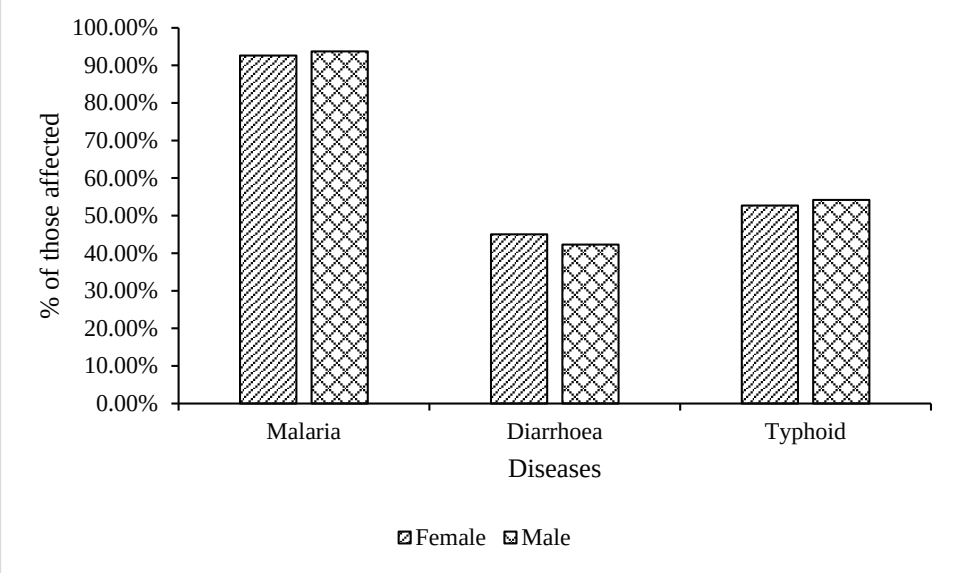

Figure 8: Diseases and the different genders

Vulnerability

The vulnerability by level of education was as shown in table 1 below. The dugsi were found to be most vulnerable, followed by the primary and secondary education and the least vulnerable were the individuals who had attained higher education. The table showing vulnerability by gender was as shown in table 19 below. The females were found to be more vulnerable than the males to effects of climate change.

Table 1: shows vulnerability by level of education and gender

	Dugsi	Higher Education	Primary	Secondary	Female	Male	Relationship
Drought	0.03	0.00	0.00	0.00	0.02	0.01	+
Inadequate food	0.26	0.00	0.00	0.00	0.20	0.31	+
Insufficient water	0.62	1.00	1.00	0.86	0.67	0.58	+
Poor access to health care	0.01	0.00	0.00	0.00	0.01	0.01	+
Poor health of livestock	0.08	0.00	0.00	0.14	0.09	0.06	+
Drought shocks	0.63	0.42	0.51	0.56	0.48	0.38	+
Diseases	0.63	1.00	0.64	0.55	0.69	0.63	+
Number of household	0.46	0.20	0.44	0.38	0.63	0.53	+
Number of animals	0.56	0.74	0.60	0.64	0.65	0.70	-
Home income	0.67	0.78	0.62	0.65	0.64	0.62	-
Vulnerability	1.49	1.10	1.37	1.20	2.8	2.59	

Discussion

Insufficient water

Individuals of all levels of education were affected by water scarcity as the major problem. The higher education and primary education individuals were the most affected compared to dugsi and secondary level of education. This may be because individuals, who have higher education prefer to seek high income jobs in the corporate world, as opposed to looking after livestock and water. This may explain why the higher education individuals were affected. The dugsi individuals on the other hand, were the least affected. This may be because, the individuals had the least level of education, which means that they solely depend on agronomy or pastoralism

as their source of livelihood and hence they are able to move from place to place in search of water for their family and animals (Hartman and Sugulle, 2009).

The problem of insufficient water was found to highly affect the females compared to the male gender. This may be attributed to the fact that the primary responsibility of looking for water in the Somali community is the women's' and in most cases, they are forced to walk for long distances in search of water. The women are also likely to use the water more, for both house chores and taking care of the children. The men on the other hand, usually benefit from the water brought by their wives and daughters into the homestead (Hartman and Sugulle, 2009).

Insufficient food

The dugsi were the most affected by the problem of insufficient food compared to the rest. This may be because since the dugsi had the least education, they are unlikely to get high income jobs or engage in activities that can increase or yield better produce from their plants and animals. Education enables one to learn new skills that can also be applied both in farm land and in taking care of the animals and since the dugsi lack these skills, which may be of food preservation amongst others. The problem of insufficient was found to affect a greater proportion of men compared to women. This may be attributed to the fact that the men are mostly the sole bread winners in the Somali community and this means that it is their primary responsibility to feed their children. The women on the other hand, may also chip in but since most of them are busy with house chores and taking care of the children, they mostly rely on the men to provide food for the family (Hartman and Sugulle, 2009).

Drought

The individuals who had the highest education were the most affected in the by 5 drought shocks, while the others were least affected. The dugsi individuals on the other hand, were most affected by four drought shocks. The proportion of individuals affected by 4, 3, 2 and 1 drought shocks were all less than 50%. All the education levels were highly affected in 2011. The higher education and primary were the most affected, while the dugsi and the secondary education individuals were least affected. The higher education was however not affected in these other years. The dugsi and secondary levels on the other hand, were also affected in 2014 and 2016. This means that the higher education individuals were only affected in one year, while the rest of the individuals were affected in the other years well. A significant relationship was found between the different level of education and

drought shocks. This means that the level of education plays a role in the number of drought shocks one receives in the study area.

Generally a higher proportion of women were affected by the drought shocks compared to men. A higher percentage of women experienced the drought shocks five time compared to men. For the four times drought shocks, almost the same proportion of men and women were affected. The three, two and one drought shocks on the other hand, affected more females than males. In the year 2011, more men were affected by the drought compared to the women. However in those other years, which were 2010, 2014 and 2016, the females were more affected than males. The findings of the study show that the women are more vulnerable to drought compared to the men. This may be attributed to the fact that they have the responsibility of taking care of their small children, who are also affected during drought

Number of animals lost

The primary education, had the highest proportion of individuals who lost 56 animals. This was then followed by the secondary education and dugsi. The higher education individuals had no proportion of people who had 56 animals lost. The individuals with higher level of education was also not affected by loss ranging from 40 to 50 animals and 30 to 40 animals. The individuals were all found to loss 20 animals, which was also a great loss but much less compared to the number of animals the other individuals lost. This implies that level of education is important as it enables one to develop strategies of how to minimize animal loss during drought. The females were more affected by animal loss compared to the males. A higher number of females lost 50 to 60 animals and 40 to 50 animals compared to males. This may be because the women are tasked with many responsibilities, which make it hard for them to pay more attention to their cattle compared to the men. The women need to take care of their children and do house chores as well, in addition to looking after the animals. This makes them more vulnerable to animal loss as the males usually have undivided attention when looking after their animals (Belay and Sugule, 2011).

Diseases

Malaria was found to highly affect the individuals of all the levels of education, as most of them had more than 90% of the individuals affected. The secondary individuals were however the least affected at 78.6%. Diarrhoea on the other hand, was found to affect all the individuals with higher education compared to the rest as 100% of the individuals were affected. The proportion of those affected was much lower in the other education levels as they were all less than 50%. Typhoid was also found to affect all the individuals with higher education

compared to those of the other education levels. This was contrary to the expected, as the educated individuals are expected to have better strategies of preventing the illnesses.

In general both men and women were highly affected by malaria. The females were however, found to be more affected by malaria compared to the men. The proportion of women affected by diarrhoea in the last 3 months was also higher compared to that of men. The women affected by typhoid was also higher. This means that the women were more vulnerable to the diseases compared to the men.

Vulnerability

The dugsi were found to be the most vulnerable to impacts of climate change, followed by the primary, secondary and lastly the higher education ones. The trend in vulnerability therefore indicates that the level of education influences the vulnerability of the individuals as the least educated individuals are more vulnerable compared to the most educated individuals. The females were found to be more vulnerable than the males to effects of climate change. This may be attributed to the fact that the females in the Somali culture are tasked with larger responsibilities compared to men. The women have the responsibiliy of looking for water, taking care of the children and doing house chores such as cooking amongst others. Whenever there is drought the women are forced to walk for long distances in search for water, which makes them more vulnerable to effects of climate change (Hartman and Sugulle, 2009).

Conclusion

The women were found to be more vulnerable compared to men, as they were greatly affected by problems that result from climate change, which include insufficient water supply, inadequate food and loss of animals compared to men. This may result from cultural practice of the Somali community, where the women are tasked with more responsibilities, which include: searching for water, doing house chores and taking care of children amongst others. In terms of level of education, the individuals with higher level of education were found to be less vulnerable to effects of climate change compared to those of lower level of education.

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