Local Knowledge on the Effect of Climate Variability on Human Health and Livelihood in Southern Ethiopia: A Qualitative Study

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Abstract

Background: The systematic collection and understanding of the local knowledge of communities can be used to formulate appropriate sector programs and interventions. It also allows scientists, researchers, and policymakers to design and implement appropriate mitigation and adaptation strategies. However, there is a lack of studies that explored the available climate-related local health and livelihood-related knowledge in Ethiopia in general and in the current study area in particular. Thus, this study aimed to identify the indigenous knowledge on the effects of climate variability on human health and livelihood of rural residents in Sidama Zone, Sothern Ethiopia.

Methods: A qualitative survey was conducted in July 2013 in eight kebeles of Sidama Administration Zone, Southern Ethiopia. Eight focus group discussions, with 8-9 study participants per group, were conducted. Data were collected using open-ended interview guide questions with identified themes. Each interview was captured by an audio recorder. The saturation of information was assured when no new information and themes were observed in the data as indicated. Data recording and transcription were followed by coding and categorizing using the OpenCode Version 3 software.

Results: The study participants revealed that climate variability has happened as a result of the destruction of the natural forest cover. Change in the precipitation pattern and increment of temperature was recognized as the main signs of climate variation. The main consequences were mentioned to be loss of water sources, frequent droughts, and health problems such as malaria, diarrhea, vomiting, and gastrointestinal disorders. Sanitation facilities have frequently collapsed as a result of climate variation, inducing floods and decomposition. The community had been participating in the adaptation and mitigation activities by planting indigenous trees and constructing climate-resilient sanitation by carving locally available stones.

Conclusion: Climate variability has multifaceted effects on human health and the livelihood of the community. Society had made some adaptation and mitigation for the problem. Therefore, intervention strategies affordable by the poor and agropastoralist community need to be expanded with the inclusion of appropriate messages. Besides, strategies need to be designed taking into account existing local knowledge that can be leveraged for future adaptation and improvement strategies.

Keywords: *Climate variation; Indigenous knowledge; Sidama zone; Southern Ethiopia*

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Introduction

Indigenous, traditional, and local knowledge refers to knowledge developed over time and linked to a specific place, culture or society. It is dynamic and exists among people living as a part of natural ecosystems (Nakashima *et al*., 2013). The knowledge set is influenced by the previous generations' observations and experiments and provides an inherent connection to one's surroundings and environment (Mundy and Lin Compton, 1991).

Climate variability refers to changeability in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events (IPCC, 2014). In the era of multifaceted challenges of environmental and climate variability, public awareness and useful information on climate change is crucial (Anteneh and Kumie, 2010).

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Understanding the local knowledge of communities helps to formulate appropriate sector programs and find interventions for climate-sensitive infectious disease (Haque *et al*., 2012). Indigenous knowledge has also been the basis for local-level decision-making in many rural communities and has value for scientists and planners striving to improve rural conditions (Mundy and Lin Compton, 1991).

Indigenous knowledge has been very useful in climate change mitigation and adaptation strategies and has added value to the development of sustainable improvement on climate change and adaptation strategies (Doss and Morris, 2000, IPCC, 2014; Nyong *et al*., 2007). Local people in Nepal, for instance, have had knowledge of a change in climate variability, rainfall pattern, vegetation composition, animal breeding, and farming, and increased human health risks and diseases (Chapagain *et al.,* 2009). In the African Sahel as well, the local populations, through their indigenous knowledge systems, have developed and implemented extensive mitigation and adaptation strategies to reduce their vulnerability to climate variability and change and their knowledge has been applied to weather forecasting and vulnerability assessment (Nyong *et al*., 2007).

Ethiopia has experienced massive environmental degradation due to natural factors, unwise use of its natural resources, unsound ecological practices, and population pressure (Woldu, 2008). In the country, warming has occurred across many of the places (IPCC, 2007), and climate change has affected the sensitive systems such as agriculture, health, and water; and the problems are expected to increase unless the right adaptation and mitigation measures are taken (Simane *et al*., 2016). In addition to these, climate change-related health problems, such as mortality and morbidity due to floods and heatwaves, vector-borne diseases, water-borne diseases, meningitis, and air pollution-related respiratory diseases are increasing in Ethiopia (Simane *et al*., 2016). Specifically, the effect of climate change was reported in our study area. According to the reports of the Regional Health Bureau and the zonal health department, climate-sensitive diseases such as childhood diarrhea are among the top five diseases in the area. Outbreaks of acute watery diarrhea which resulted in the morbidity of thousands of several people have occurred in the region since 2006 (Hameso, 2012; FMoH, 2011).

The systematic collection of information in a community regarding local knowledge helps scientists, researchers, and policymakers to design and implement appropriate adaptation strategies (Haque *et al*., 2012). However, in Ethiopia, there is limited evidence on the community's awareness of climate variability and related local knowledge (Acquah, 2011); moreover, there is hardly any information about the society's perception of the impact of climate variability on health. Therefore, our study tried to identify the local knowledge about and perception of climate variability and related health problems in rural Sidama Zone, Southern Ethiopia.

Materials and Methods

Study setting and period

The study was conducted in July 2013 in SidamaAdministration Zone, Southern Ethiopia. The administrative zone (the currentSidma Region) consisted of 19 rural districts and two town administrations.According to 2017 projected report of the Central Statistical Agency (CSA) (CSA,2013), The zone had a total population of 3,668,304, with 1,849,128 male and 1,819, 176 female. The average family size of the study area was 4.99 (Ethiopiaand International, 2012). According to the report of the Sidama Zone Financeand Economic Development Department, inappropriate utilization of forest andvegetation cover and erosion are two of the main problems facing the Sidamazone. Agricultural production with traditional farming is the predominantactivity of the area. The rural residents depend mainly on 'Enset', coffee, andmaize for consumption as well as for commercial purposes (Deqamo, 2011). The study wasconducted in 8 kebeles (kebele is the lowest administrative unit and eachkebele consists of around five hundred families or the equivalent of 3,500 to4,000 persons) selected from five districts (Hulla, Dale, Wondogenet, Boricha,and Loka Abaya). The districts were purposefully considered as they serve asthe demographic surveillance and health research center of Hawassa University.They are composed of high land, moist midland, dry midland, and low lands. Twokebeles were selected randomly from each agroecological category to obtain theeight kebeles.

Study design and population

A qualitative method with a phenomenology design was employed to identify the climate-related observational experiences of the rural community of southern Ethiopia. The study population included all male and female adult rural residents in the zone and who aged between 25 and 87 years. The study participants were selected purposefully from the eight randomly selected rural kebeles in order to keep the quality and quantity of the data found to be adequate for the study. During the selection, the study participants were briefed on the objective of the study (recruitment guideline), and the study procedure. In this study, younger participants were included mainly to reflect the current adaptation and mitigation-related activities. The study participants lived more of their life in the stud area.

Methods of data collection

Data were collected using Focus Group Discussion (FGD), which is the most common type of qualitative data collection technique. A totalof 8 FGDs (one in each kebele) were conducted using the heterogeneous technique,considering the age, sex, and residence of the study participants. The number of participants in each group ranged from eight to nine.

Before the data collection, discussions were made withthe local health extension workers, agricultural development agents, kebeleadministrators and the districts' health office representatives to get intouch with the study participants and arrange the place and time of the FGD.The FGDs were facilitated by two trained data collectors: one moderator and onenote-taker, both with a Masters's degree in Public Health.Data were collected using an interview guide withopen-ended questions. The guiding questions that considered matters aboutdeforestation and land-use change, drought, change in precipitation and temperaturepattern, health condition of the people, water, sanitation, hygiene condition,and experience on any adaptation and mitigation measures were prepared. Aquiet place with suitable seats was arranged, and the moderators assured thatthe setting didn't bias the information being collected and that all the participantsfelt comfortable and engaged with the discussion. As the questions focused onthe effects of climate change and health, they were not known to be sensitiveto gender, age, and hierarchy. Therefore, men and women, as well as youth and the elderly, were allowed to participate in an FGD. The moderator tried toforward the required questions to the participants. Cross-checking of emergingideas and probing was done to improve the quality and quantity of the dataduring the discussion. In addition to taking notes, each interview was capturedby an audio recorder. The saturation of information was assured when no newinformation and theme were observed (Saunders *et al*., 2018). The datacollectors achieved the level of saturation by being open for the participantsto give their views on the issue raised.

Data quality assurance

The discussion guides were developed in English and translated into local languages and retranslated back into English to ensure its consistency. Data collectors were selected based on their familiarity with the local language and culture. A two days training was given for the data collectors by the principal investigator and by another qualitative research expert from Hawassa University College of Medicine and Health Sciences. The discussion was made with the local (Sidama) language and recorded with an audio recorder. Then, the tape-recorded interviews were transcribed to the local language and were later translated into English.

Data processing and analysis

The discussion was made with the local (Sidama) language and recorded with an audiorecorder. Then, the tape-recorded interviews were transcribed to the locallanguage and were later translated into English. The analysis was started inthe field by taking detailed notes from the respondents and discussants. Therefore,our data consisted mainly of focus group transcripts and expanded field notes.Two members of the research team independently coded the transcripts,following the objectives and emerging themes from the data. Findings were thencategorized into different themes. A total of 7 themes were identified duringthe coding and an explanation was made based on them; then interpretation of theresults followed. The data were entered, coded, and analyzed using OpenCodeVersion 3 software.

Ethical consideration

Ethical clearance (Protocol number: 052/12/SPH) was granted by the Institutional Review Board of the College of Health Sciences of Addis Ababa University. Permission to conduct the study was obtained from the Southern Nations Nationalities People Region Health Bureau, Sidama Zone Health Department, and district health offices. During data collection, participants were informed about the purpose of the study, and written consent was obtained; confidentiality was maintained and the right not to participate or withdraw at any time as agreed.

RESULTS

Demographic characteristics of study participants

The total number of participants was 67, of which 46 (68.7%) were male. Over 40% were aged 50 years or older, and 22.4% were aged 50-59 years (Table 1). All the participants were farmers and agropastoralists in occupation.

Table 1: Age and gender distribution of the qualitative study participants, Sidama Zone, Southern Ethiopia, 2013. (n= 403)

Age category	Frequency			Percent (%)
	Male	Female	Total	
25-30	3	3	6	9.0
31-39	8	7	15	22.4
40-49	2	2	4	6.0
50-59	13	2	15	22.4
60-69	8	3	11	16.4
70-79	6	1	7	10.4
80-89	6	3	9	13.4
Total (%)	**46 (68.7%)**	**21 (31.3)**	**67**	**100.0**

The mean, minimum and maximum time elapsed for the FGDs, including thetime for the introduction, was 81, 70, and 87 minutes, respectively. The youngerparticipants were included mainly to reflect the current adaptation andmitigation-related activities. In this study, the participants expressed their experiences and viewson the current land-use change, climate variability, drought, loss of landproductivity, human and animal health, and mitigation and adaptationactivities that had been happening in their localities.

Loss of natural ecosystem and wildlife

The study subjectsanonymously argued that the population has been increasing and trees and forest covers have beenremoved to make the lands free for agriculture and construction of houses.Besides, the logs were required for the construction of housing and biomassfuel. Most of the predominant and commonly known trees such as 'Wanza' (Cordia Africana), 'Zigba' (Afrocarpus gracilior), and 'Bisana' (Croton macrostachyus) have disappeared as a consequence.

> A 75- year- old woman from Chuko kebele said*:"The forest that existed in previous years has disappeared now and as a consequence, rainfall has decreased. This is due to population increment".*

Also, other wild fruit-bearing trees such as 'Dokma' (*Syzygium guineense*) have vanished.

> *"When we were young and looking after our cattle, we used to eat wild fruits like "Doqma" (Syzygium guineense) and spend the whole day without additional food. But now, they are no more present in our area"* a 42- year- old man from Wondogenet District, Chuko Kebele.

Climate variability

The participants anonymously claimed that there are visible changes in the climate as a result of the loss of natural ecosystems. The temperature increment, erratic rainfall, drought, and dried streams are among the living indicators of climate change. Areas that used to be cold have now become hot, and the local population has been obliged to change the crops they have been growing.

> For instance, an 80-year-old male from Wirema Kebele mentioned: "*We have heard*

and seen about climate variation. For example, our area was colder and rainy, but now it has become hotter. As a result, we have started cultivating crops which have not been common in our area".

An 80-year-old man from Wireman Kebele added: *"Previously we did not cultivate maize, but now as a result of the increment in temperature, we are producing it''.*

Rainfall fluctuation

The participants believed that there has been a fluctuatiion in the period and intensity of the rainy season. The later the rainy season enters, the earlier it exits and the less intensive it is.

"In my previous experience, the rain used to be much in intensity, as compared to the present time, and raining used to start in March and end late. However, now the rain starts in May and leaves early", a 65- year-old man from Debub Mesenkela Kebele, Dale District said.

Migration of wild animals and birds

The loss of the natural forest resulted in the migration of the wild animals leaving in it.

"Those wild animals such as hyena, elephant, fox and others, which used to live around our village have disappeared as they don't have anything to shield", an 87-year-old man from Chelbessa Kebele, Hagereselam district witnessed.

The increasing the temperature has dried the natural ponds, which inturn has made migration of birds like flamingos.

"Because of the increasing heat, the marshy areas which existed downside of our village, near the rivers have dried, and birds such as flamingo which used to depend on it has disappeared as they migrated to Hawassa." a 67 years old man from Chuko Kebele, Wondogenet District.

Loss of water bodies

Natural spring water sources have dried due to the loss of trees and vegetables to deforestation and people are compelled to drink surface water, which is more likely unsafe.

"Water is available when there is forest cover. However, the water quantity is decreasing over the last 20 years" a 67- year-old man from Wondogenet District, Chuko kebele explained.

"Those springs which used to flow under the bamboo the tree has dried because the bamboo is cut and finished" a 45- year- old man from Wirema Kebele, Hagereselam replied.

Due to lack of water, people are obliged to use surface water such as pond water for domestic and drinking purposes and the community is getting ill of many waterborne and water-washed diseases.

"Once a health professional came to my house, and he refused to wash his hands with the water we are drinking every day. We are drinking this water that he feared to wash his hands" a 60- year- old man from Loka Abaya District, Argeda Kebele said.

Landslides and flood

In areas deforested for agriculture, there have always been landslides, of which some cost human life.

A 54- year- old resident of Chiko kebele, Wondogenet district said *"Our village is surrounded by hills, which were covered by forest and flood was not a problem. However, because of the loss of the natural forest cover, we have been attacked by repeated flooding… eight people died as a result of a landslide".*

Loss of productivity of agricultural lands animals

All the participants confirmed that soil fertility and land productivity have been decreasing from year to year as a result of climate variation, and there has been a shortage of food.

"In my age, we did not finish scratching one 'Enset' t*hroughout the day as it is big. We used to cut the root of the inset tree into 8 places. But now we cut it only into two, as it is smaller," a 75- year- old woman from Hulla district, Chelbessa kebele reported.*

"Previously, one plant of maize used to produce 4 heads, but now it can't give a proper

one head*" P1, an 80- year- old man from Loka Abaya Woreda, Argeda Kebele told.*

The participants also experienced drought which has been increasing and made them starve. Only few of the seeds they have planted have grown up.

"Around this area, severe drought had happened and we lost many of our domestic animals. As a consequence, we had to seek food and water support from the government, however …. Drought is happening every 3 years", a 60- year- old man from Argeda kebele, Loka Abaya district mentioned.

Animal products such as milk and butter have greatly decreased. This is because cows do not have enough pasture.

"There was enough grass (pasture) for the cattle to feed before, and they were producing enough quantity of milk and butter. But now, because of lack of pasture, the cows do not give enough milk and butter", a 75-year-old woman from Wondogenet District, Chuko kebele said.

Another respondent insisted that they used to store butter for later use as our cows produced surplus milk.

"We used to store butter from our cows and open the container after four years. But now the butter products from cows is decreasing", explained an 80- year- old woman from Argeda Kebele, Loka Abaya district.

Health problems related to climate variation

Diseases such as malaria, diarrhea, vomiting, cerebral malaria, Acute Watery Diarrhoea (AWD), gastrointestinal disorders, gland inflammation, syphilis, and hemorrhoid were considered by the participants as direct and indirect health effects of climate variability. The participants said that they used to resist diseases as they had enough food to eat as compared to the current condition.

"Previously when people caught by malaria, they did not go to bed easily because of the sickness as there was enough food to eat, and they got up without any treatment" P6, an 85 years old man from Dale District, Mesenkela Kebele.

Furthermore, animal diseases have also been on the rise. Most of the participants agreed that 'Gendi' or 'Hoche Shilo' (trypanosomiasis) is prevalent and killing their animals.

"We lack food and resources to support our children in their education as Gendi and Shilo (trypanosomiasis) are affecting and killing our cattle," claimed an 80-year-old man from Boricha, district and Dararashae kebele.

Plant disease is also on the rise.

"These days there is a disease affecting 'Enset', which is transmissible through the wind? It has become very difficult", a 40-year-old woman from Hulla District, Chelbessa Kebele spoke.

Sanitation infrastructure challenge

The respondents revealed that the community is facing lack of durable latrine construction materials and even grass to cover the superstructure of the latrine facility. Durable and strong logs (e.g. "kench") are not affordable by many of the families.

"Our main problem to construct latrine is lack of good quality wood. That is why we dug a pit up to four times per year", said a 54 year-old-man from Loka Abaya District, Felka Kebele.

"Even grass is not available in the area, so we have to use leaves, and when the leaves are dry and lodged, the latrine is open," a 55-year-old man from Boricha District, Alawarfie Kebele replied.

Even if they got the financial resources to construct good quality latrines with more durable materials they are not easily available in the market and environment as a result of a loss of the forest cover. As a result, strong woods are not easily available in the environment, and if they are available, it is prohibited to cut them.

Prediction

Participants indicated that climate-related events would be predicted taking into account current local

conditions. Although now it is not common, the dry wind was associated with the lack of rainfall. It was possible to forecast the arrival of summer or winter by listening to the songs of the birds, but that is no longer the case today. Prayers were served to predict the coming year's rainfall condition. Some did have the understanding that they get metrological information from agricultural extension development agents.

Mitigation and adaptation measures

The participants have agreed that mitigation is required to halt the existing climate change-related problems. Emphasis has been given to the reduction of land degradation and deforestation via plantation. The study subjects said that plantation is important to reduce food shortage and disease prevalence.

> *"Unless we plant trees, the lack of food and the prevalence of the diseases will continue" thought A 35-year- old man from Dale Woreda, Mesenkela Kebele.*

> *".... to solve the lack of rain, we are working on catchment development and soil and water conservation activities", a 54 -year-old man from Wondogenet Woreda, Chuko Kebele told.*

The community is taking adaptation measures to tackle the problem of latrine construction material. For example, in some places, households have used locally carved stone slabs, which are resistant to decomposition and more durable. They are also using sacks and plastic sheets instead of leaves for shielding the superstructure, as they are more durable.

Discussion

In this study, the rural residents of southern Ethiopia reflected their perception of the climate variation and its effect on the environment, livelihood, and health. They said that they have observed a reduction in rainfall intensity with an erratic onset and cessation time of rainfall, loss of forest cover (including indigenous plants), drying of streams and springs, increasing frequency of drought temperature, reduction inland productivity and animal products (such as cow milk and butter), change in disease patterns with an increment of certain types of human and animal diseases. This experience was also shared by other communities in different parts of Ethiopia, where the local communities recognized changes such as declining in rainfall amount and an increase in drought frequency, recurrent drought, feed scarcity, crop failure, and low yields leading to food insecurity (Abate, 2016; Bogale and Bikiko, 2018).

A scientific also supported the views of our study participants. Rapid population increasement resulted in environmental degradation with subsequent severe soil loss, low and declining agricultural productivity, continuing food insecurity and rural poverty, reduced availability of potable water, lessened volumes of surface water, depletion of aquifers and loss of biodiversity (Gashaw, 2017). Also, new settlements, agricultural practices and land grazing expose animals and humans to new environments, create supportive habitat for zoonotic parasites, and leads to water pollution and food contamination to result in several water-borne diseases (Lallo, 2012). A review report revealed that climate change has affected the sensitive systems such as agriculture, health, and water and expected to continue to magnify without the right adaptation and mitigation measures (Simane *et al*., 2016).

Local empirical evidence also supports the communities' the argument in that there was a projected increase in temperature and reduction in rainfall with a reduction in crop yields (Adhikari *et al*., 2015). Besides, warming also occurred across much of Ethiopia (IPCC, 2007). Erratic precipitation and the increment in temperature was observed, and the main climate hazards in Ethiopia were associated with rainfall variability and its associated droughts and floods (Conway and Schipper, 2011).

The community's reflection on the reduction of animal products such as milk and butter is supported by another similar research finding (Rojas-Downing *et al*., 2017). This might also be due to the fact that excessive temperature and humidity are likely to affect milk products (Key *et al*., 2014). In addition, the scorching weather and lack of rain could damage crops and the grass to feed farm animals. A recent review report also strengthens the argument that climate change and variability greatly affects the rain-

fed agriculture and the livestock system in Sub-Saharan Africa (Tadesse and Dereje, 2018).

According to the study participants, wild animals and birds migrated because of the loss of their natural habitat. Studies revealed that this is because climate change will have many effects on migration by altering habitat, shifting seasonality, changing resource availability, and increasing disturbance (Moore, 2011). Temperature changes and other climatic variability strongly affect the morphology, abundance, distribution, and migration patterns of plant and animal species in terrestrial and marine systems alike.

The community's view on the increase of various diseases lie with viable evidence. By listening to the songs of the birds, a recent review has shown that, in Ethiopia, mortality and morbidity due to floods and heatwaves, vector-borne diseases, water-borne diseases, meningitis, and air pollution-related respiratory diseases are increasing (Simane *et al.,* 2016). In southern Ethiopia, including the study area, outbreaks of AWD which resulted in the morbidity of thousands of people have occurred since 2006 (FMOH, 2011). In our study area, childhood diarrhea, syphilis, hemorrhoid, and other diseases have also shown an increasing trend (Beyene *et al*., 2018).Though there is no strong scientific evidence on its association with climate variability, the participants' claim for an increase of syphilis. Recent findings where two hospital-based studies in the study area revealed a higher seroprevalence of syphilis among pregnant women (5.1% in Yirgalem Hospital and 7.3% in Hawassa Referral Hospital both in South Ethiopia) (Amsalu *et al*., 2018; Shimelis *et al*., 2015).

Moreover, in the study area, the climate variation negatively affected the sanitation system. One of the main challenges was the lack of construction material, particularly strong wood, for latrines. Strong wood such as 'kench' is either not available or has been prohibited by the government to cut the trees down. Consequently, they had to buy a stronger locally available wood ('kench') to make a toilet slab or a proper superstructure. However, 'kench' is not affordable for many of the families or not available. Instead of cutting trees, the community's practice of using more durable locally carved stones as sanitation slabs are practices that need to be encouraged.

Lack of grass that could be used to cover the roof of the latrine superstructure also affected the quality of the latrines built. In the absence of grass, people apply leaves, and when the leaves dry and lodged, it becomes open. Flooding was also one of the major issues that destroyed sanitation infrastructures. The current sanitation promotion approach using community-led total sanitation and hygiene (CLTSH) as a tool encourages households to construct their latrines with locally available and affordable materials, mainly simple pit latrines. However, there has not been a provision of sanitation infrastructure (technology) options, which the community can choose and adapt based on their playing ability. These suggest that the community did not have professionals who can help them select the latrine construction sites and show them how to construct a relatively durable latrine in flood-prone places and in places where the soil is not stable. The study participants mentioned that they have been participating in different adaptation and mitigation activities such as land preservation, indigenous treeplants, and construction of climate-resilient sanitation infrastructures to tackle climate variation-induced changes. Due to the absence of durable wooden materials as a consequence of deforestation and prohibitions to cut trees, people used locally carved stone slabs that are resistant to decomposition and more durable. This implies that the communities had their adaptation strategy. Similar studies also suggested that people have a history of accumulating sufficient knowledge of how the adverse impacts of climate change could be reduced through both mitigation and adaptation, though not in an effective manner (Nyong *et al.,* 2007; Naess, 2013).

In Nepal too, as a response to the effects of climate variation, the community was able to build climate resilience into community infrastructures supplying drinking and irrigation water, traditional bridges, and trails (Karki *et al*., 2015). Studies have shown that the better the community understands the effect of climate variations, the better they participate in the mitigation and adaptation activities (Naess, 2013). For instance, in Hadiya, Ethiopia, a significant relationship was found between perceptions of farmers towards temperature changes and farming experience (Bogale and Bikiko, 2018). Pastoralists in Gujizone, Ethiopia, had many innovative adaptation responses and practices such as crop production strategies,

grazing, and herding management looking for alternative income and diversification options, and using the traditional mutual supporting system, and frequently selling of livestock (Abate, 2016). The fact that the knowledge of health professionals and the public becomes high in Asia and African countries (Levy and Patz, 2015) could make use of the local indigenous climate variation-related knowledge for mitigation and adaptation activities. This study had its strengths and limitations. By using the qualitative study design the effect of climate-induced environmental changes, the ways the community struggled to construct latrines, and the various adaptation and mitigation testimonies have been explored. The study has also got its limitations. The fact that both men and women, without age restriction, were allowed to reflect their views together might hinder the freedom of some participants to speak; however, the objective of the study was well explained and questions provided were not sensitive ones, and views on their common problem were sought. There might have been a distortion of ideas during the transcription and translation process. The use of FGD for phenomenology study was one of the limitations. Participants might have also exchanged information before the discussion. To overcome the limitations, however, experienced moderators facilitated the data collection process.

Conclusion

The study showed that the community has realized the existence of climate variation which occurred as a result of the destruction of the natural forest cover. Based on the community, climate variations were responsible for the reduction in land productivity, recurrent drought, drying of water sources, migration of birds and wild animals, different types of human health such as malaria, diarrhea, and abdominal problems. Besides, the major source of food, "Enset", has been affected by drought. Lack of latrine construction wooden materials and the collapse of sanitation systems as a result of climate variation induced floods and decomposition of construction were common. Delivery of improved and climate change resilient sanitation infrastructures and hygiene promotion suitable for the agropastoralist community may have significant importance on the child health and survival in the study area. Further interventional activities need to consider the existing indigenous knowledge that can be exploited for future adaptation and mitigationstrategies.

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Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors contributed from research design to write-up.

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