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CLIMATE VARIABILITY PERCEPTION AND ADAPTATION: DIFFERENCES BETWEEN MALE AND FEMALE CATTLE OWNERS

Fafa Oggo Cham[*,1,2], Prof. Iyabode Comfort Alemede[1], Dr. Arss Secka[3], Dr. Sidat Yaffa[4], Mamma Sawanneh[4]

[1]Federal University of Technology, Minna (FUT, Minna), PMB 65, Niger State, Nigeria

[2]Department of Livestock Services, Abuko, The Gambia

[3]International Trypanotolence Centre, P. M. B 14, Banjul, The Gambia

[4]University of The Gambia, School of Agriculture and Environmental Sciences, Brikama Campus, The Gambia

*Corresponding Author

ABSTRACT

Most research works on the impact of the climate variability on livestock health are knowledge of scientific scholars. This paper aimed at determining cattle owners' perception on the impact of climate variability on cattle health, especially with intent to compare views by gender. The study was conducted in the Upper River Region of The Gambia, and face-to-face individual questionnaire were administered to 187 respondents from three out of the seven districts of the Region. In addition, six focused group discussions (3 for men and 3 for women) were separately held with the intent of triangulating the information received from individual respondents. Participatory rural appraisal tools including pairwise ranking and matrix scoring were employed. Frequency analysis and Pearson Chi-Square test were generated for all question statements, setting significance at the standard p value < 0.05. The category sex was used as dependent variable on questions relating to perception, impact and adaptation and where there were association, a one-way ANOVA test with Turkey HSD Post Hoc analysis carried out to establish significant difference between the means. Although there was no gender effect on all questions relating to trend of climate variables, there were significant gender relationships with most of the question concerning climate variability impact and adaptation. Unfortunately, female cattle owners were more or less disadvantage in all cases. Thus, there is the need for all interventions aimed at minimising climate variability impacts to be gender sensitive. There is also the need to massively conduct climate variability awareness campaigns.

Keywords: Adaptation; Climate variability; Cattle owners; Gender; Impact; Perception

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

1. INTRODUCTION

As a developing nation, The Gambia contributes relatively very little in the global greenhouse gas emissions, less than 0.01 % (Intended Nationally Determined Contribution [INDC], 2017), yet its development agenda could be seriously impacted by the effects of climate change. Already droughts, floods, increase temperatures, shortened rainfall lengths are recorded (Jaiteh & Sarr, 2011; Yaffa, 2013) and these are likely to occur in future. Owing to the subsistence nature of the agricultural production system, characterised by low investment and being highly rain fed dependent, it is unequivocal that these mentioned phenomena will affect agricultural production and productivity.

Agriculture is often referred to as the backbone of the Gambian economy, the livestock sector taking a central role. Even though the contribution of the livestock sector in enhancing crop production is not accounted for, according to the Gambia Bureau of Statistics (GBoS) 2013 report, it's still contributing up to 9 % of the National Gross Domestic Product (GDP) and 29 % of the Agricultural Gross Domestic Product (AGDP). Besides, to the rural farmer, livestock is not only a means to save wealth to ensure food security but also serves as a form of earning honour, respect and prestige in society. Although very crucial in improving the livelihoods of rural and peri-urban dwellers, livestock production is still traditional, rendering it prone to climate variability. The statement that livestock production is amongst the most climate sensitive economic sectors (Kimaro & Chibinga, 2013) may not be an understatement as climate variability led to feed and water inadequacy and to the introduction and re-emergence of diseases (Rowlinson 2008; Megersa *et al*., 2014) all of which negatively affect the sector.

As the old adage says 'Necessity is the mother of invention'. These negative impacts of climate variability forced farmers to change life styles or production systems to minimise the effects. In addition, governments and Non-Governmental Organisations (NGOs) do intervene to help farmers curb or minimise consequences of climate variability. Fortunately, or unfortunately, it is likely that these interventions are often not gender sensitive. Usually, a single approach in reducing climate variability effects on both men and women is employed. This may largely be due to the assumption that women and men are not only affected by climate variability in the same way but also have the same perception and adaptation measures to climate variability impacts. Rightly or wrongly, the common approach of helping men and women cattle owners reduce the impacts brought about by climate variabilities may not be suitable for both sexes. These interventions and many other interventions would be more meaningful only if the perception, impact and adaptation to climate variability of both male and female cattle owners are understood. In this regard, this article examines whether male and female cattle farmers are different in perception, impact and adaptation to climate variability as this can help in more

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

effective formulation and implementation of programmes that are aimed at reducing climate variability impacts on cattle owners.

There are research works on gender and climate, however, it is still not controversial to state that there is not much research on gender and climate change (MacGregor, 2010). Climate change causes and effects are gender non- neutral not only because of the difference in experience by men and women but also that women are more severely affected than men (Aguilar, 2006; Demetriades & Esplen, 2008). Climate change impact affects all countries, although its distribution amongst areas, generations, age classes, income groups and gender is different (Intergovernmental Panel on Climate Change [IPCC], 2007). The WFP *et al.* (2009) cited by Kimaro and Chibinga (2013) also recognised that the vulnerability of women to climate change is largely associated to their high exposure to natural hazards, their direct dependence on climate sensitive resources and their inadequate ability to adapt to and manage with climate change.

Though not many, there is few research on the intersection between livestock and climate variability. However, gauging cattle owners' perception on the trend of climate parameters, how variability affects their cattle health and determine how they cope with these effects, specially to comparing it by gender is by far and large a research gap. This paper further seeks to not only find out cattle owners' thoughts about climate variability trends, how are their cattle health affected by the changes and how are they are coping with the effects but also with the intention of comparing by gender.

2. METHODOLOGY

The Upper River Region, The Gambia was subjectively chosen for this research due to its high livestock population. Nineteen villages (5, 6 and 8 villages in Wuli East, Sandu and Kantora districts, respectively) were randomly selected for the interview with a criterion of not less than 200 cattle in a village. A multiple tier stratified random selection technique was employed to select a random sample of individual cattle owners for questionnaire administering. First, of the seven districts, Sandu and wuli East (in the north) and Kantora (in the south) were randomly selected by means of lottery. The names of all the districts were separately written on a small piece of paper and wrapped. Those in the south bank were put in a pot and those in the north bank in another pot. A six-year-old boy was called to select two papers from the pot that contained the districts in the north and one from the pot that contained the districts in the southern part. Of the three districts chosen for the survey, two districts are in the northern part of the region based on the meteorological report that the north eastern part of the country receives the least amount of rainfall. In the second stage, nineteen villages (5, 6 and 8 villages in Wuli East, Sandu and Kantora districts, respectively) were selected. A stratified random selection was carried out to select the villages. These villages represent about 45 % of the number of villages

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

with cattle population of at least 200 and were obtained from the 2015 Contagious Bovine Pleuropneumonia (CBPP) Vaccination Campaign Records of the Department of Livestock Services. Names of all the villages with the right criteria were listed on a piece of paper separating them by district. The first village on each list was selected and then every other second village counted. At the village level, randomized selection of the herds was done. The selection of the herds followed the same procedures as that of the district selection except that the drawing of the herds was done by another person. The cattle ownership of each selected herd was established by sex. The manager of each selected herd provided the names and sexes of all the cattle owners in his herd. Fifty percent of male and female owners for each herd were selected and was based on who is available or most accessible. In some herds, the fifty percent target was not met because the supposed respondents were not available. Finally, 187 respondents were available for the survey.

Cognizant of the high illiteracy level of cattle owners, face-to-face interview was deemed the most effective form of administering the developed questionnaire. Besides, face-to-face interview allows for more in-depth discussion of the interview questions, however, it limits the sample size and breath (Cox, Wendy, Gardner, Lauchlan & Fraser, 2015). The time taken for in-depth discussions and to meet local protocols consume a lot of time, thus limiting the number of respondents that could be reached within a specified period. The questionnaires, which comprised both qualitative and quantitative question were first drafted, edited, pretested and necessary adjustments made before it was finally adopted. Although the questions were written in English, the interviews were done in either *Mandinka* or *Pulaar* depending on what the respondent understood and all respondents were met at their respective homes. M*andinka* and *Pulaar* are local languages spoken in The Gambia. To avoid misinterpretation of the questions, an orientation programme was organised for the field workers that participated in the survey before the exercise.

The questionnaire was divided into four section: sociodemographic, perception, impact and adaptation. Section one, which dealt with the sociodemographic issues looked at name, age, sex, village, district, experience and number of cattle own by the respondent. The second section asked questions about the perceptions of cattle owners on climate variables like temperature, rainfall and wind speed, stating if these climate variables are increasing, decreasing or not changing. In the third section, cattle owners' views on the impact of climate variability on cattle health were examined. This section intends to ascertain how respondents think variabilities in rainfall, temperature and wind affect cattle health. Another motive of this section was also to know if respondents have done something to deal with variabilities in temperature, wind and rainy season. If respondents answered in the affirmative, a follow-up question of "how do you deal with it" was asked. On the contrary, if the response was no the question "why have you not

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

done anything" was asked. The fourth and final section explored how cattle owners adapt to the impacts of climate variability. The purpose of the survey, which was written on the questionnaire was clearly explained to all respondents and was also emphasized that participation was completely voluntary.

Adapted from Mertz, Mbow, Reenberg and Diouf (2008) with some modification, focused group discussions (FGD) were held to triangulate some of the information obtained from individual respondents. In each of the 3 selected districts, two FGDs (one for males and one for females) were carried out. The discussions with the males and females were separately held to avoid influence of responses by either side thus enabling comparison between gender. In each village, the meeting with the women was held before that of the men. Participatory Rural Appraisal (PRA) tools including proportional pilling and pairwise ranking were employed. Ranking of adaptation strategies according to the mostly practiced strategy by means of pairwise ranking was carried out during the focused group discussion. Pairwise ranking is a participatory rural appraisal tool used to systematically compare various options by comparing the options in pairs (Gay, Stubbs & Galindo-gonzalez, 2016). A list of possible options is constructed and placed in a matrix table comparing each item to the other items individually and then the number of times it was chosen is summed. The item with the largest sum is deemed to be the most important item. As the participants try to compare a pair of options, they gave reasons for choosing one option at the expense of others. Where reasons were not given, the moderator of the session asked participants to explain their reasons for the choice they made. At times there are differences in opinion amongst participants but consensus was always reached. The adaptation strategies were driven from the answers given by individual respondents when answering the question on adaptation measures. Proportional pilling adapted was from Watson (1994), to determine changes in certain climate parameters and effects including temperature, wind, rainfall, wind speed, disease outbreaks and cattle mortality. During this session, various symbols including water, bone, dry and fresh leaves, charcoal, old lamps and battery were used to represent the options. For the three different periods, lines were drawn on the ground; 10 lines representing 2008 – 2010, 5 lines meaning from 2011 to 2013 and 1 line indicating the period from 2014 to 2016. The volunteer participants were asked to first identify the symbols and the lines before sharing the 10 stones in the different periods. This was done to ensure that participants understand the meaning of the symbols and lines before making their choices. The village heads and president of women groups were contacted for the selection of participants and agreeing on the venue and time of the meeting. The participants' selection criteria were mainly cattle ownership and willingness to share knowledge with the research team.

Frequency analyses and Pearson's chi-squared test were generated for all question statements and significance was set at the standard P value < 0.05. The category sex was used as dependent

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

variable on questions relating to a) perception on climate variability b) effects of climate variability and c) management of the effects of climate variability. The formula used was thus;

$$X^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(O_{i,j} - E_{i,j})^2}{E_{i,j}} \qquad (1)$$

Where r = row, c = column, O_{ij} = observed data and E_{ij} = expected data

Where there were associations, a one-way ANOVA Test was also conducted and Turkey HSD Post Hoc analysis carried out to separate treatment means, using the formula;

$$f = \sqrt{\frac{\frac{\sum_i (m_i - m)^2}{k}}{SD_{intra}}} \qquad (2)$$

Where m_i is the mean of group i, m is the mean of the means, k refers to number of groups and SD_{intra} is the within-group standard deviation.

$$a' = \frac{a}{g(g-1)^2} \qquad (3)$$

Where g is the number of categories of the factor whose categories are being compared.

However, Post hoc test could not be performed for some variables because they were either less than three groups or were fewer than two cases. The responses to questions on years of experienced in cattle management, number of cattle owned, age of respondents and the estimated annual cost on treatment were transformed into categories during the analysis. The mathematical formula to determine the width of the category was employed, which is thus;

$$\frac{\text{Maximim} - \text{Minimum}}{\text{Number of category}} = \frac{\text{Range}}{\text{Number of category}} \qquad (4)$$

To compare cattle owners' perceptions on climate variability with meteorological data, standardized anomaly index was constructed. Although there is no absolute truth in choosing the reference interval, the 30-year period normally chosen by climate scientist was adapted for this study. The mean and standard deviation of the entire observation that is the climatology (1981 - 2010), year 2014, 2015 and year 2016 were computed. The formula for the climate index anomaly is applied. Thus the formula;

$$YYi = (Q_I - Q) / {}^{\sigma}X \qquad (5)$$

Where

YYi is the anomaly index

Q_I is the value of each month

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

Q is the calculated mean

$^{\sigma}X$ is the standard deviation

3. RESULTS

3.1 Respondents' Socio-demographic Characteristics

One hundred and eighty-seven respondents were interviewed, however, three were rejected because there were lot of missing information. Of the 184 accepted questionnaires, 103 were males and the others (81) were females. Regarding the number of cattle owned, 90 respondents had between 1 and 20 cattle, 40 from 21 to 40 cattle, 10 owned between 41 and 60 and the number of respondents that have between 61 and 80 cattle and from 81 to 100 cattle were ten and thirty-one respectively (Table 1). About their level of experience in cattle management, there were 37 respondents who had less than 6 years, 34 had from 6 -10 years and twelve had between 11 and 15 years. While respondents with experience of between 16 and 20 numbered to 35, 66 respondents had more than 20 years of experience. The results of the study on educational level showed that 102 respondents received non-formal education, 6 primary level, 6 secondary level, 2 tertiary level and 68 none. The Pearson chi-square analysis revealed that there was a significant gender effect on the statements "Number of cattle owned" (X^2 (4, n = 181) = 13.25, p = 0.010) and "Years of experience in cattle management (X^2 (4, N = 184) = 13.14, p = 0.011). The significant differences were such that males were likely to have larger number of cattle and more experience in cattle management than females. There was no significant gender effect on the level of education received by male and female cattle owners.

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

Table 1: Respondents' Socio-demographic Characteristic

Variable	Male	Female	Total	Pearson chi-square	Degree of freedom	P - value
Number of cattle own by respondents (n = 181)						
1-20	43	47	90	13.25	4	0.010
21-40	18	22	40			
41-60	8	2	10			
61-80	7	3	10			
81-100	24	7	31			
Educational level of respondents (n =184						
Non Formal	55	47	102	6.50	4	0.162
Primary	2	4	6			
Secondary	6	0	6			
Tertiary	2	0	2			
None	38	30	68			
Years of experience in cattle management						
< 6 Years	14	23	27	13.14	4	0.011
6 – 10 years	15	19	34			
11 -15 years	7	5	12			
16- 20 years	20	15	35			
>20 years	47	19	66			

3.2 Respondents' Perception on trend of climate Variables

About the trend of the rainfall, 173 out of the 184 respondents said rainfall is decreasing, 10 mentioned increasing and one claimed to have no idea. On rainfall onset, about 95 % of the 184 respondents are of the view that rainy season onset is starting lately while the others (about 5 %) said it is starting early. Likewise, overwhelming majority (162) said temperature is increasing, and 19 reflected decreasing temperature. The number of respondents that believed that temperature was not changing was two and only one has no idea about the temperature trend. Ninety-one percent of the respondents mirrored the wind speed to be increasing, 7 % as decreasing, 2 % have no idea and 1 % said wind speed trend is unchanged (Table 2). In the group discussions, increasing temperature, wind speed, and late onset of rainy seasons were highlighted (Tables 3 and 4). The standardized anomaly (Figures 1,2 and 3) of temperature, rainfall and wind also showed increasing trends. The Pearson chi-square test revealed no significant effect of sex on all the questions relating to trends of climate variables.

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

Table 2: Respondents' Perception on climate variability

No	Question	Increasing	Decreasing	No change	No Idea	p- value
Q1	What is the temperature trend?	162	19	2	1	0.433
Q2	What is the wind speed trend?	167	12	2	3	0.662
Q3	What is the rainfall trend?	10	173	1	2	0.542

Q = Question

Table 3: Proportional Pilling of Trends of Events from 2008 to 2016 in Upper River Region (Men)

Variables	*2008-2010*	*2011-2013*	*2014-2016*
Rainfall	R R R R R	R R R	R R
Temperature	T T	T T T	T T T T T
Wind Speed	S	S S S S	S S S S S
Feed availability	F F F F F F	F F F	F
Water availability	W W W W W W	W W W	W
Rainfall onset	R R R R R	R R R R	R
Drought frequency	P P	P P P	P P P P P
Disease occurrence	D	D D D	D D D D D D
Cattle mortality rate	M M	M M M	M M M M M

Table 4: Proportional Pilling of Trends of Events from 2008 to 2016 in Upper River Region (Women)

Variables	*2008-2010*	*2011-2013*	*2014-2016*
Rainfall	R R R R R R	R R R	R
temperature	T T	T T	T T T T T T
Wind Speed	S S	S S S	S S S S S
Feed availability	F F F F F	F F F	F F
Water availability	W W W W W	W W W	W W
rainfall onset	R R R R R	R R R R	R
Drought frequency	P	P P P	P P P P P P
Disease occurrence	D D	D D D	D D D D D
Cattle mortality rate	M M	M M M	M M M M M

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

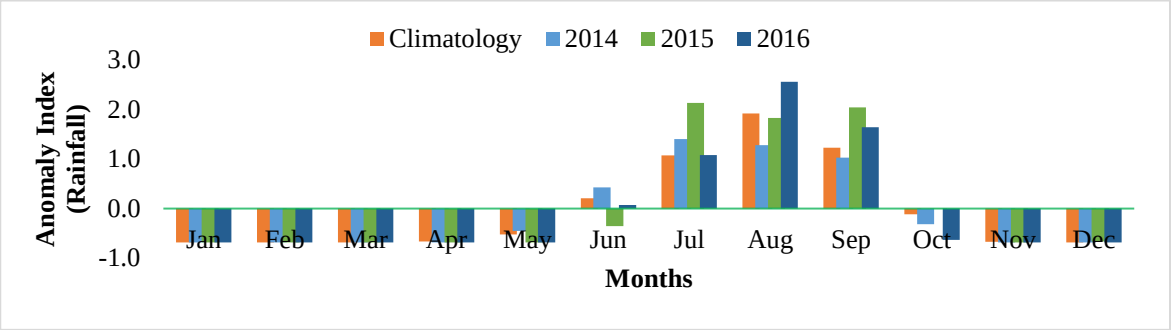

Figure 1: Rainfall standardized Anomaly comparing climatology (1981-2010) with 2014, 2015 & 2016

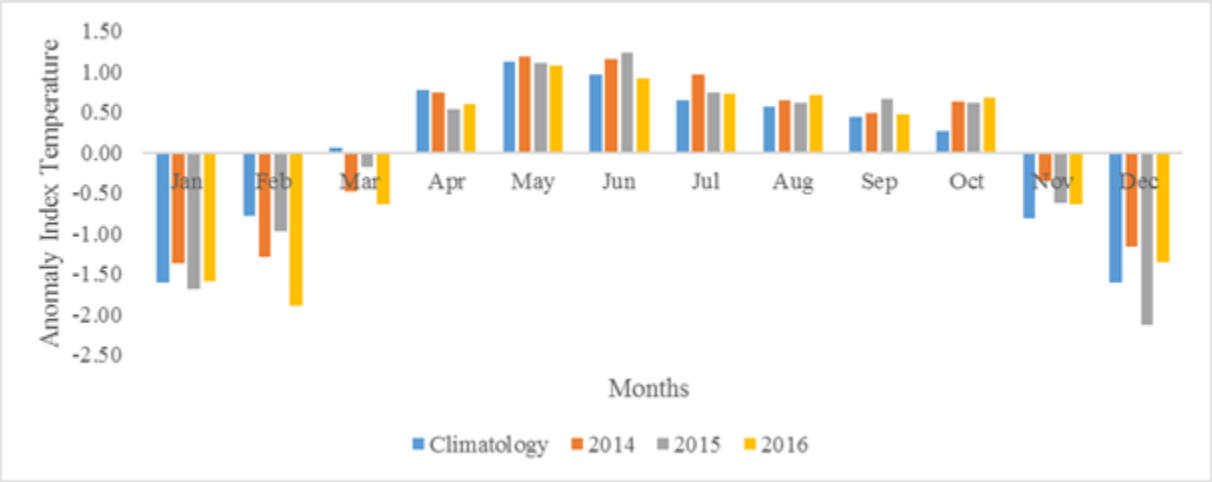

Figure 2: Monthly Temperature Standardized Anomaly for Upper River Region

3.3 Respondents' Awareness and Understanding of Climate Variability

In responding to whether they notice climate variability or not (Table 3), 101 of the 184 respondents responded in the affirmative while 24 said contrary. There were 13 respondents who claimed to have no idea. Fifteen of the 101 respondents who noticed climate variability, believed climate variability is caused by Allah, 40 incriminated tree felling and six implicated smoke and burning. There was an individual who believed that everything changes and climate is no exception. A little over 50 % of the respondents received climate variability information and about 49 % have not received climate variability information. The sources of information include radio (68), training (13), colleagues (7), elders (3), TV (1) and school children (1).

The Pearson chi-square test demonstrated that there was gender effect on the question "Do you notice climate Variability" (X^2 (2, N = 184) = 12.54, p = 0.002). The Post hoc test of the ANOVA revealed statistically significant difference between respondents who said yes and those

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

who have no idea ($F_{2,181} = 6.620$, $p = 0.002$). The difference was such that male respondents were more likely to say yes than female respondents. However, gender has no effect on the causes of climate variability. Although there was gender effect on whether climate variability information is received or not X^2 (1, n = 184) = 5.56, p = 0.013), there was no association between gender and the sources of information. Females were less expected to receive climate information compared to the males.

Table 3: Respondents' Awareness and Understanding of Climate Variability

Variable	Male	Female	Total	Pearson chi-square	Degree of freedom	P - value
Do you notice climate variability? (n = 184)						
Yes	68	33	101			
No	12	12	24	12.54	2	0.002
No Idea	23	36	59			
If yes, what causes climate variability? (n =101)						
Allah	8	7	15			
Tree Felling	32	8	40			
No Idea	24	15	39	6.91	5	0.865
Smoke	2	1	3			
Burning	1	2	3			
Eminent	1	0	1			
Do you receive information about climate variability? (n = 184)						
Yes	60	33	93	5.56	1	0.013
No	43	48	91			
If yes, from where? (n =101)						
Radio	43	25	68			
TV	1	0	1			
Colleagues	2	5	7			
Elders	2	1	3	10.76	5	0.154
School children	0	1	1			
Training	12	1	13			

3.4 Respondents' Perceived Effects of Climate Variability on Cattle Health.

Majority (83.6 %) of the 184 respondents acknowledged that rainfall variability affects their cattle health. While 9.8 % have no idea, only 6 % admitted that rainfall variability has no effect on their cattle health. Regarding effects of temperature variability on cattle health, 60.1 % of the 183 respondents opined that temperature variability has negative effects on the health of their cattle, 8.7 % assumed it has no effect and 31.1 % have no idea about the effect of climate variability on cattle health. About the variability of wind speed, almost 64 % of the 184 respondents said wind speed variability affects cattle health, 12.6 % ricocheted that it does not affect cattle health and 23.5 % have no idea. There was statistically significant difference between gender and Q4 (X^2 (2, n = 183) = 20.59, $p < 0.001$)) and between gender and Q5 (X^2 (2,

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

n = 183) = 20.59, p < 0.001) but the association between gender and Q6 was not statistically visible (X^2 (2, n = 183) = 2.614, p=0.271) (Table 4). The differences were such that males are more likely to say temperature and rainfall variabilities affect cattle than females who are likely to have no idea about the effects of temperature and rainfall variabilities on cattle health.

Table 5: Respondents' perceived Impacts of Climate Variability on Cattle Health

No	Question	Yes	No	No Idea	Chi-square	P - value
Q 4	Does temperature variability affect cattle health	110	16	57	23.49	<0.001
Q 5	Does rainfall variability affect cattle health	154	11	18	20.59	<0.001
Q 6	Does wind speed variability affect cattle health	117	23	43	2.614	0.271

Q = Question

To determine how variabilities of these climate parameters affect cattle health, respondents were asked "How do temperature, rainfall and wind speed variability affect their cattle health". On how temperature variability affects cattle health, 27 of the 110 respondents revealed that the increasing temperature reduce cattle grazing period, 15 said it increases their water demand and 33 opined that the increasing temperature adds stress to cattle. There were also 11 respondents who complained that increasing temperature burns cattle skin and 6 echoed the drying of surface water bodies that are used as cattle drinking points. Statistically, there was significant difference between gender and the question "How does temperature variability affects cattle health" (X^2 (5, n = 184) = 12.70, p- value = 0.026). The Post hoc test of the ANOVA ($F_{5,104}$ =2.714, p = 0.024) disclosed a statistically significant difference between respondents who said "burn skin" and those who mentioned "add stress". It is such that more male respondents mentioned "burn skin" compared to the female respondents (Table 5).

On how rainfall variability affects cattle health, the respondents mentioned reduced feed availability (83), reduced water availability (12), reduced feed and water availability (45), reduced productivity (4) and 10 respondents claimed to have no idea. Gender effect was not visible (Table 5).

Pointing out how wind speed variability affects cattle, 69.2 % of the 117 respondents echoed that heavy winds carry disease pathogens, 18.8 % held the view that heavy wind carries dust which gets in cattle nostrils, 6.8 % said wind makes cattle lost, 3.4 % held the view that it causes cattle to stop grazing and 1.7% have no idea about how wind variability affects cattle. The gender effect on the question "How does wind variability affects cattle health" was not statistically significantly different (Table 5).

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

Table 4: Respondents' perception on the effects of climate variability on cattle health

Variable	Male	Female	Total	Pearson chi-square	Degree of freedom	p-value
Respondents' Perceived Impacts of Temperature Variability Effects on Cattle Health? (n = 110)						
Reduce grazing period	22	5	27			
Increase water demand	12	3	15			
Burn skin	11	0	11	12.70	5	0.026
Increase stress	18	15	33			
Dry surface water bodies	4	2	6			
Respondents' Perceived Impacts of Rainfall Variability Effects on Cattle Health (n= 154)						
Reduced feed availability	46	37	83			
Reduced water availability	11	1	12			
Reduced feed and water availability	28	17	45	8.444	4	0.077
Reduced productivity	4	0	4			
No Idea	6	4	10			
Respondents' Perceived Impacts of Wind Speed Variability Effects on Cattle Health (n = 117)						
Carries disease organism	45	36	81			
Carries dust in cattle nostrils	14	8	22			
Stops cattle from grazing	2	6	8	9.307	4	0.054
Makes cattle missing	2	6	8			
No Idea	0	2	2			

3.5 Respondents' Adaptation Strategies to Climate Variability

Nearly 55 % of the 184 respondents have changed their management practices to cope with climate variability (Table 6). In describing the present practices that were not initially practiced, of the 99 respondents, 22.2 % mentioned feed conservation, 28.3 % buy feed supplements like cotton seeds, groundnut cake, and rice straw, 7.1 % herd cattle both dry and wet season, 19.2 % carry-out regular treatment, 18.2 % practice temporal nomadism, 5.1 % do go for destocking through culling for sales or slaughter. There was statistically significant association between gender and the questions on changing management practices (X^2 (1, N = 184) = 41.03, $p < 0.001$) and between gender and the question "What have you changed" (X^2 (7, N = 101) = 17.63, p = 0.014). The significant statistical difference was such that male respondents were likely to change their cattle management practices. The gender effect on the statement "If yes, what have you done" is significant (F 7,93 = 2.809, p-value = 0.011) such that males were likely to practiced feed conservation while women would probably be buying feed supplement.

The results of the focused group discussion depicted that the least practiced copping strategies by women were "herd both wet and dry seasons" and "feed conservation" while their most practice strategies were "buying feed supplement" and "treatment frequently. For the men, feed

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

conservation and buying feed supplements were the highest ranked practiced coping strategies (Tables 7 and 8).

Table 6: Respondents Adaptation Strategies

Strategies	Male	Female	Total	Pearson chi-Square	Degree of freedom	P- value
Feed conservation	22	0	22			
Buy feed supplement	16	12	28			
Herd wet and dry season	7	0	7			
Frequent treatment	13	6	19	17.63	7	0.014
Temporal nomadism	15	3	18			
Destocking	3	2	5			

Figure 7: Ranked Adaptation Strategies in the Focused Group Discussion – Men's Group

Variables	Destocking	Frequent Treatment	Temporal nomadism	Feed conservation	Buy feed supplement	Herd wet and Dry Seasons	Score	Rank
Destocking		Treat Frequently	Destocking	Feed Conservation	Destocking	Herd dry and Wet Seasons	2	4th
Frequent Treatment			Frequent Treatment	Feed Conservation	Treat Frequently	Frequent Treatment	4	2nd
Temporal nomadism				Feed Conservation	Buy Feed Supplement	Herd dry and Wet Seasons	0	6th
Feed conservation					Feed Conservation	Feed Conservation	5	1st
Buy feed supplement						Herd dry and Wet Seasons	1	5th
Herd Wet and Dry Seasons							3	3rd

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

Figure 8: Ranked Adaptation Strategies in the Focused Group Discussion – Women's Group

Variables	Destocking	Frequent Treatment	Temporal Nomadism	Feed Conservation	Buy Feed Supplement	Herd Dry and Wet Seasons	Score	Rank
Destocking		Frequent Treatment	Destocking	Destocking	Buy Feed Supplement	Destocking	3	3rd
Frequent Treatment			Frequent Treatment	Frequent Treatment	Buy Feed Supplement	Frequent Treatment	4	2nd
Temporal Nomadism				Feed Conservation	Buy Feed Supplement	Herd dry and Wet Seasons	0	6th
Feed Conservation					Buy Feed Supplement	Feed Conservation	2	4th
Buy Feed Supplement						Buy Feed Supplement	5	1st
Herd Dry and Wet Seasons							1	5th

4 DISCUSSION

4.1 Socio Demographic Characteristics

The factors responsible for the difference between male and female cattle owners with respect to climate variability impacts, perception and adaptation strategies could be better explained by a clear understanding of the respondents' sociodemographic characteristics. Although the result of this study indicated low level of education, there was no significant difference between male and female respondents. However, significant difference in the number of cattle owned and the years of experience in cattle management exist between male and female cattle owners. Unfortunate, the differences are not favourable to the females. It is well established that women have low education and high poverty (Yadav & Lal, 2017). Compared to males, females have low number of cattle as well as low level of experience in cattle management. These differences have not only created non neutral effects but also make women to be more vulnerable to climate variability (Aguilar, 2006; Demetriades & Esplen, 2008; Kimaro and Chibinga, 2013).

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

4.2 Perception and awareness

The views of the respondents that temperature and wind speed are increasing is in line with the results of the focused group discussion and the analysed meteorological data. The anomaly index of both the temperature and wind speed displayed increasing trends. Ayal & Leal Filho (2017) also highlighted that farmers perceived increasing temperatures, which was in line with meteorological records. Similarly, cattle owners' views that rainfall onset is delaying was corroborated by the results of the monthly rainfall anomaly index. This has demonstrated the shifting of the rainfall onset from May in the climatology (1981-2010) and 2014 to June in 2015 and 2016. This was also corroborated by Ayanlade, Radeny, & Morton, 2017 that most farmers perceived much delayed rainfall onset. However, the respondents' view that rainfall trend is decreasing is contrary to the meteorological data. An increase in the rainfall trend was revealed by the annual rainfall anomaly index. While Jaiteh and Sarr (2011) and Yaffa (2013) depicted reduction in the amount of rainy season, this study observed an increase in the amount of rainfall. A possible explanation for the difference in results is the difference in the study dates. While their data looked as far back as the 60's, this study was limited from 1981 to 2016. The absence of a statistically significant difference between gender and the questions relating to trends of climate parameters suggested that the changes were apparent to be detected. Although Mertz *et al*., (2009) reported that women and men had similar views regarding trends of climate variables, they still argued that because rainfall varied too much, it was difficult to determine the trend.

This study results indicated that male respondents are more likely to notice variability in climate parameters than their female counterparts. This is however, contrary to the report that females are more perceptive of changes of climate condition in their areas (Ayal & Leal Filho, 2017). Clearly, variability in climate parameters has been noticed, however, the causes of these variabilities is still not understood by many. As a result, ideas of how to manage the variability became a problem. A lot of the respondents believed that climate variabilities are natural phenomena and thus only Allah (God) has solution to them. This indicated that huge gap still exists in climate variability awareness creation. Furthermore, the significant difference between male and female with respect to noticing climate variability could be largely attributed to access to information. The low access to climate variability information is huge and more severe in women as the results depicted that men are more likely to access climate variability information than women. This may be responsible by the triple roles (reproductive, productive and community management) women perform. As women try to fully accomplish these roles, their listening to radio or attending training programmes, which are the main sources of information may be limited. This is also verified by the results of the study, which revealed that of the 13 respondents that access climate variability information through radio, only one is a female. The low access to climate variability information may also be a possible cause to the low

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

understanding of climate variability causes. Accessing information enhances deeper understanding of climate change impacts and adaptation strategies (Dinku et al., 2014).

4.3 Impacts

The majority of the respondents held the view that variabilities in temperature, rainfall and wind speed all have negative effects on the health of cattle. This is confirmed by Mert *el al*. (2009) who stated that farmers in the Easter Saloum of Senegal incriminated wind in their livestock's poor health. Many others (IPCC, 2007; Magersa *et al*., 2014; Abdela & Jilo, 2016) opined that climate variability affects livestock health. This suggested that unless much more efforts are exerted, cattle health is seriously threatened. There are however, conflicting views between male and female cattle owners such that males are likely to say that temperature and rainfall variabilities affect cattle health while the females are clueless about this. The females low understanding of the effects of climate variability on cattle health is presumed to be due to low access to information, which resulted to poor knowledge of climate variability.

The respondents' perceived climate variability impacts on cattle health are mainly categorized under feed and water, pathogen distribution and heat stress related problems. The manner in which the negative impacts of rainfall and wind speed variabilities affect cattle seems unhidden. This is demonstrated by the fact that gender effect was not visible for both statements. The respondents' views that temperature and rainfall variability add stress and reduce feed and water availability respectively were also echoed by Kimaro and Chibinga (2013) and Chatikobo, Chonga, Ncube & Mutambara (2013).

4.4 Adaptation

"One has to change production method or risk facing very high cattle mortality or even losing your herd". This was a common statement uttered during questionnaire administration. Although, temperature, rainfall and wind speed variability were all believed to affect cattle health, the practiced adaptation strategies indicated that rainfall variability was the most eminent problem. This is proven by the fact that almost all coping strategies were geared toward solving the feed and water inadequacy problem. However, many of the respondents noted that the end effect of feed shortage is poor cattle health and consequently high disease prevalence and mortality. The dominant traditional cattle management system, characterised by low investment and mainly natural vegetation dependent explained the reason for these coping strategies. Ifejika (2010) also mentioned similar coping strategies.

Men and women are statistically different in their coping strategies, which suggested that adaptation strategies are influenced by socio-economic situation. One of the female respondents mentioned *"feed conservation requires cart, donkey/horse and huge labour, which we do not*

ISSN: 2455-6939

Volume:04, Issue:01 "January-February 2018"

have. Those of us who have little money will buy cakes and other feed supplements and those who do not will leave everything with Allah". This exposed how women are disadvantage and confirmed the statement that women are one of the groups that are at greatest risk to suffer from potential impacts of climate change because of their fewer capabilities and resources (Kimaro and Chibinga, 2013).

CONCLUSION

Meteorological records and respondents' perception both acknowledged the existence of climate variability. However, there are many varied perception, impact and adaptation to climate variability by sex. Cattle owners in the Upper River Region, The Gambia have noticed the variability in climate parameters (temperature, rainfall, and wind speed), but have little understanding of what is responsible for these variabilities. This is particularly true for females and is largely associated to their low access to climate variability information. It is also evident that variabilities in these climate variables negatively affect cattle production in many ways, ranging from feed and water shortages to spreading of diseases. As climate variability continue to exist, cattle production is very much likely to be affected, which consequently could lead to increased cattle mortality and finally reduced income and increase food insecurity.

As means of minimising the effects of climate variability especially variability in rainfall, both male and female cattle owners employed several coping strategies but in different ways. The difference in coping strategies was largely dictated by their capabilities and access to resources. Unfortunately, female cattle owners are most of the time more disadvantaged as their coping strategies are very limited compared to the males. It is thus important that interventions geared towards helping cattle owners adapt to the effects of climate variabilities be gender sensitive. It is also important to increase the access to climate variability information through mass awareness campaigns, using multidimensional approaches.

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