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ASSESSMENT OF THE EFFECTS OF CLIMATE CHANGE ON THE LIVELIHOODS AND ADAPTATION STRATEGIES OF RURAL WOMEN IN KWARA STATE, NIGERIA

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Abstract

This study investigated the effects of climate change on the livelihoods and adaptation strategies of rural women in Kwara State, Nigeria, analyzing data from 124 women farmers through a structured questionnaire and employing descriptive statistics and regression analysis. The findings highlighted significant impacts of climate change, including reduced crop yields (mean score = 4.39), decreased quantity and quality of grass and forage (mean score = 4.77), limited water supply for livestock and human use (mean score =4.65), and diminished social status due to restricted access to land and water resources (mean score =4.44). Notably, the positive relationship between adaptation strategies ($\beta = 0.454$, $p < 0.01$) and perceived effects of climate change indicates that as women adopt more effective adaptation measures, their awareness of climate change impacts increases, suggesting that these strategies not only help mitigate adverse effects but also enhance their understanding of climate-related challenges. Conversely, the small coefficient for age ($\beta = -0.007$) implies that while older age is associated with a slight decrease in perceived climate change effects, this relationship is practically insignificant. This suggests that age alone does not play a substantial role in shaping perceptions, highlighting the need for more

impactful factors, such as experience and access to resources, to be considered in addressing the challenges posed by climate change. The study concludes that climate change has severely affected the livelihoods of rural women, emphasizing the need for targeted interventions. To enhance resilience, agricultural extension services, and women's empowerment programs are recommended to prioritize initiatives promoting climate-resilient crop production practices.

Keywords: Adaptation strategies, Climate change, Crop production, Livelihoods, Rural women.

تقييم آثار تغير المناخ على سبل عيش المرأة الريفية واستراتيجيات التكيف في ولاية كوارا، نيجيريا

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الخلاصة

بحثت هذه الدراسة في آثار تغير المناخ على سبل عيش النساء الريفيات واستراتيجيات التكيف لديهن في ولاية كوارا، نيجيريا. جُمعت البيانات من 124 مزارعة من خلال استبيان مُنظم، مُرفق بإحصاءات وصفية وتحليل انحدار. سلّطت النتائج الضوء على آثار كبيرة لتغير المناخ، بما في ذلك انخفاض غلة المحاصيل (متوسط التقييم = 4.39)، وانخفاض كمية ونوعية العشب والأعلاف (متوسط التقييم = 4.77)، ومحدودية توافر المياه للثروة الحيوانية والاستخدام البشري (متوسط التقييم = 4.65)، وتراجع المكانة الاجتماعية بسبب محدودية الوصول إلى موارد الأراضي والمياه (متوسط التقييم = 4.44). والجدير بالذكر أن هناك علاقة طردية بين استراتيجيات التكيف ($\beta = 0.454$)، ($p < 0.01$ والآثار المُدركة لتغير المناخ، مما يُشير إلى أنه كلما اعتمدت النساء تدابير تكيف أكثر فعالية، زاد وعيهن بهذه الآثار. وهذا يُشير إلى أن هذه الاستراتيجيات لا تُساعد فقط في تخفيف الآثار السلبية، بل تُعمّق أيضًا فهمهن للقضايا المتعلقة بالمناخ. على العكس من ذلك، يشير معامل السن الصغير (β =−0.007) إلى أنه على الرغم من أن التقدم في السن يرتبط بانخفاض طفيف في آثار تغير المناخ المُدركة، إلا أن هذا التأثير ضئيل. وهذا يؤكد أن السن وحده لا يُؤثر بشكل كبير على هذه التصورات، مما يُبرز ضرورة مراعاة عوامل أكثر تأثيرًا، مثل الخبرة والقدرة على الوصول إلى الموارد، عند مواجهة تحديات تغير المناخ. وتخلص الدراسة إلى أن تغير المناخ قد أثر بشكل كبير على سبل عيش النساء الريفيات، مما يُؤكد على ضرورة التدخلات

المُستهدفة. وتشمل الإجراءات المُوصى بها لبناء القدرة على الصمود تحسين خدمات الإرشاد الزراعي وتمكين المرأة من خلال مبادرات تدعم ممارسات إنتاج المحاصيل المقاومة لتغير المناخ.

كلمات مفتاحية: استراتيجيات التكيف، تغير المناخ، إنتاج المحاصيل، سبل العيش، المرأة الريفية.

Introduction

Climate change is one of the greatest environmental challenges of the 21st century and has been reported to have significant impact on the livelihoods and welfare of people in various parts of the world (29). Its impacts vary among regions, generations, age, classes, income groups, and gender (21). Climate change may be described as a change in the state of the climate that can be identified (using statistical tests) by the changes in mean temperatures, precipitation, and wind patterns and which persists for an extended period typically decades or longer. Climate change is therefore the statistically significant deviation or shift from the average weather conditions of climatic elements.

Climate change has gone beyond rise in global temperatures to adverse weather conditions such as drought, flood, heat and cold waves that affect agriculture productivity and increases the risk of global food shortage. It is therefore seen as the number one threat to development and sustainability in Africa (29). Farmers in Africa and other developing countries are greatly affected especially those in rural areas primarily because agriculture, which is highly vulnerable to climate change, is their primary source of income and livelihoods (24).

In Nigeria, the change in climate particularly affects rural women because they constitute the majority of producers and processors of agricultural crops. Smallholder women farmers have become the most vulnerable to climate extremes and related risks (22) due to their unequal access to land and productive resources (20), lack of productivity enhancing inputs (23) and limiting institutional and infrastructural barriers on their use of climate information (13). Moreover, women are mostly encumbered by climate change impacts because they are always trapped under the conditions which make them vulnerable to climatic shocks such as poverty, social exclusion, patriarchal dominance in decision-making, limited access to information, lack of land and property rights and ascribed gender roles (6). Also, female farmers tend to be more concerned and fatalistic about climate change (14).

Climate change is a significant challenge facing rural communities around the world and rural women are among the most vulnerable group. Women constitute a very vulnerable population group, particularly those in less economically developed countries who suffer from delayed economic development and generally live-in poverty. Nigeria is one of such developing countries and researchers (8) have shown that it is already being plagued with diverse ecological problems directly linked to the on-going climate change. In Kwara state, climate change is expected to have serious impacts on rural women's livelihoods, exacerbating the existing gender inequality and their ability to adapt and cope with food insecurity (15 and 18). Despite the increasing recognition of the importance of gender-responsive climate policies and interventions, there is lack of empirical evidence on the effects of climate change on rural women's

livelihoods and adaptation strategies in Kwara state. There is also the need to identify potential gender-responsive interventions to support rural women's adaptation to climate change. Therefore, this study aims to fill this knowledge gap by assessing the effects of climate change on rural women's livelihoods and adaptation strategies in Kwara state, Nigeria. The specific objectives were to:

1. Describe the socioeconomic characteristics of rural women and their source of information on climate change and adaptation in the study area.
2. Examine the perceived effects of climate change on livelihood of rural women farmers in the study area.
3. Investigate the perception of rural women on adaptation strategies to climate change; and identify the constraints to the use of adaptation strategies by the rural women in the study area.

Materials and Methods

This study was conducted in Kwara state which lies between longitude 5^{o} 00' 00'' East of the Greenwich meridian and between latitude 8^{o} 30' 00'' North of the Equator. The state covers 32,000 square kilometers representing 6.54% of the total land area of the country.

A multi-stage sampling technique to select respondents was used in this study comprising four distinct stages to ensure a representative sample of the target population. The first stage involved the purposive selection of four local government areas (LGAs), namely Ilorin East, Ilorin West, Asa, and Oyun, from the 16 in Kwara state. This particular selection enabled the researchers to focus on areas that were most pertinent to the study's objectives, thereby facilitating the acquisition of valuable insights into the experiences of rural women. In the second stage, two wards were randomly chosen from each of the selected LGAs, resulting in a total of eight wards. The wards selected were Oloje and Oko-Erin (Ilorin East), Baboko and Oja-Oba (Ilorin West), Afon and Koro (Asa), and Isanlu-Isin and Odo-Owa (Oyun). The third stage involved randomly selecting four rural communities from each of the eight wards, culminating in a total of 32 communities. In the final stage, a random selection of four rural women from each of the 32 communities yielded a total of 128 respondents, providing a manageable and practical sample size that was evenly distributed across the communities. This approach reduced the risk of bias, increased representativeness, and simplified the sampling process, thereby minimizing errors and facilitating efficient data collection and analysis. A total of 124 respondents completed and returned the questionnaires, resulting in a high response rate of approximately 97%.

Results and Discussion

Socioeconomic characteristics of the women farmers as seen in Table 1, slightly below half of the respondents (49.2%) were between the age of 41 to 50 years while the average age of all respondents was 46.8 years, implying that the rural women were relatively advanced in age. The ages of farmers play a vital role in agricultural productivity as most Nigerian farmers are small-scale farmers who use crude implements, requiring strength and energy (16). However, age factor is expected to contribute positively to active adoption of climate change adaptation practices.

Furthermore, the majority (80.6%) of the respondents were married. Being married implies that rural women have spouses who are expected to help in carrying out climate change adaptation activities that are strenuous at no cost. This finding conformed prior studies that the majority of rural women farmers were married (2).

A large portion (57.3%) of the respondents had secondary education while some (29.0%) had primary education. This indicates that rural women in the study area were literate, thus facilitating the adoption of any climate change adaptation strategies disseminated to rural women farmers that requires reading of instructions and keeping of records. This finding corroborates (11) who found that rural women farmers in Kwara state are literate.

Almost 42.0% of the respondents had between 6 to 10 persons in their households, with the average household numbering 5 persons. The availability of 5 persons per households is an indication of access to family labour. However, 4 persons per household were available and accessible for farm activities. This implies that rural women farmers have at least 4 household members to assist in performing climate change adaptation practices that requires the helping hands of more labour.

More than half of the respondents (52.4%) had up to 10 years of farming experience while the average years of experience was 10.8 years, suggesting that rural women farmers have reasonable years of experience in farming. The skills acquired in an enterprise depend on the time spent on it; thus, the longer time a person devotes to an enterprise, the better their understanding of the business (17). This attribute must have earned the women farmers some knowledge of climate change effects on agricultural production and the adaptation measures. This wealth of experience in farming is an indication that the rural women are contributing immensely to food crop production and food security in the south-west states. According to (3 and 4), women farmers play a vital role in food production and security despite their normal engagement in domestic chores.

Furthermore, the average farm size cultivated by the respondents was 1.8 hectares, indicating that rural women in the study area are smallholder farmers. This finding agrees with (17) that rural women in Nigeria cultivate small tracts of land.

Table 1: Socioeconomic characteristics of respondents (n=124).

Variables	Frequency	Percentage	Mean
Age (years)			
≤30	5	4.0	
31 – 40	23	18.5	
41 – 50	61	49.2	46.8
51 – 60	25	20.2	
Above 60	10	8.1	
Marital status			
Single	9	7.3	
Married	100	80.6	
Divorced	8	6.5	
Widow/widower	7	5.6	
Educational level			
No formal	10	8.1	
Primary	36	29.0	
Secondary	71	57.3	
Tertiary	7	5.6	
Household size (persons)			
≤5	69	55.6	
6 – 10	52	41.9	5
11 and above	3	2.4	
Number of household members involved in farming			
≤5	118	95.2	
6 – 10	6	4.8	
Years of farming experience			
≤ 10	65	52.4	
11 – 20	58	46.8	10.8
Above 20	1	0.8	
Size of farm (hectares)			
0.1 – 1.0	50	40.3	
1.1 – 2.0	51	41.1	1.8
2.1 – 3.0	16	12.9	
3.1 and above	7	5.6	

Source: Field survey, 2023.

Sources of information on climate change issues: Table 2 on the respondents' knowledge on the climate change phenomenon shows all (100.0%) having heard of it while 72.6% further claimed to understand the climate change concept. This shows that women farmers are aware of climate change which will help them prepare themselves for adaptation even from the onset of the cropping season. Onset knowledge on climate change will help the women farmers effectively adapt to its effects. As to the sources of information on climate change, most relied on the radio and fellow farmers at 72.6% and 86.3%, respectively. This indicated that those two sources dominated in disseminating climate change issues. In support of this finding, studies have shown that radio and farmer-farmer information-sharing play significant roles in updating and adaptation strategies (11 and 19) on the issue.

Respondents indicated that manifestations of climate change experienced include floods (86.3%), erratic rainfall (54.8%), persistent drought (45.2%), and frequent bush

fires (17.7%). This shows that farmers have experienced those effects on agricultural production. As such, information to help mitigate the effects of climate change should be directed towards these objectives for meaningful impact on the women farmers. The duration of manifestations lasted mainly for 20 years to the time of this study with a rising trend over the past 3 to 5 years (58.9%). By implication, climate change manifestations and its effects are not new knowledge to women farmers.

Table 2: Knowledge of climate change issues among respondents.

Variables	Frequency	Percentage
Heard about climate change		
Yes	124	100.0
No	0	0.0
Sources of information on climate change		
Extension agents	17	13.7
Radio	90	72.6
Television	17	13.7
Mosque/Church	39	31
Fellow farmers	107	86.3
Understanding of the concept of climate change		
Yes	90	72.6
No	34	27.4
Notice of climate change manifestations		
Erratic rainfall	68	54.8
Persistent drought	56	45.2
Floods	107	86.3
Frequent bush fires	22	17.7
Years of climate change manifestations		
Less than 10 years	50	40.3
10 – 20 years	60	48.4
21 – 30 years	6	4.8
Above 30 years	8	6.5
Trend of climate change over the past 3-5years		
The same	51	41.1
Increase	73	58.9
Decline	0	0.0

Source: Field survey, 2023.

Perceived effect of climate change on livelihood of rural women: The analysis of climate change's impact on the livelihoods of rural women highlights significant challenges, as detailed in Table 3. The foremost concern, with a mean score of 4.39, is the reduction in crop yield, which poses a serious threat to food security and agricultural sustainability. Following closely is frequent flooding during the rainy season, with a mean score of 4.25, and third is the declining fertility of farmland due to erosion, scoring 4.23. These issues not only jeopardize immediate agricultural productivity but also signal deeper environmental problems that could have lasting effects on farming practices. Additionally, ranked 4th, are increasing crop diseases and pest infestations (mean score 4.16), further complicating the situation, and underscoring the urgent need for effective management strategies.

Moreover, the inability to provide sufficient food for families, which ranks 5th with a mean score of 4.09, reflects the broader socio-economic implications of these agricultural challenges. The overall aggregate mean score of 3.75 indicates a widespread sense of urgency among farmers regarding these issues, suggesting that interventions are crucial. This analysis implies that climate change has significantly reduced soil fertility, caused flooding, and diminished crop yields for women farmers in the study area. Previous studies corroborate these findings, demonstrating that climate change adversely affects the crop yields of smallholder farmers (7, 25 and 27). Addressing these pressing challenges through improved agricultural practices and resource management is essential for enhancing food security and supporting rural women's livelihoods.

Table 3: Perceived effect of climate change on crop production.

Crop production	Mean	SD	Ranking
Declining cultivated lands	3.43	1.27	13
Reduced fertility of farm land from excessive erosion and destruction of soil microbes	4.23	0.72	3
Declining crop yields	4.39	0.80	1
Increasing crop diseases and pest infestation	4.16	0.64	4
Occasional/frequent disappearance of some perishable fruits and vegetables	3.94	0.76	9
Frequent occurrence of poor seed germination and stunted crop growth	2.23	1.54	14
Frequent flooding during the rainy season	4.25	0.72	2
Early cessation of rainy season compared to last 10 years	3.93	0.97	10
Increased drought occurrence	1.92	0.88	15
More run-off causing erosion	4.01	0.33	6
Land/forest degradation keep occurring	3.91	0.59	11
Working hours for crop production is declining day by day	3.97	0.54	8
Increasing high-cost production year by year	3.98	0.51	7
Inability to provide enough food for self and family members	4.09	0.29	5
Aggregate mean	**3.75**		**4**

Source: Field survey, 2023.

Effects of climate change on livestock production of women farmers: On the effects of climate change on livestock production (Table 4), respondents indicated that climate change has decreased the quantity/quality of grass and forage (mean=4.77), increased loss of livestock due to drought (mean=4.55), stoppage in rearing some livestock (mean=4.44) which ranked first, second, and third, respectively, as well as decrease in forages and supplementary feeds to livestock (mean=4.35), and increasing incidence of disease and pest infestation (mean=4.04). By implication, decreased quantity/quality of grass and forage, increased loss of livestock due to drought and stoppage of rearing some livestock were the leading effects of climate change on livestock business of rural women farmers in the study area.

This finding is substantiated by the literature, which indicates that climate change has had a detrimental impact on the quantity and quality of grass and forage available for livestock. The underlying factors contributing to this phenomenon include rising temperatures, which stunt growth rates and yields, as well as altered precipitation

patterns that create droughts or floods, thereby compromising growth and productivity, and modifying species composition (26 and 28). Further, the increased frequency of extreme weather events, such as heatwaves and droughts, altered growing seasons that disrupt the synchronization of growth cycles and livestock needs, and soil degradation, encompassing erosion, nutrient depletion, and salinization, which adversely affect soil health and fertility, also play a significant role in this context.

Table 4: Effects of climate change on livestock production of women farmers.

Livestock production	Mean	SD	Ranking
Decrease in forages and supplementary feeds to livestock animals	4.35	0.53	4
Stoppage of rearing of some livestock	4.44	0.55	3
Increasing loss of livestock due to drought	4.55	0.58	2
Significant reduction in grazing lands for feeding	3.99	0.43	6
Decreasing quality of grass and forages	4.77	0.52	1
Increasing incidence of disease and pest infestation	4.06	0.95	5
Aggregate mean	**4.36**		**1**

Source: Field survey, 2023.

Effects of climate change on availability of water resources: Table 5 shows reduced water supply for animal and human use (mean=4.65), decreased total rainfall (mean=4.52), and overflow of water bodies by algae, weed and chemical industry discharges (mean=4.27), ranking first, second, and third as the main effects of climate change on water resources.

This finding is corroborated by research, which suggests that climate change has had a deleterious impact on water supply for both animal and human consumption. The underlying factors contributing to this phenomenon include changing precipitation patterns, which lead to droughts or altered hydrological cycles, resulting in reduced water availability (5); increased evaporation due to rising temperatures, which worsens water scarcity (12), and altered snowmelt and runoff patterns, which affect the timing and quantity of water supply. Further, climate-related disasters, such as floods and landslides, can also contaminate water sources, reducing their quality and availability for human and animal use.

Table 5: Effects of climate change on women farmers' access to water resources.

Water resources	Mean	SD	Ranking
Decreasing annual rainfalls	4.52	0.52	2
Reduced water supply for animal and human use	4.65	0.54	1
Drying up of water sources	4.26	0.57	4
Reduced fishing activities	4.05	1.13	5
Overflow of water bodies by algae, weed and chemical industry effluents	4.27	1.07	3
Aggregate mean	**4.35**		**2**

Source: Field survey, 2023.

Effects of climate change on income of women farmers: The effects climate change on farmers income in Table 6 shows that low status due to lack of access to land and water resources by women farmers (mean=4.44) ranked first, low income due to early deterioration of perishable harvested crops and fish products (mean=4.23) ranked second, while decreasing sale of farm produce (mean=4.23) ranked third on the list of

effects indicated by respondents. This shows that climate change has adversely affected women farmers' ability to access resources, and lowered sales and earned incomes. On the aggregate, climate change effects on access to livestock production (mean=4.36) ranked first, water resources (mean=4.35) second, incomes (mean=4.03) third, while effect on crop production (mean=3.37) ranked fourth as the least.

This finding is consistent with (9) which indicated that climate change has had a detrimental impact on livestock farmers in Kwara state. The reasons for this include reduced water supply and quality, which compromises animal health and productivity, decreased quantity and quality of grass and forage, which affects livestock nutrition, and increased frequency of extreme weather events, such as heatwaves and droughts, which can lead to livestock mortality and reduced farm incomes.

Table 6: Effects of climate change on incomes of women farmers.

Income	Mean	SD	Ranking
Increasing socio- economic problems	3.41	1.01	6
Low harvesting of farm produce	4.00	0.48	4
Decreasing sale of farm produce	4.23	0.54	3
Low income due to early deterioration of perishable harvested crop and fish product	4.24	0.56	2
Increasing debts by women farmers	3.84	0.68	5
Low status due to lack of access to land and water resources by women farmers	4.44	0.50	1
Aggregate mean	**4.03**		**3**

Source: Field survey, 2023.

Effects of climate change on livelihood of women farmers: The aggregate level of individual respondents perceived effects of climate change on livelihood of rural women is presented in Table 7. It shows that 0.08% of the respondent were grouped as having low perceived effects, 10.5% having moderate perceived effect, while 88.7% were grouped as having high effect of climate change on livelihood. This implies that majority of women farmers in the study area have highly perceived that climate change phenomenon adversely affects their livelihood activities.

This finding is corroborated by existing research, which suggests that climate change has a disproportionate impact on the rural livelihood activities of women. The reasons for this negative effect include increased vulnerability to climate-related disasters, such as droughts and floods, which can destroy crops and livestock, thereby compromising food security and income (11), reduced access to natural resources, such as water and land, which are essential for rural livelihoods (10), and limited capacity to adapt to climate change due to social, economic, and cultural constraints, which can aggravate existing gender inequalities. Further, climate change may also affect women's health and well-being, as they often bear the primary responsibility for household care and food provision, making them more susceptible to climate-related stressors.

Table 7: Level of effects of climate change on livelihood of rural women.

Obtained score	Level of effects	Frequency	Percentage
31 – 72	Low	1	0.8
73 – 113	Moderate	13	10.5
114 – 155	High	110	88.7
Total		124	100.0

Min. – Max. score = 31 – 155.

Adaptation strategies to climate change used by rural women farmers: Table 8 presents the climate change adaptation strategies used by rural women farmers. The use of improved varieties (mean=2.87) ranked first, early and timely weeding (mean=2.69) second, changed harvesting date (mean=2.44) third, planting of cover crops (mean=2.25) fourth, use of organic manure (mean=2.25) fifth, while construction of dams or irrigation (mean=0.00) ranked twelfth as the least used adaptation strategies. This implies that use of improved varieties, early weeding and changed harvesting date were the leading adaptation strategies used by rural women farmers to adapt to the effects of climate change in the study area.

Table 8: Climate change adaptation strategies used by rural women farmers.

Adaptation Strategies	Mean	SD	Ranking
Use of improved varieties	2.87	0.34	1
Planting of cover crops	2.25	0.44	3
Zero tillage	1.69	0.73	8
Early and timely weeding	2.69	0.46	2
Mulching strategy	1.56	1.04	9
Use of organic manure	2.25	0.71	4
Construction of dam or irrigation	0	0.00	12
Insurance policy strategy	0.72	1.18	10
Seasonal migration	1.74	1.28	7
Changed planting date	2.13	0.65	6
Changed harvesting date	2.44	0.75	5
Rearing of heat tolerant livestock	0.72	1.18	10

Source: Field survey, 2023. Scale: Always=3, Sometimes=2, Rarely=1, Never=0.

Factors influencing the effect of climate change on livelihood of rural women: The result from regression analysis in Table 9 shows that some socio-economic factors significantly influenced the effect of climate change on livelihood of rural women farmers (R^2 = 0. 508, F=2.050, $p < 0.01$). Overall, these factors predicted only 50.8% of rural women perceived effects of climate change on their livelihood.

The coefficients of years of experience (β=0.657, $p<0.01$), land acquisition (β =0.099, $p<0.05$), perceptions on the effect of climate change (β =0.016, $p<0.01$), and adaptation strategies (B= 0.454, $p<0.01$) of the women farmers were positive and significant to their perceived effects of climate change on livelihood. This implies that increased years of experience, larger areas of land acquired for farming, positive perceptions on climate change, and enhanced resilience to adaptation to climate change in farming, when other variables remain constant, will lead to favorable perceptions among the women farmers on the effects of climate change on livelihood.

Alternatively, age (β = -0.007, $p<0.05$) and constraints (β = -0.197, $p<0.038$) showed negative and significant relationships with perceived effects of climate change

on livelihood. This implies that while older age is associated with a slight decrease in perceived climate change effects, this relationship is practically insignificant. This suggests that age alone does not play a substantial role in shaping perceptions, highlighting the need for more impactful factors, such as farming experience and access to resources, to be considered in addressing the challenges posed by climate change. This agrees with (1) who noted that farming experience was amongst significant socioeconomic factors influencing women farmers' choice of adaptation strategies against climate change.

Table 9: Multiple linear regression showing the determinants of rural women's perceived effects of climate change on their livelihood.

Effect of climate change on livelihood	Unstandardized		Standardized		
	B	Std. Error	Beta	t-value	Sig.
Age	-0.007*	0.104	-0.155	-1.694	0.039
Marital Status	-0.045	0.048	-0.085	-0.939	0.350
Education	-0.038	0.038	-0.089	-1.022	0.309
Household size	0.031	0.033	0.175	0.920	0.360
Farming experience	0.657*	0.236	0.263	2.784	0.006
Farm size	-0.032	0.038	-0.078	-0.843	0.401
Land acquisition	0.099*	0.050	0.188	2.004	0.048
Membership of cooperative	0.036	0.128	0.048	0.285	0.776
Access to extension services	0.130	0.199	0.181	0.655	0.514
Number of extension services	-0.140	0.091	-0.365	-1.541	0.126
Perception	0.016*	0.005	0.307	3.433	0.001
Adaptation strategies	0.454*	0.142	0.291	3.190	0.002
Constraints	-0.197*	0.044	-0.154	-2.719	0.038
Constant	1.945	0.547		3.558	0.001

R-square 0.508; Adjusted R-square 0.407; Std Error 0.332; F 2.050; Sig. 0.001.
*Significance at $p \leq 0.05$ level.

Conclusions

This study assessed the effects of climate change on rural women's livelihoods and adaptation strategies in Kwara state, Nigeria. Based on the major findings of the study, it can be concluded that the majority of respondents were middle-aged, married and literate, at least, at primary education level. The radio and fellow farmers were their primary sources of climate change information, highlighting the role of informal networks and media in disseminating knowledge. Also, climate change severely impacted crop production, with reduced yields and frequent flooding being the top concerns, while livestock production suffered due to degraded forage quality and water scarcity, with diminished access to land and water resources leading to lowered incomes and social status.

Adaptation strategies predominantly used by the women farmers included planting improved crop varieties, early weeding, and adjusted harvesting dates. However, advanced strategies such as irrigation were rarely adopted, reflecting limited access to resources and technology. Targeted interventions that will ameliorate existing vulnerabilities among rural women to climate change are recommended. These include strengthening extension services, promoting climate-resilient practices, and addressing

structural inequities in resource access to enhancing adaptive capacity and safeguarding livelihoods.

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