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Perception and adaptation of agricultural households to climate change in the semi-arid regions of Rajasthan – a gender perspective study

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Abstract

Purpose – The study aims to analyze the gender-wise perception of the agricultural households toward climate change and the adaption measures taken by these households, especially women, to mitigate climate changes.
Design/methodology/approach – Purposive random sampling technique is used to collect primary data from a pilot survey conducted in two semi-arid districts of Rajasthan, India. Data mainly focused on analyzing the gender-based perception and adaptation strategies undertaken toward climate change. And descriptive statistics are used for analysis.
Findings – The study found that both the gender are aware of the climatic changes. Deforestation increased population, change in living standards, urbanization and industrialization contribute to climate changes. The women are employing limited adaptation strategies to mitigate the climatic stress compared to males.
Research limitations/implications – This is a pilot study; hence, it has an insufficient sample size for the detailed statistical analysis. Further, it is only limited to two semi-arid districts of Rajasthan.
Originality/value – This pioneering study highlights gender-wise differences in perception and adaptation strategies undertaken in this region. The study suggests raising awareness about climate change and providing credit facilities for undertaking adaptation measures to reduce agricultural households' vulnerability, particularly enhancing women's adaptive capacity to climate change.

Keywords Climate change, Perception, Gender, Primary data, Adaptation strategy
Paper type Research paper

1. Introduction

Climate change is defined as "change of climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere observed over comparable periods" (UNFCCC, 2011). Climate change refers to the long-term changes in the components of climate such as temperature, precipitation, evaporation and intensity and frequency of extreme events such as drought and floods. The rural communities in the developing country are expected to be affected more due to their extensive dependence on climate-sensitive

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livelihood options and limited adaptive capacity to the changes (UNFCCC, 2009). Adaptation to climate change refers to the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2007). Adaptation to climate changes has emerged as the most effective tool in combating adverse climatic effects (Chattopadhyay and Hulme, 1997).

The fact is that climate change affects men and women differently (Sultana, 2013), and its effects are being felt upon the household activities of the members depending on their gender relations. Moreover, women are considered more vulnerable to climate change than men (Dankelman, 2002; Yavinsky, 2012). Several studies attempted to understand this phenomenon and the gender differences in the perception of climate change. Results indicate that women are more concerned about the environment and have a higher risk perception regarding climate change (Ballew *et al.*, 2018). This perception, in turn, influences the adaptation strategies of women to cope with climate stress. The other significant factors influencing the adaptation strategies of women to mitigate climate change includes socio-economic factors, demographic factors and institutional factors (Batool *et al.*, 2018).

Arid and semi-arid areas are considered more vulnerable to climate change due to their dependence on sensitive sectors such as agriculture, fisheries, forestry and water (Prasad *et al.*, 2014). In India, the hot arid region occupies nearly 246,790 sq km, mostly falling in most of the districts of Rajasthan. These regions are marked with low, erratic rainfall and high mean maximum temperature (Manga *et al.*, 2015).

Hence, this study attempts to exclusively deal with the agricultural households in the semi-arid regions of Rajasthan and their gender-wise perception toward climate change and the adaptation strategies undertaken to reduce the adverse impact of climate change.

2. Research method

The study is based on primary data collected from a pilot study comprising both male and female respondents in two semi-arid districts of Rajasthan, India, namely, Jaipur and Tonk. The survey data was collected from 85 households with the help of a well-structured questionnaire by employing a purposive random sampling technique. The study analyzes the data by using descriptive statistics.

3. Results and discussions

3.1 Demographic characteristics

Falaki *et al.* (2013) pointed out that their households' demographic attributes largely influence their perception of climate change. The demographic characteristics of the sample respondents' in both the districts are presented in Table 1. Most of the household heads were male in both districts, and merely 10.6 of the total household heads were female. The household heads belonged to the age category of 35–55, indicating that both districts have a higher percentage of the middle-aged population. In both the districts, the majority of the male respondents are working-class or dependents, while the female respondents consist of the workforce. Agriculture is the primary occupation as 91.8% of the households are traditional farmers. The majority of the households belonged to the low-income categories, with 51.8% having an annual income of less than Rs. 3 lakhs while 41.2% having income between Rs. 3 to 5 lakhs. It indirectly indicates the poor standard of living and lower labor force participation in agricultural households.

3.2 Gender-wise perception of the households

This section addresses the gender-wise perception of agricultural households toward climate change and the primary reasons behind these changes over the last decade, as depicted in

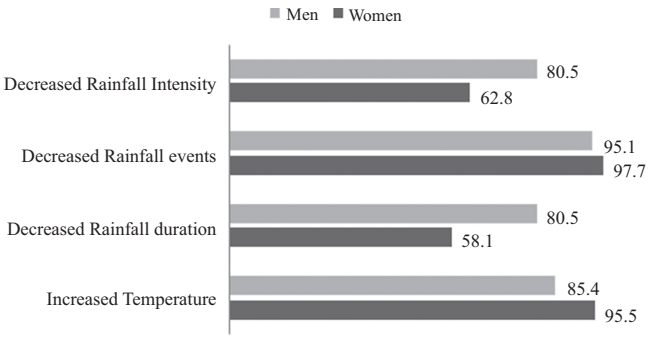
Indicators		Total %	Total Frequency	Jaipur %	Jaipur Frequency	Tonk %	Tonk Frequency
Gender	Male	89.4	76	91.1	41	87.5	35
	Female	10.6	9	8.9	4	12.5	5
Age	15–35	15.3	13	13.3	6	17.5	7
	35–55	49.4	42	53.3	24	45	18
	55–75	31.8	27	31.1	14	32.5	13
	Above 75	3.5	3	2.1	1	5	2
Originality	Native	100	85	100	45	100	40
Marital status	Married	98.8	84	100	45	97.5	39
	Widowed	1.2	1	0	0	2.5	1
Number of years stayed in community	20–29	9.4	8	8.9	4	10	4
	30–49	37.6	32	35.6	16	40	16
	Above 50 years	52.9	45	55.6	25	50	20
Household size	<3	10.6	9	4.4	2	17.5	7
	4–6	47.1	40	53.3	24	40	16
	7–10	36.5	31	37.8	17	35	14
	>10	5.9	5	4.4	2	7.5	3
Social responsibility	Yes	2.4	2	4.4	2	0	0
	No	97.6	83	95.6	43	100	40
Health status	100% fit	87.1	74	93.3	42	80	32
	Sickly	12.9	11	6.7	3	20	8
Literacy status	Neither read or write	25.9	22	24.4	11	27.5	11
	Read only	3.5	3	2.2	1	5	2
	Write only	1.2	1	2.2	1	0	0
	Read and write	69.4	59	71.1	32	67.5	27
Educational status	No schooling	29.4	25	26.7	12	32.5	13
	Primary(1st–5th std)	24.7	21	26.7	12	22.5	9
	Upper primary (6th – 8th std)	16.5	14	20	9	12.5	5
	Secondary (9th – 10th std)	18.8	16	22.2	10	15	6
	Senior secondary (11th –12th std)	3.5	3	4.4	2	2.5	1
	Vocational	1.2	1	0	0	2.5	1
	College/University	5.9	5	0	0	12.5	5
Number of years farming	1–5 years	3.5	3	4.4	2	2.5	1
	5–10 years	4.7	4	2.2	1	7.5	3
	>15	91.8	78	93.3	42	90	36
Type of agriculture	Rainfed	83.5	71	84.4	38	82.5	33
	Rainfed and irrigated	16.5	14	15.6	7	17.5	7
Annual income	<3	51.8	44	46.7	21	57.5	23
	3–5	41.2	35	48.9	12	32.5	13
	5–10	5.9	5	4.4	2	7.5	3
	>10	1.2	1	0	0	2.5	1

Source(s): Pilot Study

Table 1. Demographic characteristics ($N = 85$, $n_1 = 45$, $n_2 = 40$)

Figure 1. The respondents noted these changes include the increased temperature, decreased rainfall events, decreased rainfall intensity and the short duration of rainfall. These findings are similar to results as identified by Zhang *et al.* (2020).

95.1% of the men and 97.7% of the women have reported an overall decrease in rainfall events. According to the men respondents, the reduction in rainfall has negatively affected their agricultural practices, such as irrigation and soil pH balance. At the same time, the female respondents reported a higher impact on them than the males, mainly due to a decline in the amount of potable water. Also, decreased rainfall events and increased temperature has made it difficult for women to fetch water from different sources. Again, most male respondents have noticed a decrease in rainfall intensity and duration, while few females



Source(s): Pilot study

Figure 1.
Changes in the environment

have felt these changes. The study also analyzed the annual rainfall pattern of Rajasthan over the years, as provided in Figure 2.

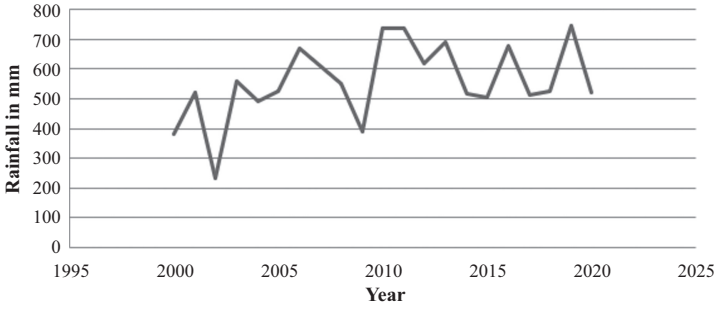
The rainfall pattern shows some inconsistency, with some years experiencing higher rainfall and some years receiving deficient rainfall from the graph. However, an overall conclusion is that the average rainfall has depleted over the last years, and the respondents' perception regarding rainfall pattern and intensity is accurate and acceptable to a certain extent.

Figures 3 and 4 analyses the gender-wise perception of the extent of changes in climate and the significant causes behind climate change. As evident from Figure 3, 72.1% of the women respondents and 78% of the men respondents perceived these changes in climate as extreme events. While 20.9% of women and 14.6% of men respondents have found these changes as minimal.

The primary reason for long-term environmental changes is deforestation, as indicated by 90.7% of women and 80.5% of men in Figure 4. The figure shows that 65.9% of men and 62.8% of women have also found an increase in population as an indicator of climate change. Figure 4 also indicates a shift in the standard of living, rapid urbanization and industrialization are also other factors contributing to climate change, and that there are also differences in gender-wise perception.

Further, many women were unaware and ignorant of the factories and industries setup around their residing areas.

3.2.1 Impacts of climate change. This section analyses the major impacts of long–-term climatic changes and determines the extent of gender-wise differences in the respondents'



Source(s): Water Resource Department, Rajasthan; Annual Rainfall data 2020

Figure 2.
Annual rainfall pattern of Rajasthan (2000–2020)

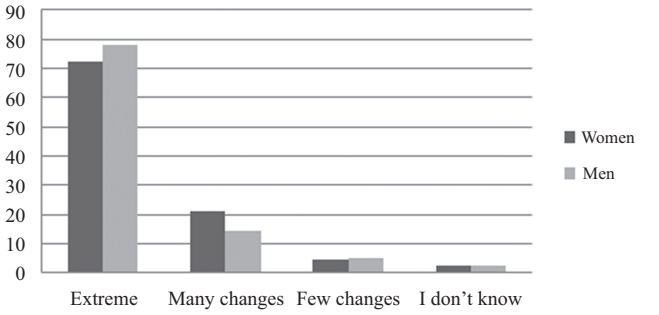


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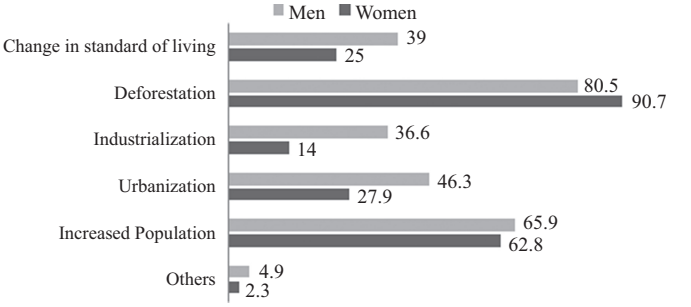
Figure 3.
Extent of changes in climate



Source(s): Pilot study

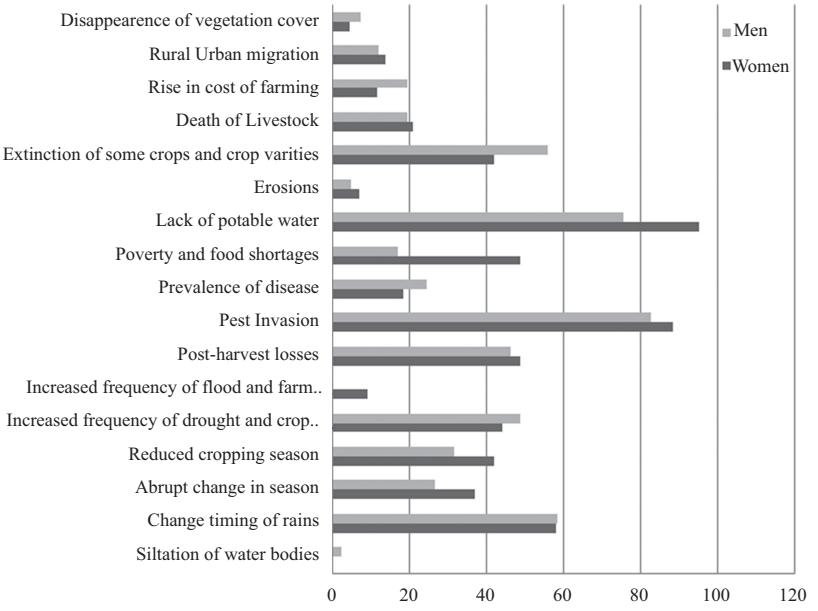
Figure 4.
Causes of climate change

perceptions regarding climate change. Figure 5 shows the significant implications felt due to long-term climate change. As identified by 95.3% of the women and 75.6% of the men respondents, the substantial impact is lack of potable water. This finding is similar to the conclusion drawn by the other studies, where they found that the change in climate and extreme weather conditions can result in the poor accessibility of water and sanitation facilities (Kibria *et al.*, 2017; Abedin *et al.*, 2019). The other significant changes felt are the increased pest invasion, increased frequency of drought and flood, abrupt change in the season leading to change in cropping season and the extinction of some crop and crop varieties.

Unpredictable change in the timing of the rain is another significant impact of climate change, as mentioned by the respondents. In the absence of any weather forecasting resources, people cannot predict the arrival of rain. Since a majority of the agricultural households are dependent on rain-fed agriculture, they are finding it hard to sustain crop production. Apart from that, 18.6% of women and 14.4% of men agreed that the long-term changes had caused illness and other health-related issues, including skin diseases, malnourishment and body pain. Again, the women in the households are much aware of the climatic changes; but, the effects are perceived differently.

3.3 Adaptation of the households

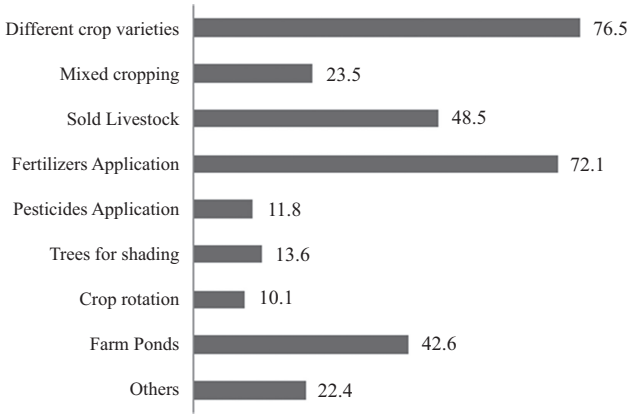
Agricultural households have developed several adaptation measures to sustain crop production. According to Akinnagbe and Irohibe (2014), three possible adaptation objectives include reducing exposure to the damage, developing specific steps to cope with the damages



Source(s): Pilot study

Figure 5.
Impacts of the long-term changes in climate (in percent)

and taking advantage of new opportunities. This section explains the major adaptation strategies adopted by the households of the male and female respondents, as illustrated in Figures 6 and 7, respectively. Figure 6 demonstrates that 76.5% of the agricultural households have used different water-efficient crop varieties, 72.1% of the farmers use fertilizers, including urea, to improve crop yield. Many farmers have also started applying bio-fertilizers and vermin composts in their farmland. 48.5% of the farmers have sold their livestock at a higher price to raise their income and save extra expense in feeding the livestock to overcome the financial stress due to climate change.



Source(s): Pilot study

Figure 6.
Adaptation strategies

Source(s): Pilot study

Figure 7.
Adaptation strategies of women in households

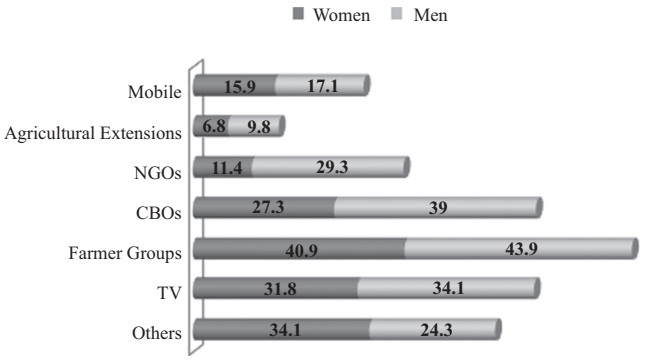
Apart from that, 42.6% of the households have constructed farm ponds, 23.5% of the farmers have adopted mixed cropping. 22.4% of the agricultural households have opted for modern irrigation techniques like sprinkler and drip irrigation methods. At the same time, very few farmers have used other major adaptation strategies include pesticide application, trees for shading and crop rotation.

3.3.1 Adaptation strategies of women. Apart from this, the section exclusively analyzed the adaptation strategies put forward by the female respondents. Generally, women are said to have a poor influence on the household level decisions regarding climate change adaptation strategies and have limited capacity and resources to resist the impacts of climate change (Uniacke, 2018). The women's social roles can also be a reason for the poor adaptation strategy (McKinley *et al.*, 2016). In this study, women have adopted specific strategies to sustain the household living conditions and agricultural initiatives.

Figure 7 shows the adaptation strategies taken by the woman in the households. 47.1% of the women sell their household assets, and 42.4% sell their jewelry to cope with the financial loss incurred during climate change. The essential assets of women primarily include their jewelry which is either mortgaged or sold to raise the households' income. Apart from this, 35.3% of the women use household savings as an adaptation strategy. However, 23.5% of the women mentioned adopting no strategy, mainly due to their unawareness or lack of decision-making capacity in the family. Since 72.7% of the women in this study are not working and are financially dependent on their husbands, their independent decisions are ignored in male-dominated households.

3.3.2 Sources of information. Adaptation strategies undertaken by any individual are mainly dependent on the source of information related to climate change and its impact (Semenza *et al.*, 2011). Figure 8 analyses the primary source of information regarding the adaptation strategies as mentioned by the women and male respondents.

The graph shows that 40.9% of women and 43.9% of men have their primary source of information from the farmers' groups, indicating that the farmers' groups are very active in each district. 31.8% of women and 34.1% of men receive information from television, especially from news programs. Similarly, 15.9% of women and 17.1% of men receive information from mobile phones, indicating that men spend relatively more time on social media than women. Moreover, 27.3% of women and 39% of men receive information from community-based organizations (CBOs), indicating that men are more involved in social groups than women. And finally, 34.1% of women and 24.3% of men get information from other sources such as neighbors and family members.



Source(s): Pilot study

Figure 8.
Source of information

4. Conclusion

The study attempted to analyze the gender-wise perception of the agricultural households regarding climate change, the major adaptation strategies undertaken to mitigate climate change. It was evident that the agricultural households' are aware of climate change, and there are gender-wise differences in perception. Their perception is entirely analogous to the meteorological data of Rajasthan. Both the men and women respondents have identified deforestation, change in the standard of living, increased population, urbanization and industrialization are major factors attributable to climate change. The long-term climate changes have impacted the sustainability of livelihood of agricultural households due to the extinction of certain crops in the region, changed the timing of rains, increased frequency of droughts occurrence and lack of access to potable water. Women are affected more due to the lack of potable water, poverty and food shortages when compared to men. The major adaptation strategies of the agricultural households include crop diversification, applying excessive fertilizers, constructing farm ponds and mixed crop farming. However, the women have also undertaken specific adaptation strategies to sell household assets and personal belongings like jewelry. Further, the essential source of information includes farmer group discussions, community-based organizations and other social news.

Therefore, based on the above analysis, it is highly recommended to improve the existing policy standards to address rural households' agriculture issues, such as providing the required information and agricultural training sources to both men and women. Both the men and women of the households should receive specific training related to the management of climatic stress. The government attempt to implement an efficient and effective weather forecasting system can provide farmers timely alert regarding climate change. Moreover, active SHGs can uplift the women of the households by making them financially independent and improving their decision-making strategies. Farmers should be aware of the benefit of crop insurance schemes such as the Fasal Bima Yojana or Kisan Credit Card scheme. Moreover, the community-based organizations, including women members and agricultural extension services, should be more functional to extend support to the farmers during any climatic stress.

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