

Research Article



Assessing Perceptions of the Households-heads Regarding Food Security Status in Drought-hit Areas of District Tharparkar, Sindh, Pakistan: A Case Study for Agricultural Extension

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Abstract | According to the census of 2017, the population of Pakistan has exceeded 220 million. Most of the population depends on agriculture to earn their livings and to meet the desired level of food security. Despite all the progress the country has made so far, its population combating with the threat of food insecurity. Tharparkar, (the largest desert area not only in Pakistan but also in the South Asian region) is considered at the front line district in the country about food insecurity and malnourishment. The purpose of this study was to assess the perceptions of the respondents for ongoing food security status in the district of Tharparkar, Sindh-Pakistan and to highlight the role of extension service delivery organizations in the area. District Tharparkar is the most vulnerable area in the country for food insecurity. Tharparkar has four tehsils such as Mithi, Diplo, Chachro and Nangerparkar. Out of four tehsils, one tehsil Mithi was selected purposively. A well-structured questionnaire and key informant interview guide were used for data collection. Collected data were analyzed by statistical package for social sciences (SPSS). According to the results of the survey, the majority of the respondents perceived that factors such as global warming and climate change, unproductive land, depleting water resources, unavailability of drought-tolerant crop varieties, lack of health facilities, lack of awareness for food security measures, lack of Extension services in the area, limited income resources, and insufficient information for food security were the main factors cause food insecurity in the study area. The results further described the strategies adopted by respondents in the study area to combat food insecurity were the construction of water storage facilities, reliance on animals' food products, kitchen gardening, reuse of preserved food and other products, migration to food secure areas and reduced number of meals eaten in a day. It is recommended that government should focus on education, employment opportunities, development of natural resources for producing food secure crops and start awareness movements among the inhabitants of Tharparkar to revitalize the status of food security in the study area.

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Introduction

Food security is caused by high malnourishment tangled with inadequate water availability that affects plant growth and productivity ultimately leading to loss of yield popularly known as food insecurity vs. growing population. Most of the areas of the world are turning to arid where water deficiency is reinforcing drought conditions due to climate change and global warming (Siddiqui and Safi, 2019). The under-ground water level is decreasing, and the pattern of rainfall is changing that is making the lower Sindh province of the country water deficient. Being the low income province, people are facing agricultural as well as the economic drought that is causing severe food insecurity and health issues (Herani *et al.*, 2009). Rain water is collected in mud wells (opened or protected) and used up to next rainfall. However, fewer communities rely on government water supply schemes. Respondents travel a long distance of many kilometers in search of water on camels, donkeys and carts as transportation sources. A few respondents use cloth filter and boiling to improve water quality, but contaminants and chemicals are not removed by these techniques. Uncovered water in mud pounds is excessively consumed by small and large animals in the affected areas. Different survey reports show that more than 70% sampled water collected from reverse osmosis (RO) units installed by the Government of Sindh in Tharparkar is unsafe for human use (Suleri, 2010). Manchar Lake is the largest source of fresh water in Sindh province which contains different heavy metals that cause health issues. According to the literature, these heavy metals include arsenic, mercury, magnesium, and cadmium (Kleinschek *et al.*, 2007).

Pregnant and lactating women and children under five years of age in the family are more vulnerable groups suffering due to prevailed drought and food insecurity situations across the district of Tharparkar (Sand *et al.*, 2018). Food insecurity rates in Tharparkar are alarming (UNICEF, 2015). Almost 68% of the women surveyed in 2015 and were either landless or share- croppers. Moreover, 41% of households were landless agricultural laborers or pastoralists, and 27% were sharecroppers, these are likely to persist up to the present time (UNICEF, 2015). The issue of food security has taken an even more intense form in Sindh and it is the need of the hour to call for a nationwide awareness and well designed interventions to minimize widespread malnutrition and poor

dietary practices (Ali *et al.*, 2018). Tharparkar is a major district of Sindh and it has been declared as the most food insecure area due to the frequent droughts which create unfeasibility for the presence of rain-fed agriculture and livestock. As livestock has always remained a major source of the livelihood of the inhabitants of Sindh rural area, most of the population can only manage to earn their living and to have an access to nutritious food. Consequently, even less severe drought can drastically effect the population. Likewise, climate change has emerged as one of the obvious reasons behind the drought and food scarcity in the Tharparkar region of Pakistan (Memon *et al.*, 2018). In the past, the devastating situation caused by droughts considered to be the result of less or no rainfall. However, the changing patterns of rainfall, largely because of the climate change situation, have aggravated the situation to such extent that the region now grapples with erratic rainfall patterns. Although inhabitants of Tharparkar district have experienced several droughts in the past, yet there is no applicable remedy suggested to face this serious challenge (Akbar and Yasmeen, 2017). Torres (2007) described in his study that Pakistan is facing the change in environmental conditions and Tharparkar region has become more vulnerable to food insecurity and malnutrition.

This situation has proved to be consequential and it is anticipated that food insecurity will have adverse effects on the livelihoods of the local inhabitants of Tharparkar region. Moreover, the climate change has had extreme impacts on human lives (Akhtar and Jariko, 2018). Nothing serious has been done in this case to reinvigorate the drastic conditions of the largest desert of Pakistan. Although policymakers are struggling to carve out the solutions to make the situation better for the people of Tharparkar, no compliance has been observed for the efforts of policymakers (Shahzad, 2017). All districts in the surroundings of Tharparkar were adversely affected by the droughts. The people are not able to do much because there are no proper services available to them (Mahmud *et al.*, 2009). In the case of Tharparkar, hardly anything had been implemented to improve the situation. Therefore, the current situation is getting worse because of an alarming rate of food insecurity and malnutrition in this area. Present study was designed to highlight major causes of food insecurity in Tharparkar and to suggest possible measures to tackle the issue of poor food security in the study area. The study was based on

the following objectives.

Research objectives

1. To study the demographic characteristics of the respondents.
2. To assess the factors affecting food security conditions in the study area.
3. To explore the factors responsible for the provisions of secure food in the study area.
4. To assess the measures required to manage food security status in the study area.

Materials and Methods

Research design

Descriptive cross sectional survey research design was applied to measure the research objectives of the study. A survey was conducted for data collection. This design is helpful in describing existing conditions of food security vs. insecurity; drought hit conditions, coping strategies of households against food insecurity in the perspective of agricultural extension services.

Population and sample

The study was conducted in district Tharparkar, the most food insecure district of Sindh province. Administratively, it has divided into four subunits (tehsils) namely Mithi, Diplo, Chachro and Nangar Parkar. Out of these four subunits (tehsils), one tehsil (Mithi) was selected purposively. Tehsil Mithi was constituted of 12 union councils. Secondly, all union councils were surveyed in the study. The population of the affected inhabitants of 12 union councils of tehsil Methi was unknown. The overall sample size from unknown population of 12 union councils was computed by the formula provided by Casley and Kumar (1989).

$$n = Z^2 V^2 / d^2$$

Where,

Z= Normal variant or confidence level 95%= 1.96;
n= Sample size; V= 51% assumed variation in the sample size of selected households heads those were highly; affected from food insecurity in tehsil Mithi;
d= assumed marginal error (5%).

$$n = \frac{(1.96)^2 (0.51)^2}{(0.05)^2} = 399.68 \approx 400$$

Table 1 described the sampling procedure for the study. Two villages from 11 union councils and three

villages from one union council using non-random purposive sampling were selected in the study. Thirdly, 16 households' heads (respondents) from each village were included with the help of assisting field staff for implementing survey using purposive sampling from most affected unknown population of tehsil Methi. It is worthwhile to mention that non-probability purposive sampling is highly effective when randomization is not possible, population is large, scattered, unknown and researcher has limited resources, time and helping hands.

Table 1: Distribution of respondents as per computed sample size.

S. No.	No. of union councils	Total No. of villages selected	No. of respondents selected from each village	Total No. of respondents in the sample
1.	11	22	16	352
2.	1	3	16	48
Total	12	25	16	400

Research instrument

The study employed two types of data collection instruments. Face to face structured interview schedule and key informant interview guide. The interview schedule was used for data collection from 400 household heads while interview guide was used to collect qualitative data from other stakeholders in the study area.

The reliability coefficient for quantitative instrument was calculated using Cronbach Alpha formula applying statistical package for social sciences (SPSS). Alpha (α) ranges from 0 to 1. A value of ≥ 0.70 reflects good reliability. Reliability coefficient for all factors measured on 5-point Likert-type scale was computed and found satisfactory for the present study which was above 80%. The content and face validity was established by seeking the suggestions of the experts from the discipline of Agricultural Extension Education. Relevant variables matching scope of the study were included in the instrument. Instrument was reviewed by incorporating the suggestions of the experts from the discipline.

Pre-testing of research instrument

Thirty respondents were purposively selected from Tehsil Mithi for pilot study. Respondents from different locations were included for pre- testing to ensure plausible and authentic responses. Revisions were made in the light of respondents' observations

and opinion of the experts on the quality of research instrument to enhance its validity and reliability.

Data collection procedures

The household heads as respondents were sampled for the study to answer the questions on the issue of food security and how they tackle the situation as the leader of their families. Quantitative data were collected from purposively selected respondents from the study area for interview sessions conducted by using structured questionnaire and administered by the researcher face to face.

Data analysis

Quantitative data were analyzed using the computer software program statistical package for social sciences (SPSS). Distinct categories, patterns and themes were identified to elaborate the data both in quantitative and qualitative manners. The tools of descriptive statistics such as percentages, frequencies, and means were used to describe the data and inferential statistics such as multiple regression analysis was conducted to see how different factors in the study can play their role to improve food security in the study area.

Results and Discussion

Socio-economic characteristics of the respondents

Socio economic indicators generally influence attitude and behavior of respondents. Indicators like age, education, size of land holding, and profession, played central role in determining attitude of the respondents towards adoption or rejection of any new idea.

Age, gender and education level of the respondents

Socio-economic indicators may affect awareness and adoption levels of the respondents. Demographic characteristics are important in explaining entire population of the study (Ashraf *et al.*, 2018). The socio-economic characteristics of respondents in the study area are presented and discussed below.

Findings from Table 2 show that 16.75% of respondents were in the young age group (15 to 30), while 59.5% belong to middle aged group that ranged from (31-45) years followed by 20.25% were in the category of (46-60) years. On the other hand, 3% of respondents were in the old age category (61-75 years) followed by 0.5% in the category of (76-90) years. Previous studies had shown that older a person, the higher experience he gets in terms of agricultural practices (Ramzan *et al.*, 2003; Khurshid *et al.*, 2006).

Table 2: Frequency distribution of Age, gender and education of the respondents in the study area.

Age group in years	Frequency	Percentage
15-30	67	16.75
31-45	238	59.50
46-60	81	20.25
61-75	12	3.00
76-90	2	0.50
Gender		
Male	264	66.00
Female	136	34.00
Education		
No formal education	220	55.00
Primary	64	16.00
Middle	70	17.40
Metric	31	7.80
Intermediate	15	3.80

Gender distribution showed that there were 66% male and 34% female household heads in the study. Moreover, Table 2 also indicates the educational level of the respondents of Mithi area of Tharparkar. Findings described that majority of the respondents 55% were unable to read and write. Sixteen percent had education up to primary and 17.40% of respondents had education up to middle level. Whereas 7.8% had education up to metric and 3.8% had intermediate education. Research studies show that respondents with formal education can get more benefits than uneducated when they use print media for information. In order to achieve higher level of food security, education should be taken into serious consideration since only quality of education can provide valuable skills to the respondents (Amaza *et al.*, 2006; Dave *et al.*, 2009).

Profession and income level of the respondents

Job opportunities and other income generating resources of the respondents in the study area were evaluated to estimate their income levels from each profession in the following cross tabulation analysis of profession vs. income levels of the respondents to understand the category in which one falls.

Table 3 depicts that respondents had different profession to earn their livings. The professions in the area were farming, labor work, stitching/embroidery, government job and private job. According to the data depicted in Table 3, majority of the respondents such as 35% have had labor work major profession in the study area followed by the stitching/embroidery and

private job with 26.5% and 20.2% respectively. In case of income level for these professions, labor work is considered as the major income generating profession (Rs. $\leq 10,000 \approx \$ 61$) with 46.5%. The results show that majority of the respondents in the study had monthly income to Rs. $\leq 10,000$.

Table 3: Cross tabulation for professions vs. income levels of the respondents.

Profession	Income levels			
	$\leq 10,000$	10,001-20,000	20,001-30,000	Total
Farming	29(14.6)	6(5.8)	3(3.1)	38(9.5)
Labor work	92(46.5)	26(25.00)	22(22.4)	140(35.00)
Stitching/em-broidery	45(22.7)	29(27.9)	32(32.7)	106(26.5)
Gov. job	11(5.6)	109.6)	14(14.3)	35(8.8)
Private job	21(10.6)	33(31.7)	27(27.6)	81(20.2)
Total	198(49.5)	104(26)	98(24.5)	400(100.00)

Note: Numbers shown in the parenthesis are the percentages of respondents regarding income level from specific profession.

Factors affecting food security in the study area

The second objective of the study was to describe factors those affecting food security in the study area. Following Table 4 gives the detailed picture of the prevailing situation of the area.

Table 4 highlights the various factors which were affecting food security in the study area. Among various factors global warming and climate change were the major reasons affecting food security in the study area with mean score of (4.49) which lies between high affect and approaching to very high affect on Likert type scale. According to the survey, among other factors, lack of irrigation facilities, shrinking arable land due to drought, level of accessibility of the respondents to food supply chain and decrease in jobs and agri-business opportunities for income generation resources with mean scores of (4.40, 4.34, 4.34) and (4.33) respectively were other major factors affecting food security in the study area.

Under the present scenarios of climate change, it is predicted that evapotranspiration (a sum of evaporation and plant transpiration from the land and ocean surface to the atmosphere) will increase, and crop water requirement will also increase. Kamaran *et al.* (2016) described that drought tolerant crop varieties require less water and produce better yield under reduced water conditions. It is also described that lack of proper irrigation water resources have major role to

strengthen ability of the respondents to produce food, generate income and ensure food security. It brings higher earnings through better yields, cropping intensity and the ability to grow high-value crops, which results in higher returns. Hussain and Hanjra (2004) also pointed out that irrigation benefits to the rural poor through higher production, higher yields, and lower risk of crop failure. Findings in Table 4 further described that mean value of (3.66) was found for almost all low yield cultivated grain crops which further deteriorating the food security situation in the study area. Hence from the results it is inferred that higher crop yield ensures food security while lower yield increases food insecurity and malnutrition risks in the study area.

In the formal discussion, respondents pointed out that irrigational water is a significant issue and causes food infirmity in the study area. According to one study, deficiency of water system frameworks has negative effect on farmers' income that reduces their ability to produce better food crops (Akbar and Yasmeen, 2017). This argument showed that there is no dependable source of water in the study area and respondents have no access to utilize proper irrigation water and hence the inhabitants of Tharparkar region face lack of access to fresh water for drinking and to irrigate their crops (Usman and Nichol, 2020). Factors such as climate change, water scarcity, and lack of sustainable system of irrigation continue to reshape and transform the dynamic condition of the region. Further, many studies described that women in particular have unpleasant effects of drought on their lives since the droughts and malnutrition affect women more than men (Solomon, 2019).

Animals' deaths due to drought in the study area

Many deaths of animals reported during the period under study by the respondents due to prevailing drought spell in the region. A brief survey picture is presented in the following Figure 1.

Findings from Figure 1 show that the percentage of animals deaths due to drought and food insecurity during the year (2014-15) such as peacock 22.97% followed by poultry birds 20.95%, goat 11.25%, cow 13.21%, camel 8.11%, deer 7.19, donkey 8.43% and sheep 7.89%. The results further showed that percentage of death for cow was gradually increased from the year 2014 to 2017. This shows the serious impact of drought conditions on the loss of milk producing animals.

Table 4: *Factors affecting food security in the study area of Tehsil Mitthi District Tharparkar.*

Factors affecting food security	n	Mean	Rank
Population imbalance in the study area	400	3.99	12
Food supply chain			
Inconsistent production of staple food items	400	4.30	7
Untimely access to staple food items	400	3.50	20
Inadequate storage facilities of food items at household level	400	4.15	11
Inadequate availability of consumable food items	400	4.17	10
Inadequate availability of processed food items	400	3.82	17
Inadequate availability of food to all family members at least two times a day	400	4.32	6
Poor purchasing power of the respondents for purchase of food items	400	3.83	16
Drought tolerant crop varieties			
Unavailability of drought tolerant crop varieties a, Cluster beans; b, Jatropha; c, Olive; d, Peanuts; e, Datepalm; f, Motch beans; g, Cactus	400	3.98	13
Low yield of cultivated crops a, Millet; b, Guar; c, Mung; d, Sesame; e, Check peas; f, Cheku; g, Mulberry; h, Falsa	400	3.66	18
Climate change			
Drought due to Global warming and climate change a, Depleting soil moisture; b, Rising temperature; c, Changing weather pattern; d, Decrease in biodiversity conservation; e, Decrease in fresh water resources; f, Insect/pest attack on crops due to climate change	400	4.49	1
Water			
Unavailability of water storage tanks	400	3.66	18
Lack of proper irrigation sources (water pump, rainfall)	400	4.40	2
Livestock			
High death rate of meat and milk producing animals a, Cow; b, Sheep; c, Goat; d, Deer; e, Camel; f, Birds (Peacock and chicken)	400	4.17	8
Poor awareness for food security measures	400	3.97	14
Shrinking cultivable / arable land due to drought	400	4.34	3
Lack of appropriate Extension advisory services in the study area	400	4.16	9
Decrease in jobs and agri-business opportunities	400	4.33	5
Social inequalities in resource distribution (food products, facilities etc.)	400	3.91	15
Level of accessibility of the respondents to food supply chain	400	4.34	4

Scale: 1: No affect; 2: Little affect; 3: Moderate affect; 4: High affect; 5: Very high affect.

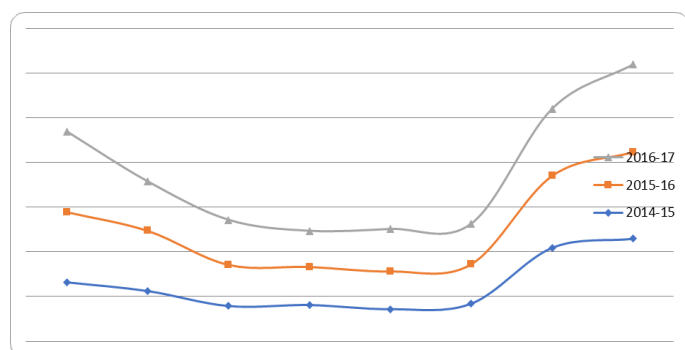


Figure 1: *Percentage of Animals' deaths due to drought/food insecurity. Source: Field survey 2016-17.*

Human deaths due to prevailing drought in the study area

Results regarding human mortality in the study area depicted in the following Figure 2. The Figure 2 shows

that 45% of new born babies died during (2016-17) followed by 39.47% (2015-16) and 33.11% during the year (2014-15). The mortality among children of age 1-5 years ranked second in Tharparkar. High percentage of 26.35% of children aged 1-5 years died during (2014-15) followed by 22.36% during (2015-16) and 21% during (2016-17). The figure further shows that almost 11.18% of children under the age group of 5-10 years died during (2015-16) followed by 10.81% during (2014-15) and 6% during 2016-17.

Huge percentage of women mortality was found before pregnancy that ranged from 10.13% to 9% during the years (2014-15), (2015-16) and (2016-17) respectively. Women deaths during pregnancy were observed as 7.43%, 8.55% and 12% during the years

of (2014-15), (2015-16) and (2016-17) respectively. About 9.43% children aged 10-15 years died during (2014-15) followed by 3.28% during (2015-16) and 3% during (2016-17). In addition, 5.26% adults died during (2015-16), 4.73% during (2014-15) and 4% during (2016-17). These results clearly describe the adverse effects of drought and climate change on human life in the study area.

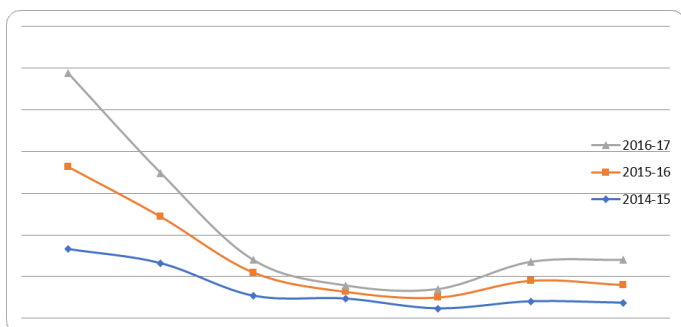


Figure 2: Year-wise percentage of human deaths due to drought in the study area. **Source:** Field survey 2016-17.

Factors responsible for provisions of secure food in the study area

The third objective of the study was to explore the factors responsible for provisions of secure food in the study area as perceived by the respondents. According to the respondents, there are many factors such as food supply, services delivery, grain food crops, animal and poultry by-products and water resources those could play significant role in improving food security status. These factors were identified during in-depth personal interviews and survey with the respondents. The summarized results are shown in the following Table 5.

The findings of the survey described in Table 5 show that different types of food items such as milk meat, mung, chickpeas, millet, peanuts and motch beans were little available to meet the food requirements of the respondents with the mean score of (2.35). Findings of the survey were discouraging and indicate clear difference in the standard food security situation and existing situation in Thar area. Mean score for "availability of food across the year" was (1.68) indicates that food was either "not available" or "little available" on 5 point Likert type scale. So, it is concluded that most of the respondents do not get food all over the year and they were in severe food insecure situation during the survey period in the study area. Mean availability of sufficient food two times a day shows that little food was available with the mean score of (2.01) which was not enough to

feed the entire family members at household level. These results indicate the scarcity of food products for the respondents in the study area. During the survey, it was also observed that women family members at household level sacrifice their share in food for male members and consequently causes abortions, miscarriages and malnutrition especially among pregnant women.

Table 5: Mean level of availability of factors responsible for provision of secure food.

Items	n	Mean	Rank
Different types of food items i, Milk; ii, Meat; iii, Mung; iv, Chickpeas; v, Millet; vi, Peanuts; vii, Motch Beans	400	2.35	1
Availability of food across the year	400	1.68	6
Sufficient food available two times a day	400	2.01	4
Availability of information from Ext. services for food security	400	1.69	5
Availability of processed food items	400	1.27	10
Availability of Eggs, chicken and vegeta- bles	400	1.51	8
Availability of Meat and Beef	400	1.34	9
Availability of drought tolerant crop varieties	400	1.08	12
Availability of food from different Non-profit organizations	400	1.53	7
Availability of Reverse Osmos water plants	400	2.03	3
Availability of ground water	400	2.09	2
Availability of water harvesting reservoirs	400	1.25	11

1: Not available; 2: Little available; 3: Moderately available; 4: highly available; 5: abundantly available.

Source: Field survey 2016-17.

According to the results from Table 5 regarding availability of milk show that little milk was available with the mean value of (2.35) on 5 point Likert type scale. Milk is perfect diet and is essential for healthy life of children and pregnant women but due to severe drought conditions and no vegetation, animals either died or produce very little milk which does not meet the needs of child bearing women and children of different ages. Availability of processed food items with the mean score of (1.27) shows that drought stress further affected the supply chain of prepared food items from different organizations in the area. Findings show that in the study area, drought tolerant crop varieties either were not available or majority of the respondents were not inclined to grow due to shortage of water resources or other reasons that

can produce better yield under drought conditions. Further results show that availability of reverse osmosis (RO) water plants, ground water and water harvesting reservoirs either not available or little available in the study area. Availability of water for human use and for animals was a dream for rural masses in Tharparkar during survey period. It was observed that water stored beneath earth's surface is slightly salty in taste and not suitable for human health as well.

High temperature speeds up the process of evaporation by changing water to a gaseous state that eventually increases the pace of the process of circulating water through earth and its atmosphere. As a result, higher latitude areas receive more rainfall as compared to dry and semi-arid zones (OCHA and FAO, 2016). Agricultural activities are dwindling due to the prolonged drought and increasingly erratic monsoon in Tharparkar.

Condition of natural resources in the study area

For the level of acceptance of the natural resources in the study area, the respondents showed entirely unacceptable level for existing condition of natural resources in the study area (Table 6).

Under the current scenario of climate change, pattern of rainfall and rising temperature; agricultural researchers have pivotal role in reducing the food insecurity in the study area and to boost up the natural resources for better agricultural production to meet some level of food security in the study area. Therefore, dependency on natural resources is increasing to feed hungry mouths.

The results show that production of crops such as cluster beans, jetropha, olive, peanuts, date palm, and motch beans were not in acceptable condition at all. In addition, the results also showed that crop production practices and input resources are absolutely not in acceptable condition. Further according to the results, under ground water was in little acceptable condition. However, water for farming not acceptable at all and for drinking at slightly acceptable condition. Respondents also showed not acceptable condition of rainfall in the study area.

Measures required to manage food security status in the study area

Multiple regression analysis was used to accomplish the fourth objective of the study. The factors such

as provision of information drought tolerant crop varieties water resources and fertile agriculture land have been manipulated to assess their contribution in provisions for food security in the study area. The factors responsible for the provision of secure food in the study area considered as dependent variable in the analysis.

Table 6: Mean acceptable condition of natural resources helpful in provision of secure food.

	Natural resources	n	Mean	Rank
Agriculture land	Cultivable land	400	2.39	2
	Soil fertility	400	2.03	5
Water resources	Availability of water	400	2.33	3
	Water for farming	400	1.30	6
	Water for drinking	400	2.17	4
	Underground water	400	2.45	1
	Rainwater	400	1.23	7
Crops	Drought tolerant crop varieties	400	1.19	8
	i, Cluster beans; ii, Jetroupha; iii, Olive; iv, Peanuts; v, Datepalm; vi, Motch beans			
	Crop production practices and input resources	400	1.09	9
	i, Ploughing; ii, Fertilizer; iii, Spray; iv, Irrigation			

*1: Not acceptable condition; 2: little acceptable condition; 3: moderate acceptable condition; 4: high acceptable condition; 5: very high acceptable condition. Source: Field survey 2016-17.

A complete regression model was applied to assess the role of independent variables (predictor) such as provision of information/awareness through training to respondents on how to keep secure food, cultivation of drought tolerant crops, water availability for irrigation and for home usage, and cultivable land for food crops for explaining dependent variable (provision of secure food in the study area). This type of analysis estimates the extent to which independent variables affect the dependent variable. Following regression equation was used to evaluate the role of independent factors for explaining dependent factor.

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \epsilon_j$$

Where;

y= Factors responsible for the provision of secure food in the study area; α = Constant/slope in the regression model; β_1 = regression coefficient for x_1 =Satisfaction of respondents regarding information/training to maintain desired level of food security; β_2 = regression

coefficient for x_2 = Drought tolerant crop varieties in the area for provision of secure food crops; β_3 = regression coefficient for x_3 = Water resources for irrigation and home usage; β_4 = regression coefficient for x_4 =Agricultural land used for producing secure food crops; ϵ_j = associated error (residual) of the observations and causes observable overall change occurred in the dependent variable of “factors responsible for the provision of secure food in the study area” when controlling other factors (Tables 7 and 8).

Table 7: Model summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	0.901	0.813	0.811	2.509

Table 8: ANOVA.

Model	Sum of squares	df	Mean square	F	Sig.
Regression	10783.076	4	2695.769	428.130	0.000
Residual	2487.164	395	6.297		
Total	13270.240	399			

a. Dependent variable: factors responsible for the provision of secure food in the study area

b. Predictors: (Constant), info, natural resources factors such as: drought tolerant crop varieties, water sources, agricultural land

Table 7 shows the value of R-Square (0.813) which means (81.3%) variation was explained by the dependent variable such as factors responsible for the provision of secure food in the study area. Table 8 shows that MR model fitted well for analyzing the factors of provision of information drought tolerant crop varieties water resources and fertile agricultural land. The alpha level 0.05 was used. The model was statistically significant $F(4,395) = 428.130$ $p < 0.05$ and accounted for 81.3% of the variance in the dependent variable of factors responsible for the provision of secure food in the study area.

To show the individual contribution of independent variables in regression analysis, unstandardized coefficients, standard error, standard coefficients, and t-value were employed. Standard coefficients illustrated the net effect in “factors responsible for the provision of secure food in the study area” (dependent variable), which was related to one unit change in independent variables such as agricultural land,

water, crops and information sources, etc. in terms of standard deviations.

Table 9: Regression coefficients.

Model	Unstd. coefficients		Standardized t coefficients		Sig.
	Beta	Std. error	Beta		
(Constant)	3.584	1.454		2.465	0.014
Land	3.322	0.083	0.919	40.134	0.000
Water	0.082	0.030	0.062	2.742	0.006
Crops	-0.261	0.065	-0.088	-4.028	0.000
Information	-0.260	0.028	-0.205	-9.209	0.000

a. Dependent Variable: factors responsible for the provision of secure food in the study area.

Results from Table 9 show that standardized beta coefficients demonstrate individual predictive significance of the independent variables and point out the average change in the dependent variable which is associated with the same amount of change in any particular independent variable with one standard deviation when other independent variables remain constant. In this study, when the independent variable of land changes one unit, the standardized beta coefficient value of (0.919) shows the same amount of change in the dependent variable; this means that when other independent variables of water, crops, and information remain constant, the dependent variable of factors responsible for the provision of secure food in the study area also increases by the same amount of (0.919) standard deviation.

In addition, the standardized beta coefficients compare the strength of the effect of each individual independent variable to the dependent variable. In this study, the independent variable of crops (-0.088) and information (-0.205) show that drought tolerant crop varieties and necessary information and training to respondents are not available to maintain standard food security in the study area and have more effect as compared to other independent variables of land and water. The results from the above table emphasized that there is a dire need to work on drought tolerant crop varieties and providing information and training to the respondents to make the food more secure in the study area. Results also indicated that independent variables like cultivable land, availability of water for irrigation and for home usage, cultivation of drought tolerant crops, provision of information, training and awareness to respondents regarding secure food are the key factors

which can ensure food security in district Tharparkar, Sindh, Pakistan.

Conclusions and Recommendations

It is concluded from the analyses that majority of the respondents in the study were middle to old age households heads including both men and women. Education plays a critical role in understanding the sensitivity of food security status and respondents could learn new techniques how to keep food secure. However, the findings of the study show that many of the respondents participated in the survey had had no formal education which is another cause of poor food security status in the region.

Purchasing power of the respondents is important to get access to food supply chain which depends on the job or business opportunities available in the area and the income level. It is concluded from the findings that many of the respondents were involved in the labor work and barely make less than or equal to Pak. Rs. 10,000.00 (almost \$ 61) a month. This level of income does not give enough money to buy food items for a large or extended family for the month in tehsil Mithi, district Tharparkar. This might be the reason that many of the respondents were not able to buy or store enough food items in the study area for rainy days.

From the findings of the survey, it is inferred that unavailability of drought tolerant high yielding crop varieties, inconsistent food supply chain, population imbalance, low yielding crops, climate change, scarcity of water resources, high death rate of milk and meat producing animals, poor awareness of food security measures, decreasing arable land, lack of proper Extension services interventions, limited job and business opportunities and social inequalities in distribution of food resources are major factors affecting food security status in the study area.

Findings of the study further lead to conclude that food security status was highly affected by the prevailing diseases in humans and animals due to drought and unhygienic conditions in the study area consequently left majority of deaths especially meat and milk producing animals, pregnant women, new born babies and children under five years of age. Many of the deaths occurred due to non-availability of health services in the nearby locations in the study area.

Resultantly, it is concluded that responsibility to improve the status of food security for the respondents not only in the study area but also the district of Tharparkar, Sindh-Pakistan lies with public or private Extension service organizations. More efforts are required for consistent food supply through different means across the year. Proper information, awareness and training for food security measures are helpful for the respondents to understand the food security status in the study area. It is also concluded that more accentuated efforts are required for improving drought tolerant crop varieties for better yielding capabilities, livestock development for producing meat and milk and water resources and reservoirs in the study area.

It is deduced from the findings that respondents were more satisfied from non-government organizations (NGOs'), self-help groups, neighborhoods, electronic media and up to some extent from their elders for receiving guidelines, training and information regarding food security measures as compared to public extension services or research and educational institutes in the study area. In addition, it is also inferred from the findings of multiple regression analysis that status of the factors responsible for providing secure food in the study area can only be changed on sustainable bases if the services providing extension organizations put high emphasize on delivery of correct information, training or awareness to respondents for food security measures, natural resources such as factors like high yielding drought tolerant crop varieties, to increase water resources and to reclaim more arable agricultural land for the respondents in the study area. Moreover, public agricultural extension organizations has limited role in the area which is another key factor need to be addressed in future to make the area more food secure.

Following are the few recommendations for Agricultural extension services organizations to improve the status of food security particularly in tehsil Mithi and district Tharparkar at large.

- **Improve demographic factors:** Educational and awareness level of the respondents need to be increased by initiating short-term and long-term educational programs for the respondents especially women to give them awareness how to maintain food security at household level.
- **Timely assessment of factors causing food insecurity:** Continuous efforts are required to find and tackle such factors those contribute in

increasing food insecurity. In addition, more earning hands need to be increased to improve family income and the job opportunities in different professions to increase purchasing power of the respondents for buying agricultural land and animals to improve food security situation in the study area.

- **Control in human and animal diseases and death rate:** Timely and accessible health services must be provided both to human and animals to improve health services for maintenance of better food security status in the study area.
- **Improve natural resources in the study area:** Factors such as water resources, arable agricultural land, drought tolerant crop varieties have significant role in improving food security status on sustainable basis. Public agricultural extension service organizations must provide assistance to the respondents on war bases to improve these factors for achieving the goal of sustainable food security in the study area.

Novelty Statement

This study is a part of doctoral level research work. The unique aspect of this research is the intervention in Tharparkar district by the scholar without any external funding and other resources to show the solidarity with the people of the Tharparkar in Sindh province. The sole purpose to conduct this research in Tharparkar-Sindh is to pinpoint the sensitivity of the issue prevailed in one of the greatest deserts in the world. This study is an effort to unveil the ongoing sufferings of the respondents in Tharparkar where according to one UNICEF report “the district has been hardest hit when it comes to infant mortality” due to malnutrition and drought in the area. Women, newborn babies and children under five years of age are the most vulnerable parts of the society to this ongoing predicament in the study area.

Author's Contribution

Nadeem Abbas Shah conceived the idea of the study, prepared instrument for the survey with the help of other members of research team and collected the data from the field. Ejaz Ashraf supervised the overall research process and advised the scholar on every step of the research process. He further helps in data analysis and preparation of the manuscript. Zaheeruddin Mirani helped in the instrument preparation and

facilitated the scholar in data collection from the field. Hafiz Khurram Shurjeel helped in the instrument preparation and in the final write-up of the research. Usman Rafiq and Raees Abbas Shah helped in data collection, data entry and preparation of the final manuscript before submission. All authors have read the final manuscript before submission.

Conflict of interest

The authors have declared no conflict of interest.

References

- Akbar, S. and B. Yasmeen. 2017. Famine in Tharparkar: An examination of risk, vulnerabilities and social crisis. *Paradigms*, 11(2): 243-247.
- Akhtar, S. and G.A. Jariko. 2018. Socio-economic characteristics of poverty and their impact on seasonal migration in Tharparkar district, Sindh, Pakistan: A logistic regression analysis. *J. Grassroots*, 52(1): 1726-0396.
- Ali, S.N., S.A.K.A. Mohammed, S.U. Kazmi and J. Mariner. 2018. The association of disease with animal production systems and its socio-economic impact in district Tharparkar, Sindh, Pakistan. *Bint. J. Biol. Biotech.*, 15(2): 383-393.
- Amaza, P.S., J.C. Umeh, J. Helsen and A.O. Adejobi. 2006. Determinants and measurement of food insecurity in Nigeria: some empirical policy guide. *Present. Int. Assoc. Agric. Econ. Annu. Meet.*, August 12-18, Queensland, Australia.
- Ashraf, E., H.K. Shurjeel and Z. Baloch. 2018. Knowledge level of farmers regarding producing, processing and marketing of dates in Panjgur-Balochistan, Pakistan. *Sarhad J. Agric.*, 34(2): 251-257. <https://doi.org/10.17582/journal.sja/2018/34.2.251.257>
- Casley, D.J. and K. Kumar. 1989. The collection, analysis and use of monitoring and evaluation data. The world bank, IFAD, FAO London: John Hophkins Univ. Press, Page-83. Retrieved from <http://documents.worldbank.org> on 17-5-2018.
- Dave, J.M., A.E. Evans, R.P. Saunders, K.W. Watkins and K.A. Pfeiffer. 2009. Associations among food insecurity, acculturation, demographic factors, and fruit and vegetable intake at home in Hispanic children. *J. Am. Diet. Assoc.*, 109(4): 697-701. <https://doi.org/10.1016/j.jada.2008.12.017>
- Herani, G.M., M. Mahmud, M.A. Qureshi and

- A.W. Rajar. 2009. Livelihood diversification and opinion polls' analysis: Evidence from Tharparkar-Sindh (Pakistan). *Indian J. Manag. Soc. Sci.*, 3(1): 64-79.
- Hussain, I. and M.A. Hanjra. 2004. Irrigation and poverty alleviation: Review of the empirical evidence. *Irrig. Drain*, 53(1): 1-15. <https://doi.org/10.1002/ird.114>
- Kamaran, S., T.M. Khan, A. Shakeel, R. Ahmad and A. Zeb. 2016. Genetics of salt stress tolerance in upland cotton (*Gossypium hirsutum* L.). *Genetics*, 5(7): 31-37.
- Khurshid, K., M. Iqbal, M.S. Arif and A. Nawaz. 2006. Effect of tillage and mulch on soil physical properties and growth of maize. *Int. J. Agric. Biol.*, 8(5): 593-596.
- Kleinschek, M.A., A.M. Owyang, B.J. Shaikh, C.L. Langrish, Y. Chen, D.M. Gorman, W.M. Blumenschein, T. McClanahan, F. Brombacher, S.D. Hurst, R.A. Kastelein and D.J. Cua. 2007. IL-25 regulates Th17 function in autoimmune inflammation. *J. Exp. Med.*, 204(1): 161-170. <https://doi.org/10.1084/jem.20061738>
- Mahmud, M., G.M. Herani, A.W. Rajar and W. Farooqi. 2009. Livelihood diversification and opinion polls' analysis: Evidence from Tharparkar-Sindh (Pakistan). Retrieved from: <https://mpra.ub.uni-muenchen.de/15002/> MPRA Paper No. 15002, posted 04 May 2009 07:33 UTC July 13, 2019.
- Memon, M.H., N. Aamir and N. Ahmed. 2018. Climate change and drought: Impact of food insecurity on gender based vulnerability in district Tharparkar. *Pak. Dev. Rev.*, 57(3): 307-321. <https://doi.org/10.30541/v57i3pp.307-321>
- OCHA and FAO. 2016. Office of Coordination for Humanitarian Affairs and Food and Agricultural Organization-Joint Mission Report on Tharparkar. <https://reliefweb.int/report/pakistan/pakistan-ocha-fao-joint-mission-tharparkar-1-3-may-2016>.
- Ramzan, S.K., M.A. Sharma and B.R. Singh. 2003. Separation of the components of type A botulinum neurotoxin complex by electrophoresis. *Toxicon*, 41(3):321-331. [https://doi.org/10.1016/S0041-0101\(02\)00309-4](https://doi.org/10.1016/S0041-0101(02)00309-4)
- Sand, A., R. Kumar, B.T. Shaikh, R. Somrongthong, A. Hafeez and D. Rai. 2018. Determinants of severe acute malnutrition among children under five years in a rural remote setting: A hospital based study from district Tharparkar-Sindh, Pakistan. *Pak. J. Med. Sci.*, 34(2): 260-265. <https://doi.org/10.12669/pjms.342.14977>
- Shahzad, A.K., 2017. Tharparkar fiasco in Pakistan: A crisis of governance and its Future Implications. *J. Gov. Pub. Pol.*, 9(1): 77-98.
- Siddiqui, S. and M.W.A. Safi. 2019. Assessing the socio-economic and environmental impacts of 2014 drought in District Tharparkar, Sindh-Pakistan. *Int. J. Econ. Environ. Geol.*, 8(4): 8-15.
- Solomon, S., 2019. Understanding the impacts of climate change on water access and the lives of women in Tharparkar District, Sindh Province, Pakistan: A Literature Review, 1990-2018. Retrieved from <http://jhir.library.jhu.edu/handle/1774.2/61827> on July 13, 2019
- Suleri, A.Q., 2010. The social dimensions of food insecurity in Pakistan; In *Hunger Pains: Pakistan's food insecurity*. Woodrow Wilson International Center for Scholars, Asia Program, 78-85. Retrieved from https://www.wilsoncenter.org/sites/default/files/media/documents/publication/ASIA_100412_PakistFood_rptL0713FINALVERSION.pdf on May 22, 2018
- Toress, C.A.Q., 2007. Drought in Tharparkar: From seasonal to forced migration. *State Environ. Mig.*, 19(1): 64-75.
- UNICEF, 2015. Nutrition and mortality survey Tharparkar, Sanghar and Kamber Shahdadkhot districts of Sindh Province, Pakistan UNICEF Annual Report 2015.
- Usman, M. and J.E. Nichol. 2020. A spatio-temporal analysis of rainfall and drought monitoring in the Tharparkar Region of Pakistan. *Rem. Sens.*, 12(3): 580. <https://doi.org/10.3390/rs12030580>