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AN ASSESSMENT OF FOOD SECURITY STATUS AND CONTRIBUTION OF LIVESTOCK IN HOUSEHOLDS CONSUMPTION PROFILE: A COMPARATIVE STUDY IN DIFFERENT REGIONS OF PUNJAB

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ABSTRACT

Livestock is one of the fastest-growing sectors, especially in emerging economies, to meet the projected demand for protein for the growing population. Livestock's role is beyond its contribution to meat and milk. It affects food security in multiple ways. The current study is designed to assess the food security status of households having livestock and the caloric contribution of livestock in the consumption profile of households. For this purpose, a sample of 456 households was collected from three districts (152 from each Bahawalpur, Faisalabad, and Rawalpindi) of Punjab, representing the southern, central, and northern regions of the province. The calorie intake of households is assessed by studying the consumption profile and evaluation of generated energy in terms of calories to assess food security. The contribution of livestock is estimated from cumulative energy generated in the form of calories from the consumption of livestock products. Data analysis reflects that 59% of Bahawalpur households are food secure compared to Faisalabad, where 63% of households are food insecure. Similarly, Rawalpindi has 60% of households with food security status. The households with livestock and whose women participate in livestock activities extract 20% of their nutrition from animal sources in Bahawalpur, 20% in Faisalabad, and 30% in Rawalpindi. The overall food security situation can be improved by increasing the share of livestock products in the household's consumption profile.

Keywords: Food Security; Livestock; Calorie contribution; Household; Punjab.

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INTRODUCTION

The world's population will reach 9.6 billion by the end of 2050, challenging the agricultural system to raise production to ensure accessible and affordable food for all. The livestock sector is core of food system development. Being the complex and dynamic agriculture sector, it has a one-third contribution of global agricultural GDP with inference for animal health and nutrition, animal feed demand, market integration in the supply chain, amplification of production at the farm level, farm income, and land use. Livestock has frequently changed the dynamics of agriculture in recent decades. It is the principal client of land resources having 26% under grazing lands and one-third of arable land under feed crops. The strong link of livestock with the feed crop sector is through the generation of by-products like manure and draught power. In many developing countries, livestock serves as the store of wealth and a safety network. It is a landscape of cultural distinctiveness and traditional practices in many societies of the human race. The evolution in demand for animal-sourced food has put pressure on the sector through diversification in land use

patterns. A wide range of livestock production systems exist like extensive (e.g., grazing in ruminant animals), intensive (which includes a large number of animals fed through concentrated feed contents in a controlled environment), and intermediate systems between the two. It is quite essential to enhance beneficial economic, social and environmental impacts and minimize the harmful impacts by defining the pathways. Based on the assumption that the livestock sector can serve as an appealing vehicle to achieve nutritional and food security through the exploration of the potential pathways of sustainable agriculture development. The importance of the livestock sector in accelerating socio-economic prosperity in Pakistan's economy can be realized from its share in the gross domestic product, i.e., 11.7 percent with a 2.58 percent growth rate. It is a source of income for more than eight million families (30 million people) who directly draw 35 percent of their income. Its contribution to providing dietary nutrients, poverty alleviation, and earning foreign exchange has highlighted this sector (GOP, 2020).

In the future, livestock will be one of the fastest-growing sectors, especially in emerging economies, to meet such a projected demand for protein (Thornton, 2010). 800 million of the world's population was found undernourished in 2015 due to an insufficient supply of micro and macro nutrients (protein, fats, and carbohydrates) especially having hidden hunger, i.e., poor intake of micro nutrients causing different kinds of food deficiencies like anemia and vitamin A, etc. (FAO, 2015). Livestock has an 18 percent contribution in providing calories and a 25 percent contribution in the provision of protein (FAO, 2016). Apart from its share in high-quality protein, it also has a share in food security through the provision of high-quality vitamins like vitamins A, B-12, riboflavin, calcium, iron, and zinc, which are impossible to get from other sources like plants in such a huge quantity (Randolph et al., 2007; Murphy and Allen, 2003). Livestock's role is beyond its contribution to meat and milk. It affects food security in multiple ways (Gerber et al., 2015). The positive contribution of livestock includes i) Provision of micro and macro nutrients, ii) Drought power for agricultural operations, and iii) Income generation for household and national economy (Mottet et al., 2017). In a study exploring the role of livestock in food security in Morocco and Saudi Arabia, demand for livestock-derived products was found to increase due to population growth, urbanization, and growing wealth. While in developing countries, the region's dependence on pastoral livestock has raised the food insecurity risk for rural households due to changes in precipitation patterns and increased reliance of urban consumers on imported content (Jaber et al., 2016). In Sub-Saharan Africa, households with livestock contribute more to animal-sourced food in their menu than households without livestock. They have significant use of milk, meat, poultry, and egg in their diet and are extracting a significant portion of their livelihood (Hetherington et al., 2017). Kassa et al. (2015) highlighted the role of livestock in food security by analyzing the data from small farms in Ethiopia. They found that the households fulfilled 27 percent of their energy requirements from livestock. In Pakistan, Punjab is the largest province in human and livestock populations. A large number of the population has adopted livestock as a source of livelihood and food security, especially women. So it is essential to explore the food security status of households having livestock and the contribution of livestock to the consumption profile of households.

REVIEW OF LITERATURE

Valdivia and Gilles (2001) conducted a study covering gender, livestock asset, resource management, and food security aspects in Indonesia. She evaluated the impact of the program regarding the development of small ruminants on food security. He collected data from poor households who had reared goats, sheep, and camelids and earned their livelihood. His research showed that women had cash crops poultry, sheep, goat, and some farm income as sources of income. It also showed that women were the managers of pastures, and changes in their use directly affected the dietary status of livestock and hence income earned from it.

Cohen (2005) explained the importance of livestock for the vulnerable segments of society who had poor housing, infrastructure wealth, and health facilities. A little is being done to combat poverty and the hunger situation. A dollar spent for fighting hunger can generate 20 times more benefits by investing in productive resources.

Walingo (2009) explained the case study of Kenya's role of women in livestock projects for sustainable food security. The variables used for this analysis such as per capita income, expenditures, chronic energy, and obesity. Findings were explained based on the ANOVA table. Concluding remarks explained a significant relationship between the empowerment of household women and welfare. But according to the literature, women's empowerment was less due to a lack of education. So education was found to be the main factor that enhanced the empowerment of women.

Ali and Khan (2013) explained the case study of Pakistan concerning rural household food security and livestock ownership. The variables used for this analysis such as market distance, education, bank distance, age, caste, experience, family size, land holding, and road distance. Poisson regression was applied for the empirical analysis. Concluding remarks explained that a positive association was found between food security and ownership of livestock. While there found an inverse relationship between food security and the non-ownership of livestock.

Herrero et al. (2019) explored in an international study the sustainability of the food system and its relation with livestock production. They explained the positive relationship between sustainable growth and improving nutritional supply for stockholders. According to their findings, the current growth of livestock in sub-Saharan Africa and Central Asia will not be able to meet the local animal-derived food demand. The number of animals that will grow, like the growth of mono gastric species like poultry, will increase compared to small ruminants.

Kariuki (2013) wrote a chapter titled Women livestock and food security in which they explained how women's access to productive resources plays a role in securing the nutritional requirements of their families. They presented three indicators of calculating food security through household dietary diversity score (HDDS), food consumption score (FCS), and a month of adequate household food provisioning (MAHFP). They explored that livestock holders have higher food security but HDDS not significantly different than the non-owners of livestock, and similar results were found in the case of MAHFP. But in the case of women's ownership of livestock scenario was different as she could influence the decision of how the products would be used, and food security showed different readings than men's ownership. Further, they concluded that the dietary diversity of food was responsive to the household's ability to purchase food.

Galie et al. (2015) conducted a study in Tanzania, Ethiopia, and Nicaragua on perceptions of rural women regarding resource ownership and their impact on household food security. They analysed data collected from 138 respondents, including both male and female participants. Both men and women have ownership of livestock, women had an inheritance or dowry, but the ownership in the case of the male was more number of heads of livestock, while in Nicaragua, most of the women given the statement that they can only have chicken rest of things owned by men. They reasoned that men owned large animals because women were majorly in-charge of house chores. They argued that the women-headed household having livestock consumed a major chunk of milk, and income obtained from it goes into expenses of her children like health education, etc.

Jodlowski et al. (2016) explored the effect of livestock distribution on the dietary status of households in Zambia. They used difference-in-difference regression to analyse the data collected. Keeping other

variables constant, the consumption of livestock products increased from 43 percent to 65 percent. And per capita consumption expenditures improved from 1.75\$ to 2.16 \$.

Jumrani and Birthal, (2016) used the data of 26734 households from the Indian Human Development survey to assess the impact of women empowerment in the ownership of livestock and its impact on the nutritional status of children. They researched that both men and women participate in livestock activities, but women earned 7 percent more income as compared to their opponents. They found a strong binding between the ownership of livestock and its impact on the health of children, especially in case of malnutrition of children and ownership of small ruminants. They further concluded that the nutritional security of children was also impacted by the parent's characteristics and dwellings. Rahman et al. (2017) used time-series data from 1980 to 2015 to explore the relationship between GDP growth and the production of livestock products like beef, mutton, milk, poultry, hides, skins, eggs, etc. Results were obtained using the Augmented Dicky-fuller test and OLS and interpreted using the Johansen Co-integration test. They showed that a significant positive relationship existed between milk, mutton, fat, egg, bones, and agricultural growth of GDP, while beef, poultry, wool, hair, skins, and hides had a negative relationship with Agricultural GDP growth hence poverty. Doss et al. (2018) conducted a research study to link livestock agriculture diversification with food security. They analyzed the data collected from 986 respondents using Poisson and the negative binomial regression technique. They concluded that positive relation was found between livestock diversification and respondents' nutritional diversity. Investment in cattle, goat, and poultry production significantly affected the dietary requirements of respondents positively. Similarly, the production of cereal and pulses also had a positive relation with dietary diversity. They concluded that agricultural combinations of cereals, pulses, green vegetables, livestock cattle, small ruminants, and poultry were crucial for dietary diversification. Salazar et al. (2018) explored the effect of livestock transfer on food security.

They analyzed a sample of 1200 respondents who were involved in the livestock asset transfer program and were food insured before the receipt of an animal head. They assessed their food security in three dimensions, i.e., food availability, accessibility, and use. Results showed that participants improved their food security level through increased income obtained from the sale of milk and meat, and the contents of food improved through the intake of milk and protein. Women empowerment increased and reduced gender parity. Enahoro et al. (2018) used scenario analysis to explore the impact of livestock development on a sustainable basis on nutrition and livelihood, livestock-derived demand for food and its production, and options for investment in sub-Saharan Africa and South Asia. They were found to support the opinion that improving livestock sectors in these two regions had better return in terms of food security, gender equality, and economic well-being and limiting global warming by reducing the impact of greenhouse gases.

MATERIAL AND METHODS

A sample of 456 households was collected from three districts (152 from each Rawalpindi, Faisalabad, and Bahawalpur) of Punjab, representing the northern, central, and southern regions of the province. Consumption patterns of the household are studied to check the consumption profile and to estimate food security. Many food security measurements have been widely used in most food security research worldwide. However, no method provides a full assessment of food security because they fail to take into account the vulnerability and sustainability elements of food security. Hence, neither method has been accepted as a "gold standard" for an analysis of household food security (Maxwell, 1996).

In the current study, the above-mentioned issue is tackled by calculating the calorie intake of each household. The calorie intake of households is calculated by multiplying the quantity of food by its energy.

It is then compared with recommended calorie required (demand) per household. The available calorie will be calculated with the help of the Adult Equivalent Unit (AEU). Appropriate values are picked according to age group and sex (according to the demographic structure of the household) and then summed to compute the total Adult Equivalent Units for the particular household. The adult Equivalent Unit for each household is multiplied by 2450 calories for the sake of calculating of total calories required for that household because one adult equivalent unit requires 2450 calories per day (GOP, 2003). The difference between calorie intake and calories required by a household is used to determine the food security status of the household (Bashir et al., 2012).

$$FS_i = \alpha_0 + \sum \alpha_i Z_i + \mu_{i=1} \tag{1}$$

Where (i=1,2,3.....450)

FS_i is the Food security status of the household

α_0 is the intercept

α_i represents the coefficients of ith factor affecting the food security of the household

Z_i represents the vector of different livestock and socio-economic factors affecting the food security status of the household

RESULTS AND DISCUSSIONS

The livestock characteristics and food security attributes of households are described in this segment. Table 1 shows the composition of a livestock farms in different regions of Punjab which shows that Bahawalpur is the district in which most of the households prefer cows and small ruminants, comprising 31 percent and 48 percent of farms respectively, in tehsil Ahmadpur and 14 percent of cows, with 41 percent small ruminants in tehsil Yazman. Similarly, the households in Faisalabad have a majority of buffaloes and small ruminants at their farm, i.e., 22 percent and 35 percent, respectively, in tehsil Faisalabad and 18 percent buffaloes and 34 percent small ruminants in tehsil Jaranwala while in Rawalpindi, households have 21 percent buffaloes and 29 percent small ruminants in tehsil Gujar Khan and 23 percent buffaloes and 24 small percent ruminants in Kotli Sattian respectively.

Table 1. Composition of livestock herd in different regions of Punjab.

District	Tehsil	Buffalo	Cow	Calves	Goat/ Sheep	Poultry	Others
Bahawalpur	Ahmadpur East	16 (10)	53 (31)	24 (7)	44 (48)	12 (4)	1 (1)
	Yazman	27 (11)	34 (14)	21 (9)	47 (41)	16 (24)	1 (1)
Faisalabad	Faisalabad	36 (22)	34 (18)	18 (9)	42 (35)	15 (14)	2 (2)
	Jaranwala	36 (18)	36 (17)	17 (13)	44 (34)	19 (17)	1 (1)
Rawalpindi	Gujar Khan	51 (21)	47 (16)	21 (10)	36 (29)	24 (24)	1 (1)
	Kotli Sattian	30 (23)	26 (14)	41 (14)	43 (24)	42 (22)	1 (0)

Note: () have the %age of household livestock herd while other value is frequency of having that animals.

In District Faisalabad, tehsil Faisalabad households have 18 percent cows which are 17 percent in tehsil Jaranwala. In Rawalpindi district, tehsil Gujar Khan has 16 percent of cows in their livestock farm, which is 14 percent for tehsil Kotli Sattian. In tehsil Ahmadpur calve forms the 7 percent of total livestock while Yazman and Faisalabad tehsils have same 9 percent share for each. Calves proportion in tehsil Jaranwala is 13 percent, 10 percent in tehsil Gujra Khan, and 14 in tehsil Kotli Sattian. The contribution of domestic poultry found in household livestock is 4 percent in tehsil Ahmadpur, 24 percent in Yazman, 14 percent in Faisalabad, 17 percent in Jaranwala, 24 percent in Gujar Khan, and 22 percent in tehsil Kotli Sattian.

Food Security Status of Rural Households

The food security status of the rural households is estimated by calculating the food utility in terms of the daily caloric intake of the households and per person availability of food. The distribution of households having food security status in different regions of Punjab is shown below.

Table 2. Region-wise distribution of respondents on the basis of food security status.

District	Tehsil	Food secure	Food insecure
Bahawalpur	Ahmadpur East	42 (55)	34 (45)
	Yazman	47 (62)	29 (38)
Faisalabad	Faisalabad	51 (67)	25 (33)
	Jaranwala	45 (60)	31 (40)
Rawalpindi	Gujar Khan	47 (62)	29 (38)
	Kotli Sattian	46 (61)	30 (39)

Table 2 shows the utilization-based food security status of households in different regions among the rural households rearing livestock. The results in the table reflect that 45 percent of rural households in tehsil Ahmadpur east of Bahawalpur district are not meeting sufficient dietary needs and experiencing a food insecurity situation, while 55 percent of households are falling in the ambit of secure food households. 62 percent of rural households who have livestock are food secure in tehsil Yazman, while the other 38 percent are facing a situation of food insecurity. 33 percent of rural households in tehsil Faisalabad, 40 percent in tehsil Jaranwala, 38 percent in tehsil Gujar Khan, and 39 percent in tehsil Kotli Sattian are food insecure and not receiving sufficient amounts of calories in their daily intake.

Similarly, figure 1 shows the classification of rural household having livestock based on food security status. Extreme food insecure is the rural household that has availability of less than 50 percent of threshold calories while ultra-food insecure households have more than 50 percent but less than 75 percent of threshold calories in comparison to food-insecure households who have utilization of greater than 75 percent but less than 100 percent of threshold calories. Vulnerable food secure are those households having greater than 100 percent but less than 125 percent of threshold calories. Households consuming more than 125 percent of threshold calories are categorized as food secure. The results shown in graphical form reflect that Yazman followed by Jaranwala has the situation of extreme food insecurity, i.e., 12 and 11 percent, respectively, as compared to Ahmadpur, Faisalabad, and Gujar khan having 3, 4, and 4 percent, respectively. Most of the vulnerable food-secure rural households lies in Kotli Sattian, i.e., 47 percent, followed by Gujar khan at 43 percent, Ahmadpur at 25 percent, Yazman at 22 percent Jaranwala at 20

percent, and Faisalabad at 18 percent. If a shock may lead to a reducing the nutritional status of households to 25 percent may push the vulnerable household to the food-insecure category. The studies conducted by Abid et al. (2015) and FAO (2019) on food security in Pakistan endorsed the results of current research.

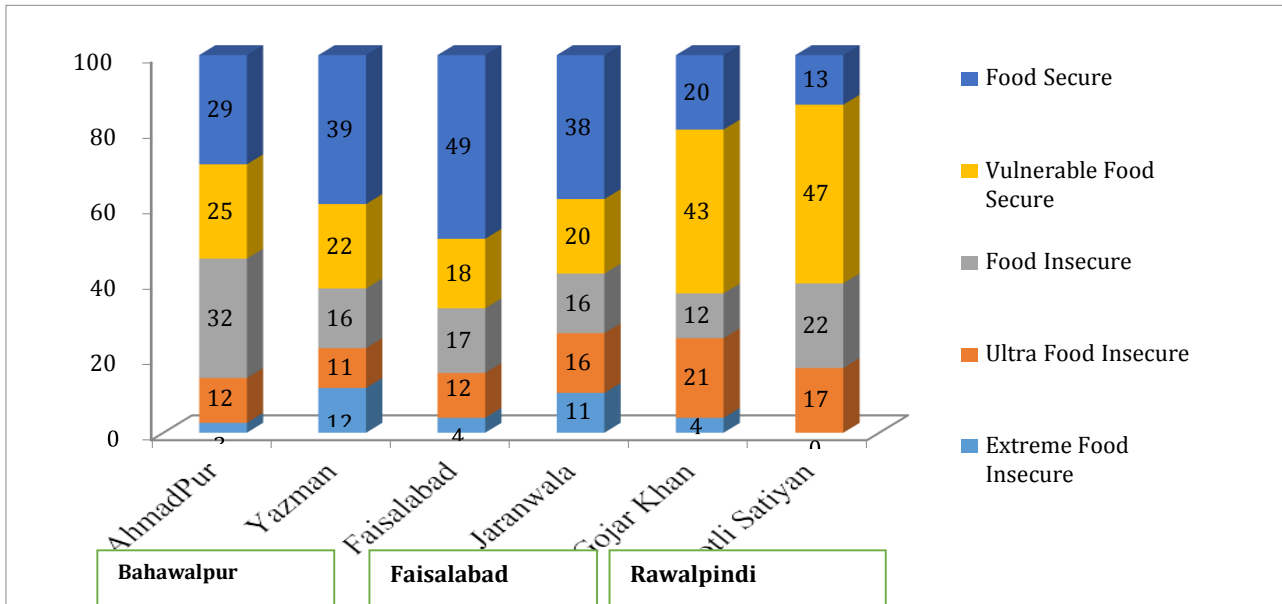


Figure 1. Classification of household on the basis of available calories.

Share of Livestock in Food Security

Table 3 shows livestock's average contribution to households' nutritional security. Rural households in Ahmadpur extract an average of 591 calories from livestock, i.e., 20 percent of daily intake, while in Yazman, 24 percent of intake comes from livestock to meet the dietary needs of the household and take 76 percent of their food from plants and other sources.

Table 3. Region wise distribution of respondents on the basis of share of livestock in nutrition.

District	Tehsil	Livestock Calories	Non-Livestock Calories
Bahawalpur	Ahmadpur East	591 (20)	2308 (80)
	Yazman	766 (24)	2393 (76)
Faisalabad	Faisalabad	724 (21)	2655 (81)
	Jaranwala	508 (18)	2344 (82)
Rawalpindi	Gujar Khan	799 (31)	1766 (69)
	Kotli Sattian	678 (29)	1677 (71)

Note: () contains % ages.

The contribution of livestock in rural household calories is 21 percent, while in Jaranwala, it contributes 18 percent of households' intake on average. In Rawalpindi, livestock contributes 31 percent of the household's diet in Gujar Khan, while its share is 29 percent nutrition of rural households in Kotli Sattian. Ali and Khan (2013) results also reinforce the finding of this study.

CONCLUSIONS AND RECOMMENDATIONS

Food security estimates of the different regions show that Bahawalpur (Yazman), followed by Jaranwala, has a situation of extreme food insecurity as compared to Ahmadpur, Faisalabad, and Gujar Khan. Most vulnerable food-secure rural households lie in Kotli Sattian, followed by Ahmadpur. The average contribution of livestock to households' nutritional security is 20 percent in Ahmadpur, 24 percent in Yazman, 21 percent in Faisalabad, and 18 percent in Jaranwala. In Rawalpindi District, livestock contributes 31 percent to the households' diet in tehsil Gujar Khan and 29 percent in tehsil Kotli Sattian. Increasing ownership of livestock and its commercialization through improved productivity and increasing the consumption of livestock products can be helpful for improving food security.

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