

Research Article



Role of Women in Livestock Management in the Rural Area of District Swabi, Khyber Pakhtunkhwa, Pakistan

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Abstract | The purpose of this empirical study was to identify the participation of women in livestock management practices and to explore factors determining their engagement in district Swabi, Khyber Pakhtunkhwa, Pakistan. A multi-stage sampling approach was adopted to choose a random sample of 110 women farmers from the union council of village Shewa, and a well-structured questionnaire was designed to accumulate the primary dataset from rural women through face to face interviews. A women's participation index was designed to compute the degree of women's involvement, and a multiple linear regression model was proposed to measure factors influencing women's participation in livestock management practices. The computed value of the mean composite index was 4.81 which showed that women farmers on average engaged for 4.81 hours per day in the livestock management practices. The multiple regression results illustrated that women's education, family size, and livestock income significantly affect women's participation; however, women's age and herd size insignificantly affect women's inclusion in the livestock farming operations. The findings of this study recommend that the importance of rural women's involvement in the livestock sector should be identified in federal and provincial government plans and agricultural policy formulations. The study also recommends that the provision of agriculture credit facilities and livestock training facilities to women farmers could stimulate their involvement in livestock practices and anticipates the decision-making power in livestock management practices.

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Introduction

It is widely accepted that the agriculture sector is the backbone of economic growth and development and poverty alleviation in emerging global economies where it is the main source of income of rural people (Doss, 2011). The economy of Pakistan is agriculture-oriented where most people live in rural regions and agriculture is the principal occupation of their

livelihood. Baig and Khan (2006) reported that 67.5 percent of Pakistanis are living in rural regions across the country and they are directly or indirectly dependent on sustainable agriculture production for their welfare. The agriculture sector has also manifold connections with other non-farming rural operations, which permit the inhabitants to produce services and collect revenue in adjacent zones. It contributes about 21% in the GDP figures and approximately 43.5% of

the labor force employed in the agriculture sector, and it shares around 56% of the total exports of Pakistan (Ahmad et al., 2007).

The agriculture sector is also playing a significant role in ensuring food security, family nutrition, livelihoods, family income, poverty reduction, transport and transformation towards industrialization. The recent economic policies designed by the government of Pakistan aimed to improve the living standard of the people and to combat hunger from the territory by making agriculture a prominent sector of the country (GOP, 2009). Mostly, in rural regions, the male personnel of the society are largely responsible for agriculture practices in the fields; however, women are not only assigned to do household tasks inside the four walls of their houses but also, they are excessively anticipating in the livestock activities. The daily domestic activities of women include cleaning of the home, food cooking, stitching, carrying children, etc.; whereas, the livestock farming activities consist of animals shed cleaning, caring of sick animals, milking, animals feeding, and preparing dairy products such as butter, yogurt and ghee (Zubair et al., 1999). About half of the rural natives of Khyber Pakhtunkhwa include women, who actively counted 60 to 80 percent as a labor force in the livestock practices. These women have been participating mostly in the animal grazing activities under the small-scale holding of the farming lands in order to increase the household income level, food security, and non-food products (Younas et al., 2007).

Khyber Pakhtunkhwa's economy

Khyber Pakhtunkhwa (KPK) is the 3rd largest economy in Pakistan, which is demarcated into 7 administrative divisions and 35 districts. Its share in the national GDP has historically recorded 10.5% because this province accounts for about 12% of Pakistan's total population (Bengali and Sadaqat, 2010). The entire population of KPK was 35.53 million in 2017 and above 83% of its population were living in countryside areas (GoP, 2017). The total land of KPK spreads about 10.17 million hectares, where 2.75 million hectares land was able to cultivate. Out of the cultivable land, 1.8 million hectares were cultivated for production purposes; whereas, the remaining land was a cultivable waste (Abbas, 2013).

KPK is an agrarian province of Pakistan, where agriculture activities prevail over a long period, in district Swabi, the main cash crops contain tobacco,

wheat, maize, rice, and sugar beets. This province possesses 4.2 million (21%) cattle, 1.4 million (7%) buffalos, 2.8 million (12%) sheep, and 6.8 million (16%) goats. Besides, this province contributes 9% in milk, 24% in beef, 15% in mutton, 20% in hides, 18% in skins, 28% in wool, and 17% in hair production (Ishaq et al., 2016). The women of this province are performing a pivotal role in the agriculture production in general, and in the livestock production in specific irrespective of the numerous social and cultural barriers from the society. They help out the farmers (especially family members) in the field in the shape of domestic animal production, dairy farming, poultry farming, gardening, etc. But specifically, livestock is the main subsistent activity of these women, which they use for the purpose to accomplish family food requirements and to enhance the earning of their families. However, the production of livestock depends on the farm size, crop sample, accessibility of rangelands, climate, temperature, rainfall patterns, fodder, and territory. But this is an undeniable fact that the portfolio of rural female households in livestock farming has either been ignored or underestimated at the global level (IFAD, 2007). Women restricted to stay at home offering the livestock substantially owned by the men. Therefore, women are predominantly engaged in farming, which includes livestock activities (Girei and Onuk, 2016).

Role of women

District Swabi is blessed with fertile agricultural soil; hence, most of the dwellers are mainly engaged in the agriculture sector. Tobacco is an important cash crop in district Swabi and provides employment and income generation to the people (Rahman et al., 2011). Women of this district perform a magnificent involvement in the agriculture sector and its productivity. Although these women are intelligent farmers, they perform the supplementary role in the crop production viz. grinding, husking, drying, winnowing, sowing, and storing tasks in agriculture (Saba, 2016). They regularly perform various indoor activities without any economic gains. These women also do work in the field and participate in all aspects of animal husbandry, for instance, herding, cutting fodder, animal feeding, chopping, transporting fodder, and cleaning the sheds, etc. Currently, the incomes generated from the services rendered by these rural women constitute a bigger part of the family's income, but unfortunately, these women cannot get the amount in a suitable quantity (Ahmad, 2001). Unfortunately, the role of women in the manufacturing sector and

livestock farming practices has been underestimated and unrecognized. That's why, the actions carried by men are navigable everywhere across the globe; however, the activities performed by rural women are ignored. Women workers, who account for more than 1/3 of the labor employment in the agriculture sector, are not mentioned in the National Agriculture Policy. Likewise, the recognition of women's status in the field of education in Pakistan has not yet been conceived, and the same is the case with their intellectual values in society (Saba, 2016).

Problem statement

The striking reason for carrying out this empirical research is to throw light on the partaking of women in the overall agricultural operations in general, and in the livestock management activities in particular in the village Shewa, district Swabi. The rural women in this territory are illiterate and are generally unskilled. They often work at their homes for days and nights without any appreciation and economic reward from their family members. Women's participation has not yet gained any proper value of any kind at any stage just due to their unrecognized status. They are considered as the first in taking the accusation for harvesting the food crops needed by men for the household subsistence; however, their uphill struggle goes into the account of voluntary services. Therefore, the present study is an endeavor to highlight the role of women in livestock farming in the form of policy revision. This quantitative study will enhance the understanding of women's contribution to livestock activities and would be helpful in the policymaking and its implications in KPK, Pakistan. As per the best of authors' observation, this empirical study is the earliest undertake of its nature to carry out an in-depth analysis of the contribution of women's involvement in livestock practices in the village Shewa, district Swabi.

Study objectives

The main objectives of the current study are listed as follows:

1. To recognize the kinds of livestock kept by rural women farmers in the village Shewa, district Swabi.
2. To gauge women's involvement in livestock practices and also explores factors affecting their partaking in the research area.
3. To recommend policy suggestions for the betterment of women in livestock farming activities in the research area.

Limitation of the study

According to the latest 2017 Census of Pakistan, the total population of district Swabi was 1,624,616, where the number of rural population to urban population was 1,348,691. Swabi District is covering a vast area, which is 1,543 km² and is considered a fertile region of the KPK, where the whole soil is a good preference for the agricultural production to be covered. Albeit, the underlying study is confined only to a single village named Shewa, and the whole district has not yet been covered in the analysis because of the lack of transportation facilities, budget constraints, and security issues. Therefore, for the mere convenience, one village is selected from tehsil Razzar for the purpose to investigate the role of women in the agriculture sector and then generalized the estimation results to the whole tehsil.

The rest of the current study is formatted as follows: Section 2 points out the review of literature, Section 3 describes materials and methods, and Section 4 deals with the research methodology where the econometric model is discussed. Section 5 reports the empirical results and also discussion. Section 6 concludes the entire study alongside the policy implications.

Literature review

Since the beginning of the 21st century, a list of research studies has been conducted which focuses on the contribution of women in livestock farming operations across different regions of Pakistan. A pioneering attempt made by (Zakaria et al., 2007) investigated to determine the partaking of women in livestock practices in the rural area of Muzaffargarh, Punjab. A multi-stage sampling technique was employed for selecting respondents through a pre-tested interview schedule from 500 families. Out of total 1000, 902 respondents were finally selected which consisted of 451 wives and 451 husbands. The analysis concluded that most livestock management practices were performed by wives in comparison with husbands and the t-statistic results show there was a remarkable diversity between wives and husbands in executing the livestock management activities. A relevant study undertaken by (Shafiq, 2008) made a comparison between Pashtoon and Baloch belt people by considering 500 livestock households in preference to evaluate the performance of women in livestock farming. The results of the comparative analysis showed that the role of women was relatively significant in all the activities of livestock and women

of both regions were participating in such activities in the same manner irrespective of tremendous difficulties in practice. Similarly, another empirical attempt made by (Nosheen et al., 2011) concluded that rural women of the Potohar region mainly participated in livestock practices in the form of animal production, animal protection plus poultry husbandry; however, the most common livestock farming activities of rural men include animal production and animal protection. It is further concluded that rural men wanted training mostly in animal protection, animal production, marketing, and poultry husbandry, respectively; in contrast, these women of the research area were desired to avail proper training session in livestock farming, followed by animal production, poultry husbandry, and animals marketing to make better the productive capacity of the livestock.

Khan et al. (2012) went a step forward by making comparisons between pre-harvest and post-harvest practices of rural women in district Peshawar, KPK, Pakistan during 2004-05. Collecting the primary dataset randomly from a sample of 80 women through an interview schedule, the study concluded that these women spend more time on post-harvest works as compared to those pre-harvest works, and such activities include wheat, maize, and sugarcane. The analysis further revealed that family income, household size, and respondent's educational status had a negative significant impact on the engagement of females in crop yield; nevertheless, the respondent's age and tenure status had a positive significant influence on the involvement of rural households in agriculture workings. In contrast, the analysis of (Zubair et al., 1999) concluded that education, family type, caste, and income had no significant impact on the contribution of rural dwellers in livestock daily works. Arshad et al. (2013) focused on the involvement of rural women in a variety of livestock activities. Using an interview schedule for data collection, the authors selected randomly a sample of 120 rural households from tehsil Jhange, Punjab by utilizing the multi-stage sampling procedure. The findings of the study revealed that milk processing, dung cakes making, animals shed making, watering, livestock feeding, etc. were the key livestock production practices; however, their involvement in such activities was medium to very low. Batool et al. (2014) aimed to explore the participation of rural households in the activities of the dairy farms under smallholdings and to investigate factors determining their involvement

in Bhakkar and Jhelum districts of Punjab. In order to maximize the productivity of the smallholder dairy farm, the analysis suggested the implementation of strong extensive programs to improve the prevailing skills and knowledge of respondents.

A more recent study conducted by (Girei and Onuk, 2016) determined the role of women in livestock production practices in the Mangu states in Nigeria. By designing a well-structured questionnaire, a random sample of 90 women respondents was chosen from the livestock industry. Employing the multiple regression analysis, the findings showed that the respondent's age, experience, education, and extension contact had a significant influence on women's contribution to livestock farming operations. In the context of Pakistan, a most recent empirical study attempted by (Andaleeb et al., 2017) examined the influence of respondent's age, head's age, education, experience, size of family, type of family, size of the herd, and credit access to women's participation in livestock practices in Mardan district, KPK. The method of multi-stage sampling was developed to choose a random sample of 274 women from 6 adjacent rural union councils, and the primary data had been collected from selected women through a questionnaire. The calculated value of the livestock participation index was 4.8 hours, which exhibited that rural women under examination were on the basis of average allocated for 4.8 hours daily in livestock practices. Besides, the estimates of multiple regression analysis also showed that all the mentioned factors had a significant influence on the contribution of rural people in livestock practices.

Materials and Methods

Study area

District Swabi is classified into 4 main tehsils; namely, Swabi tehsil, Topi tehsil, Lahor tehsil, and Razzar tehsil. A multi-stage sampling technique, which involves selecting the sample in stages, was employed for determining the sample size. In the initial stage of sampling, out of four tehsils (Swabi, Topi, Lahor, and Razzar) of district Swabi, only tehsil Razzar was focused purposefully for having the highest quantity of livestock farms. This tehsil was categorized into rural and urban UCs (union councils) and 3 union councils were randomly picked from each union council. In the last stage of sampling, families in each UC were further divided into livestock vs. non-livestock farmers. Afterwards, families from

livestock farming were randomly chosen. Thoroughly 110 women households were chosen and numbers of families from the selected union council of Shewa were chosen based on Yamane's formula (Yamane, 1967).

$$S = \frac{N}{1 + N(e^2)} \dots (1)$$

In Equation 1, S denotes the total sample size, N represents the total number of livestock farm households in the union council, and e stands for the precision (commonly known as the margin of error) which is set at 8% (0.08). It is important to note that the total population of village Shewa is 35,000, where the household density stood at 8. Therefore, the total number of households in the research area is 4,375. Approximately, on average, 10% of households were concerned with the livestock practices; hence, the total livestock households were 400. These households were having a minimum 4 to 5 livestock heads and greater than 10 percent of poultry birds as well. The distribution of sample households can be reported in Table 1 as follows:

Table 1: Distribution of sample households.

Research area	Gross livestock households	Selected households
Shewa	400	110

Source: Field survey (2019).

Data collection

Primary data were collected through a well-constructed questionnaire from the chosen women farmers using face-to-face interviews for the rationale to investigate the role of rural women in regular livestock operations. The designed questionnaire was prepared while keeping the research objectives in mind which includes information upon the variables such as the age of women, educational status, herd size, livestock income, family size, household size, etc. A series of efforts were taken to keep the questionnaire simpler, more focused, and applicable in order to obtain all the required information.

Data analysis

In order to quantify the role of rural women's contribution to livestock farming activities, a composite index was constructed as reported by (Ullah et al., 2015) in their respective study. The rural women were questioned to record the duration they allocated to the particular livestock practice on a

daily basis at home. The allocated duration for each livestock practice was then transformed employing the equation as follows:

$$TV_i = \frac{X_i - Min}{Max - Min} \dots (2)$$

In Equation 2, TV_i represents the transformed value for i^{th} activity on a specific day, X_i denotes the time allocated to i^{th} activity, Max shows the highest number of minutes spent on i^{th} activity in 24 hours, and Min stands for the minimum time allocated to i^{th} activity in 24 hours. Furthermore, the TV was measured for each livestock activity and for each selected family. After that, the average TV value of each livestock practice was deduced and aggregated to obtain a composite index for the contribution of women in livestock activities in the research area. It can be noted that the responsible determinants influencing the sharing of rural people in livestock farming were derived from the comparative review of the existing empirical literature.

Research methodology

In order to empirically investigate the key indicators influencing the participation of rural women in livestock farming practices at the village Shewa, a multiple linear regression model was employed. Women's involvement in livestock activities can be derived by allocating the no of hours a woman spends in livestock activities per day. In the empirical literature, it is noticed that the rural women's contribution to livestock activities can be determined by considering a list of key factors, namely, respondent age, level of education, size of family, herd size, number of poultry heads, livestock earning, etc. Following (Zahoor et al., 2013; Girei and Onuk, 2016; Andaleeb et al., 2017), the multiple regression model for the contribution of women in livestock management activities is formulated as follows:

$$WTP_i = \beta_0 + \beta_1 Age_i + \beta_2 Educ_i + \beta_3 HS_i + \beta_4 LI_i + \beta_5 FS_i + \varepsilon_i \dots (3)$$

Where;

WTP_i = Time spent by women in livestock management activity/livestock participation index (number of hours per day); Age_i = Respondent age (years); $Educ_i$ = Level of education (years of schooling); HS_i = Herd size (number of animal heads); LI_i = Livestock income (in Rs/month); FS_i = Family size (i.e. total number of family members); β_0 = Constant term; $\beta_1 - \beta_5$ = Regression Coefficients; ε_i = Error term such that ε_i

$\sim iid(0, \delta^2)$; i = Number of households.

The proposed econometric model indicated in Equation 3 can be estimated using the OLS (Ordinary Least-Squares) method of estimation and the direct parameter estimates can be obtained while processing the SPSS and EViews statistical software programs. Before estimating the proposed econometric framework, various post estimation diagnostic econometric tests were checked for the presence of multicollinearity, heteroscedasticity, and normality with the help of most commonly suggested econometric testing procedures in the literature of Econometrics.

Results and Discussion

This section of the article deals with the empirical analysis and interpretation of the estimated data. The primary data were collected from a sample of 110 rural women through a well-structured questionnaire. The collected data were then processed and quantitatively analyzed in line with the objectives of the study. The section of results and discussion has been presented under the following sub-sections in detail.

Respondents' age vs. education

Table 2 reports that 52.7% of women fall in the age category of 31-45 years, followed by 42.7% of respondents in the age category of 46-60 years, and the rest 4.5% of women in the age category of 15-30 years. The analysis showed that 57.3% of women were completely uneducated; however, the remaining 14.5 percent, 23.6 percent, and 4.5 percent respondents were literate up to the Primary level, Middle level and Metric level of schooling, correspondingly. Furthermore, the probability value of the χ^2 statistic is 0.017, confirming that the relationship between age vs. educational level of the respondents is significant at the 5% significance level. Besides, the gamma statistic for two examined variables is -0.547, showing the negative and a moderate extent of correlation between the two examined categories.

Respondents' age vs. experience

Table 3 reports that 36.4 percent female respondents were having 11 to 15 years of experience in livestock farming, followed by 27.3% women who were having 6-10 years experience, 18.2% women were having 16-20 years experience, 12.7% women were having more than 20 years experience, and the remaining

5.5% women were having 1-5 years experience in livestock activities. The analysis also illustrates that the association between age vs. experience of the women in the livestock activities is statistically significant, and this relationship was found statistically significant at the 1% significance level. Mostly experienced women (52.7%) between 31 and 45 years of age were involved in livestock farming activities and thus the age coefficient is consistent with prior expectations.

Table 2: Results of respondents' age vs. education.

Age group (years)	Education group (years of schooling)				Total
	Illiterate	Primary	Middle	Metric	
15 to 30	1	1	2	1	5
	0.9%	0.9%	1.8%	0.9%	4.5%
31 to 45	26	11	18	3	58
	23.6%	10.0%	16.4%	2.7%	52.7%
46 to 60	36	4	6	1	47
	32.7%	3.6%	5.5%	0.9%	42.7%
Total	63	16	26	5	110
	57.3%	14.5%	23.6%	4.5%	100.0%

Source: Field survey (2019). χ^2 statistic = 15.45, p -statistic = 0.017, Correlation value = -0.547

Table 3: Results of respondents' age vs. experience.

Age group (years)	Experience group (years)					Total
	1-5	6-10	11-15	16-20	Above 20	
15-30	2	2	1	0	0	5
	1.8%	1.8%	0.9%	0.0%	0.0%	4.5%
31-45	3	23	25	5	2	58
	2.7%	20.9%	22.7%	4.5%	1.8%	52.7%
46-60	1	5	14	15	12	47
	0.9%	4.5%	12.7%	13.6%	10.9%	42.7%
Total	6	30	40	20	14	110
	5.5%	27.3%	36.4%	18.2%	12.7%	100.0%

Source: Field survey (2019). χ^2 statistic: 41.195; p -statistic: 0.000; Correlation value: 0.703

Respondents' education and experience

Table 4 reports that the interrelation between education and experience status of the respondents is statistically significant, which can be clearly seen from the probability value of the χ^2 statistic, which is 0.025. Furthermore, the correlation statistic of 0.025 with a negative sign illustrates a lower extent of the connection between two determinants of the livestock activities. The negative correlation value (-0.025) indicates that with the increase in the years of schooling, the experience level drops down. On the basis of this empirical outcome, we can say that

educated women are less concerned with livestock practices.

Table 4: Results of respondents' education vs. experience.

Education (years)	Experience group (years)					Total
	1-5	6-10	11-15	16-20	20+	
Illiterate	4	12	21	13	13	63
	3.6%	10.9%	19.1%	11.8%	11.8%	57.3%
Primary	0	8	6	2	0	16
	0.0%	7.3%	5.5%	1.8%	0.0%	14.5%
Middle	2	10	8	5	1	26
	1.8%	9.1%	7.3%	4.5%	0.9%	23.6%
Metric	0	0	5	0	0	5
	0.0%	0.0%	4.5%	0.0%	0.0%	4.5%
Total	6	30	40	20	14	110
	5.5%	27.3%	36.4%	18.2%	12.7%	100.0%

Source: Field Survey (2019). χ^2 statistic: 23.380; p -statistic: 0.025; Correlation statistic: - 0.025

Types of families

The structure of a family reflects an essential connection with the engagement of rural women in livestock operations. Table 5 reports that 59 women (53.6%) belonged to the joint family structure, and the remaining 51 women (46.4%) belonged to the nuclear families. It is worthy to note that the dwellers of this locality are mostly living in the joint family structure because majority households are relying on the agricultural output and they are having combined lands that compel these women to live together.

Table 5: Family structures of the respondents.

Family type	Frequency (f)	Percent-age	Cumulative percentage
Nuclear	51	46.4	46.4
Joint	59	53.6	100.0
Total	110	100.0	----

Source: Field survey (2019).

Family head and family size

From Table 6, it was observed that 73.6% of rural women were the wives of the family members, 16.4% of respondents were mothers of the family members, 9.1% of respondents were daughters of the family members, while the remaining 0.9% of respondents were sisters of the family heads. It was also observed that 18.2% of respondents consisted of 1-5 members per family, 55.5% of respondents were 6-10 members per family, 20.9% of respondents were 11-15 members per family, and the remaining 5.5% of respondents

consisted of 16-20 members per family. Furthermore, the positive value of the gamma statistic indicates a positive, but insignificant relationship between two variables.

Table 6: Results of family head and family size.

Head of household	Household size				Total
	1-5	6-10	11-15	16-20	
Wife	17	46	15	3	81
	15.5%	41.8%	13.6%	2.7%	73.6%
Mother	1	10	6	1	18
	0.9%	9.1%	5.5%	0.9%	16.4%
Sister	0	0	1	0	1
	0.0%	0.0%	0.9%	0.0%	0.9%
Daughter	2	5	1	2	10
	1.8%	4.5%	0.9%	1.8%	9.1%
Total	20	61	23	6	110
	18.2%	55.5%	20.9%	5.5%	100.0%

Source: Field survey (2019). χ^2 statistic: 12.263; probability statistic: 0.199; Correlation value; 0.304

Income level and sources of income

The major occupations of the sampled respondents include farming, private or public sector jobs, own business, and livestock farming. Table 7 reports that the majority women (68.2%) were involved in the agriculture sector as well as in the private/public sector jobs, 20.9% women were getting income only from the agriculture sector, 5.5% respondents were active in various livestock practices, 3.6% women were concerned in the livestock and farming activities, and the rest 1.8% women were doing non-farming activities. The table also shows that the income of women per month is heterogeneous due to the changing nature of occupations. Furthermore, the analysis shows that there exists a positive significant relationship between the families' monthly income vs. income sources because the p -value of the χ^2 statistic is 0.000, which is significant at the 1% significance level.

Livestock head counts

All the sampled women do keep one or more types of cattle. It is customarily the major occupation of most of the farming families in the village under consideration. Such families keep animals to fulfill the households' needs and to generate their income. Table 8 shows that the total numbers of buffalos in all households were 169, cows were 204, bullocks were 69, goats were 177, and the poultry was 322. The empirical result concludes that the majority of the

rural women in livestock production kept poultry as their major livestock enterprises. This was followed by cows and goats. This result tallies with that of (Ayoade et al., 2009) and (Gerei and Onuk, 2016) who explain that women claim smaller species of animals, for instance, poultry and goat are cheaper to raise and requires the lesser initial cost of investment that the larger ruminants, namely, buffalo and bullocks.

Table 7: Results of households' gross earning.

Income (Rs./month)	Sources of Income					Total
	Agri-culture	Agri. & job	Live-stock	Livestock & agri.	Any other	
0-20,000	5	0	0	1	1	7
	4.5%	0.0%	0.0%	0.9%	0.9%	6.4%
20,001-40,000	15	18	5	3	1	42
	13.6%	16.4%	4.5%	2.7%	0.9%	38.2%
40,001-60,000	2	33	1	0	0	36
	1.8%	30.0%	0.9%	0.0%	0.0%	32.7%
60,001-80,000	1	16	0	0	0	17
	0.9%	14.5%	0.0%	0.0%	0.0%	15.5%
80,001-100,000	0	1	0	0	0	1
	0.0%	0.9%	0.0%	0.0%	0.0%	0.9%
Above 100,000	0	7	0	0	0	7
	0.0%	6.4%	0.0%	0.0%	0.0%	6.4%
Total	23	75	6	4	2	110
	20.9%	68.2%	5.5%	3.6%	1.8%	100.0%

Source: Field survey (2019). χ^2 statistic: 53.425; p -statistic: 0.000; Correlation value: 0.230

Table 8: Results of livestock head counts.

Livestock name	N	Mini-mum	Maxi-mum	Sum	Average
Buffalo	110	0.00	4.00	169.00	1.5364
Cow	110	0.00	6.00	204.00	1.8545
Bullocks	110	0.00	1.00	69.00	0.6273
Goat	110	0.00	6.00	177.00	1.6091
Poultry	110	0.00	14.00	322.00	2.9273
Herd size with poultry	110	0.00	26.00	941.00	8.5545

Source: Field survey (2019).

Households' income and livestock income

Table 9 shows that 29.1% of women were earning money up to Rs. 10,000 per month mainly from the livestock activities, 50% of women were receiving money in the income range of Rs. 10,001-20,000 per month, 13.6% of women were earning the amount in the earning category of Rs. 20,001-30,000 over a month, and the rest 7.3% of women were receiving the amount in the remuneration category of Rs.

30,001-40,000 over a month from various livestock activities in the research area under examination. Furthermore, the relationship exists between the household remuneration and the income generated from the livestock activities is found statistically significant at the 5% level of significance. However, the negative value of the gamma statistic (-0.202) shows the negative relationship between two factors under discussion, revealing that families with more income levels are getting a lesser amount of income over a month from livestock activities.

Table 9: Results of households' income vs. livestock income.

Income (Rs./ month)	Income from Livestock (Rs./ month)				Total
	1-10,000	10,001-20,000	20,001-30,000	30,001-40,000	
0-20,000	2	5	0	0	7
	1.8%	4.5%	0.0%	0.0%	6.4%
20,001-40,000	12	12	12	6	42
	10.9%	10.9%	10.9%	5.5%	38.2%
40,001-60,000	11	22	2	1	36
	10.0%	20.0%	1.8%	0.9%	32.7%
60,001-80,000	3	12	1	1	17
	2.7%	10.9%	0.9%	0.9%	15.5%
80,001-100,000	0	1	0	0	1
	0.0%	0.9%	0.0%	0.0%	0.9%
Above 100,000	4	3	0	0	7
	3.6%	2.7%	0.0%	0.0%	6.4%
Total	32	55	15	8	110
	29.1%	50.0%	13.6%	7.3%	100.0%

Source: Field Survey (2019). χ^2 statistic: 26.748; probability statistic; 0.031; Correlation value: - 0.202

Time profile of livestock activities

Table 10 reports that women under examination were substantially involved in a list of indoor practices viz. watering, feeding, milking, yogurt preparation, shed cleaning, chicks feeding, dung collection, animals cleaning, dung cakes making, milk processing, and so forth. A transformed measure for each daily livestock practice was computed and average measure of the entire changed value was too computed and finally the grand average of all average converted calculated values was computed (4.81), showing that the participation of women on the daily basis in various livestock practices was approximately 5 hours. These empirical findings are in accordance with the results of (Hashmi et al., 2007; Arshad and Ashraf, 2013; Andaleeb et al., 2017) etc. These listed studies

concluded that rural households play a key role in livestock farming within the boundaries of Pakistan and that livestock operations as mentioned earlier are performed by rural women across different regions of the country.

Table 10: Women participation index in livestock farming practices.

Daily Activities	Maximum time	Minimum time	Mean TV
Fodder carrying	3.00	0.00	0.057
Fodder cutting	3.00	0.00	0.297
Feeding	1.00	0.00	0.216
Watering	1.00	0.00	0.338
Cleaning shed	2.00	0.00	0.753
Dung collection	1.00	0.00	0.566
Dung cakes	2.00	0.00	0.566
Milking	3.33	0.00	0.378
Milk processing	1.50	0.00	0.429
Marketing of animal produce	1.00	0.00	0.358
Marketing of animal	3.00	0.00	0.144
Bringing dry fodder	2.00	0.00	0.358
Bathing	1.00	0.00	0.351
Grand mean	24 Hours	0 Hours	4.812(5 Hours)

Source: Field survey (2019).

Table 11: Results of time profile of various indoor activities (per day).

Indoor activities	Daily time profile (Minutes)
Breakfast	62
House Cleaning	36
Dish Washing	27
Cooking	106
Child Caring	76
Sewing, Knitting, Embroidery	106
Laundry	41
Total	454 (7.55 hours)

Source: Field survey (2019).

Time profile of non farming activities

Besides the livestock management activities, all the women under discussion have been progressively engaged in the indoor activities such as breakfast, cleaning of the house, washing of utensils, food cooking, children care, sewing, and so forth. Table 11 reports that the most time-consuming activities of the selected women were cooking and sewing, child caring, breakfasting, and house cleaning on which they spend consecutively more minutes of

the day, respectively. Put it differently, the less time taking activities includes cleaning of the house and dishwashing which consume time on average of 0.6 and 0.44 hours on a daily basis. We can conclude that, on average, women spent 454 minutes (or 7.55 hours) on all the indoor activities.

Diagnostic checking Tests

To test the suitability of the proposed regression model presented in Equation 3, various statistical diagnostics were applied to check for the presence of heteroscedasticity and multicollinearity as suggested by (Gujrati, 2004) diagnostic procedures. The result of the Breusch-Pagan LM Test (1979) reported in Table 12 concludes that the problem of heteroscedasticity is not present in the data at hand. Besides, the Jarque-Berra statistic reveals that the error terms are white-noises; therefore, the inferential statistics (i.e., t-statistic and F-statistic) of the regression equation are valid.

Table 12: Results of the Breusch-Pagan LM test.

Test	LM = n * R ²	Probability value
Breusch-Pagan LM test	13.242	0.12

Source: Field survey (2019) (EViews 10).

As we have a set of explanatory variables in our proposed regression equation, there is the likelihood of the model to suffer from multicollinearity. For this purpose, the current study has employed both the VIF (Variance Inflation Factor) and tolerance values ($TOL_i = 1 - R_x^2$) statistics in order to diagnose the issue of multicollinearity. The statistical values of VIF_i and TOL_i reported in Table 13 conclude that there is no clear evidence of induced multicollinearity in the data at hand.

Table 13: Results of multicollinearity.

Explanatory variable	VIF	Tolerance (1/VIF)
Age	1.33	0.753
Education	1.15	0.866
Herd size	1.28	0.782
Livestock income	1.18	0.847
Family size	1.22	0.782

Source: Field survey (2019) (EViews 10).

Estimated model results

The livestock women's participation model was empirically estimated with the selection of the OLS estimation technique because our post-diagnostic statistical tests as above-mentioned concluded

that there is no clear evidence of heteroscedasticity and multicollinearity, and the data follows the normal distribution. The parameter estimates of the econometric model specified in Equation 3 are given in Table 14. The calculated value of the R^2 is 0.26 which illustrates that 26% changes in the response variable (WTP) induced by the changes in the independent variables.

Table 14: *Estimates of multiple regression model.*

Variable	β_i	S. E	t-statistic	p-value
Constant	3.156	0.20857	15.13	0.000**
Age	-0.0049	0.0055	-0.90	0.369
Education	-0.0167	0.0082	-2.02	0.046*
Herd size	0.0122	0.0087	1.40	0.165
Livestock income	0.000012	0.0000049	2.42	0.017*
Family size	0.0337	0.0096	3.53	0.001**

Source: Field Survey (2019) (EViews 10). *R-square (R^2): 0.26; F-statistic: 9.53; p-value: 0.000. Note:* **: significance at 1%; *: significance at 5%

Effect of age: The estimated findings indicate that women's age has negative and insignificant parameter estimate with a probability statistical value of 0.369, which is greater than 5% (0.05), and the outcome is in line with the results of (Khan et al., 2012). The reason is, most women of the respondents (52.7%) belong to the middle age who involved in livestock management activities.

Effect of education: The regression analysis revealed that 57.3% of women involved in livestock management activities were illiterate, that's why; the women's educational status was chosen as an independent variable in the multiple regression analysis. Therefore, as rural women acquire higher education, they have a preference for occupation in the services sector like teaching in a school or nursing in a local or nearby hospital. Head education level has a positive significant effect on rural women's participation in livestock management activities. Those heads of the family who are more qualified are often interested in non-farming activities and hence their women are majorly occupied in livestock activities. The regression results show that the educational status of women has a negative significant parameter with a probability value of $0.046 < 0.05$, suggesting that as the educational level of rural women increases their participation in livestock activity decreases. And this finding is consistent with recent studies conducted by (Khan et al., 2012; Girei and Onuk, 2016) for the

economy of Pakistan and Nigeria, respectively.

Effect of herd size: The findings show that the size of the herd has a positive, but the insignificant influence on the contribution of rural people in livestock practices, which is similar to the analysis of (Andaleeb et al., 2017). As the size of herd increases, domestic livestock is bringing out the four walls of homes in separate farming fields. But, in the Pashtun society, women are frequently controlled to in-house livestock activities; hence, their involvement is restricted to fewer operations as the size of herd increases.

Effect of livestock income: The findings report that income generated from livestock activities has a positive significant influence on the daily women's involvement in homes. The earnings from livestock farming also depend on the contribution of women; therefore, it is a bidirectional association between two variables. The same findings can be clearly seen in the recent empirical work conducted by (Andaleeb et al., 2017) on the district Peshawar, Pakistan.

Effect of family size: The findings illustrate that the size of the family has a positive significant influence on the contribution of rural people in livestock management activities. Large-sized households and joint family structures were anticipated to have positive influences on the participation of women in livestock management activities. Actually, these prior projections were founded on the theoretical grounds that in the combined family structure, respondents in rural regions have more helping hands in indoor practices so they find additional time to remain in contact with livestock activities. Therefore, the estimated coefficient sign is completely consistent with set expectations.

Conclusions and Recommendations

The involvement of women in livestock farming practices changes from location to location because of the dynamic trend in social and cultural values of every society. The key determinants of their involvement in the livestock management practices were educational level, family size, and livestock income which were established to be significant at the different levels of significance. On the contrary, factors like women's age and herd size with different signs have insignificant affects women's involvement in livestock farming operations. The average composite index for the

livestock production practices was 4.81 hours, which reveals that rural women were involved, on average, for around 5 hours daily in livestock management practices in the particular village.

The importance of rural women's involvement in the livestock industry should be acknowledged in the government's future plans and in the agricultural policy for Pakistan. The women should be enlightened with modern knowledge and advanced technology regarding livestock farming and its allied diseases in order to optimize the productivity of the livestock sector. The non-governmental organizations (NGOs) such as National Rural Support Programme (NRSP), Committee on the Elimination of Racial Discrimination (CERD), Rural Support Programmes Network (RSPN), Sarhad Rural Support Programme (SRSP), etc. working for the rural people development in the province of KPK should be actively participating in the awarding of agricultural loan and livestock training facilities for rural women to engage them in the livestock farming. Furthermore, the government of Pakistan should strengthen the agricultural extension system so as to commercialize the women's agricultural activities both at the regional and national levels; as a result, the commercial farmers will try their level best to boost livestock production activities.

Novelty Statement

The current study is one of the few studies in the field of Agriculture Economics which empirically investigates the contribution of rural women in livestock management activities in district Swabi, Khyber Pakhtunkhwa, Pakistan.

Author's Contribution

This research article is part of the first author's (Saba) M. Phil thesis. Shahnaz Akhtar was her major research advisor. Waqar Khalid helped in the econometric modeling and testing procedures. Saifullah Khan helped in the analysis and interpretation of data.

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