IMPACT OF DAIRY TECHNOLOGY ADOPTION ON THE LIVELIHOOD OF RURAL MILK PRODUCERS IN MUZAFFARABAD, AZAD JAMMU AND KASHMIR

Summara Abbasi[1], Khalid Nawab[1], Mahmood Iqbal[1], Ayesha Khan[1], Urooba Pervaiz[1] and Tariq Rahim[1]

1. Department of Agricultural Extension Education and Communication, The University of Agriculture, Peshawar, Pakistan
2. Department of Food Science and Technology, The University of Agriculture Peshawar, Khyber Pakhtunkhwa, Pakistan
3. Department of Food Science, The University of Guelph, Canada

Corresponding Authors: Naveed Ul Haq,

ABSTRACT

A survey was carried out in district Muzaffarabad of Azad Jammu and Kashmir to study the impact of dairy technology adoption on the livelihood of rural milk producers by selecting 8 villages purposively, based on the average number of livestock population i.e. 2-3 heads per household, for dairy production. A structured and pretested interview schedule was used to collect the primary data from randomly selected 333 respondents. For analysis of data propensity score matching (PSM) were used through statistical package for social sciences (SPSS) and STATA. Results propensity score matching indicate that there was a significant difference between the milk production and income of adopters and non-adopters of crossbreeds in the study area. Hence, dairying has significant contribution as sustainable source of income to the rural milk producer in the study area. Majority of the farmer 69 percent possesses cross breed animal for milk production and its sales. About 16-30 liter of average daily milk produced was recovered by 53.5 percent of households. Results indicated that dairy technology adoptions has significantly increased their per day milk production by 28percent, consumption of milk was 44 percent and also adopter household sold 4 liter more milk than the non-adopters. Meanwhile like this dairy technology adopter got 34 percent more income as compared to non adopters could spend more on households' items and got more opportunity in educating their children. According to study results it is concluded that dairy farming was found to be an important source of livelihood. Hence, the government should arranged continuous training on adoption benefits of

dairy technologies and provides credit facilities in consideration to their socio-economic conditions.

Key words: Adopters, non- adopters, Propensity score matching

INTRODUCTION

Majority of the world's poor live in rural areas among them about 75 percent are extreme poor and depend mainly on natural resources for their livelihood. For a healthy survival and useful living on this Earth consumption of natural assets ranked as primary fruitful activity for a human being. More than 883 million people are surviving on less than $1.25 per day. Approximately 1.5 billion populations are under excessive poverty as reported by World Bank (WB, 2013).This condition challenges all sectors including the livestock and dairy sector more broadly to reflect on the contribution towards livelihood improvement by eradicating poverty (Jabbar, 2003).

According to the World Development Report (2019), three out of every four poor people in developing countries live in rural areas, and most of them had their vital source of income from the livestock.

Among the South Asia farm animal is a vital agricultural division in Pakistan it shares 11.11 percent in GDP and 58.92 percent of the revenue generated from the agriculture sector. Gross value addition of the livestock sector at regular price has increased from Rs.735 billion (2011-12) to Rs.756 billion (2012-13); presenting an enhanced growth of 3.76 percent in 2017-18 as compared to 2.9 percent growth of the previous year (GoP, 2017-18).Worldwide, the average dairy herd size is about two cows providing an average milk quantity of 11 liters per farm per day (Rome,Livestock production is the generally powerful way to enhance the income of the landless and the small farmers in AJK by contributing about 62 percent in the GDP when compared with agriculture. 2010).The dairy sector in AJK plays a significant role and its value is supplementary than the joint value of wheat, Maizeand Rice (Bilal and Sajid, 2005).According to milk production survey 2006 in AJK average daily milk yield per cow, buffalo and goat at the state level was 4.6090, 6.188 and 1.000 litres, respectively.

According to milk production survey 2006 in AJK average daily milk yield per cow, buffalo and goat at the state level was 4.6090, 6.188 and 1.000 litres, respectively. Per day average production of milk from all types of milking animals reported in Livestock Census 2006 was 2,457.9 thousand liters.The current increase in per capita milk production has enlarged over the past numerous years by an increase in the number of dairy animals relatively than by an increase milk yield per animal (FAO, 2016).On the other hand human needs are not fulfilled by the total milk production of the research area. The main reason behind this shortfall is that the human population is increasing at the rate of 3 percent annually but the milk production is not increasing with the same rate (GoAJ&K, 2012). To enhance the production potential of dairy animals several interventions and technologies like improved feed technology, use of cross breeds, health care services, proper management and artificial insemination have been provided through extension services in the study area so that it can meaningfully contribute to the socio-economic development of farmers. Both government and private agencies played significant role in disseminating these technologies including the research area. However, its adoption rate varies from area to area based on some factors. Likewise its technology benefits also differ from household to household. So literature on dairy technology impact on livelihood of rural milk producers is crucial and helpful for extension personnel and policy mangers to improve the performance of this sector and provide valuable recommendation/suggestion.

Objectives of the study

Therefore, keeping in view of this perspective the present study was designed to find

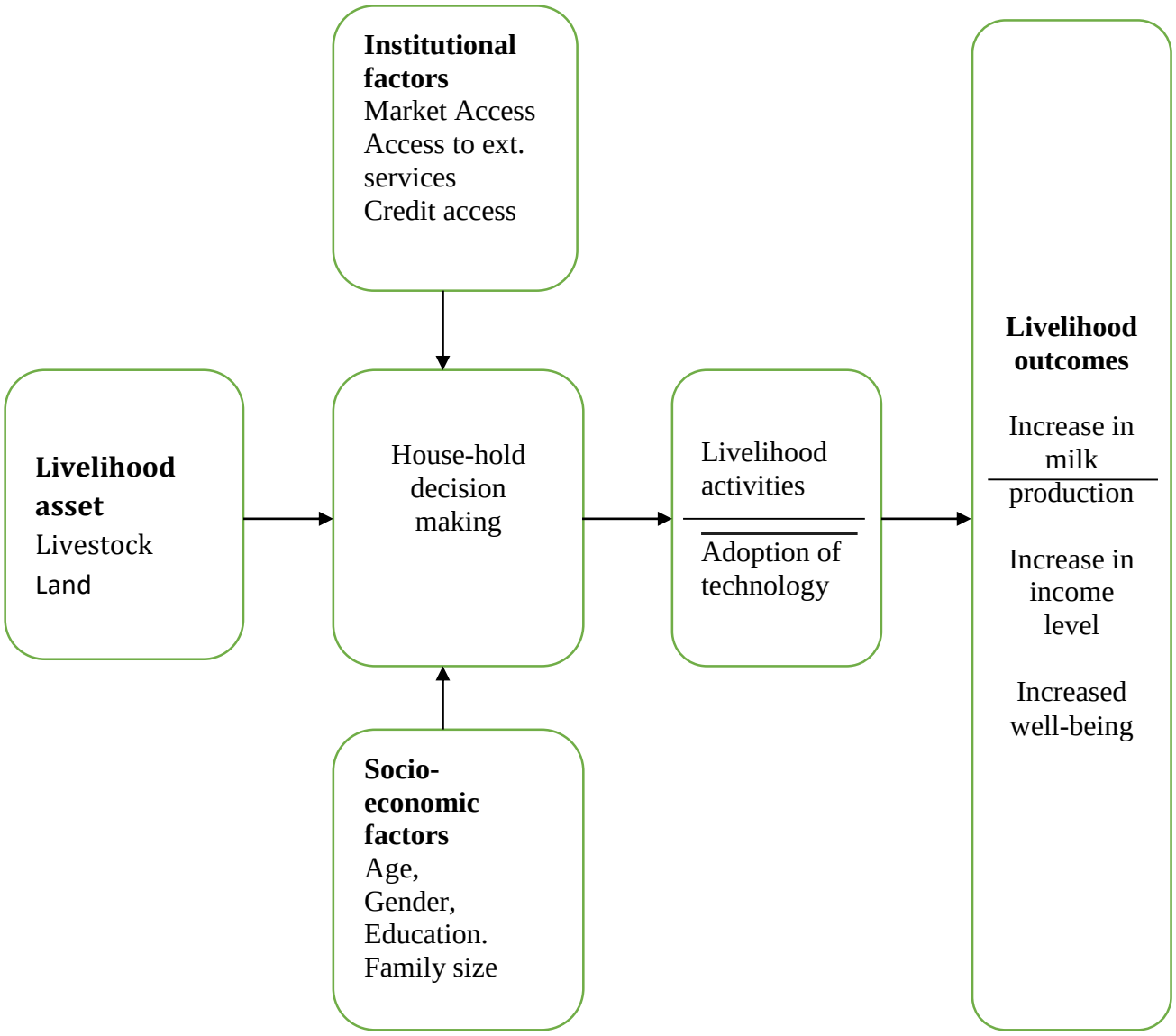
- The impact of dairy technology adoption on the livelihood of rural milk producers.
- To formulate recommendations for further research and extension programming.

The Conceptual Framework on livelihood

The theoretical framework has been drawn from the relevant literature on adoption of dairy technology and its impact in advancing livelihood of rural inhabitants in developing countries for the present study. According to Degnet and Belay (2001) a

total effect of the socio-demographic and other factors may in one way or the other influence a farmer to adopt and continue practicing the skills one learned. The total effect imposed by the different factors on an individual might enhance or retard the level at which a farmer will use the practices. According to Ellis (2000) a livelihood is a living gained using assets, activities and opportunities. To obtain sustainable livelihood outcomes household's pursue different livelihood strategies that depend on their resources and socio-economic characteristics. Livestock found to be an important contributor to rural livelihood in the study area. Adoption of dairy technology is considered a livelihood strategy influenced by different socio-economic factors. The conceptual framework is drawn in figure 1.

Figure 1. Dairy technology adoption and livelihood outcomes indicators



MATERIALS AND METHODS

Universe of the Study

Muzaffarabad is blessed with mountainous valleys and lush green forests making it most beautiful region. Muzaffarabad the capital city of AJK is situated on the banks of the Jehlum and Neelum rivers. The district covers an area of 1642 square kilometers and total human population is 650370 (Azad Jammu & Kashmir Statistical Year Book, 2017).Majority of the households are indulged in farm activities which significantly contributing to their livelihoods. Being hilly nature rearing of livestock is uniformly well-liked for milking purposes as well as to add-on their income in the area. As focus of the research is to probe the "Impact of dairy technology adoption on the livelihood of rural milk producers through extension services in AJK" so the data was collected from the area where potential of milk production is commercially produced. To sketch the necessary sample multistage sampling procedure was used for the present study. From the 25 union councils (UC) of MZD four were selected purposively based on dairy development interventions like adoption of dairy technology and distribution of cross breeds which was delivered by the government of the AJK. Then from each UC two villages were selected purposively based on the average number of livestock population i.e., two to three heads per household for dairy production. Based on the population of milk producers, total sample size of 333 households were selected at random through Sekaran table (Sekaran, 2003). A technique proportional allocation sampling was used, to determine appropriate sample size in each village (Cochran, 1977).

The formula for proportional allocation is

$$ni = \frac{n}{N} \times Ni$$

n=total sample size required for researcher

N=total no of livestock farmers in study area

ni =selected respondent size from each village

N_i = population of each village

Data Collection

Based on the study objectives a well-planned interview schedule was prepared for the collection of primary data.

Data Analysis

Dairy technology (cross-breed) is assumed to have considerable impacts on the livelihood of rural milk producers. It is measured by using different indicators *i.e.*, household income and improvement in productivity through propensity score marching. Individuals in households adopting cross-breed (treatment cases) and households not adopting cross-breed (the controls) are considered. According to Heckman *et al*., 1998; Rosenbaum and Rubin, 1983propensity-score matching is a suitable technique to estimate the net outcome of social programs. Based on this propensity score participants and non-participants are then compared. The mean difference in output among two groups is calculated through the net effect of program treatment (Khandker *et al*., 2010).The first step in PSM method is to estimate the propensity scores.

The propensity score is a probability, it ranges in values from 0 to 1. The p-score in this study was generated using different variables that determine probability of a household to be influenced by the adoption of dairy technology as explained above. After the estimation of propensity score the preference of matching estimator was determined. According to Dehejia and Wahba (2002), the ultimate choice of a matching estimator was headed by diverse criterion like equal means test compared to as the balancing test, peudo-R2 and matched sample size. Balancing test is considered to find out a standard mean differentiation among the two groups (Alemu, 2010).The matched sample was used to compute the Average Treatment Effect for the treated (impact). Then the effect of household's participation in dairy technology adoption on a given outcome (total household milk production and total income from milk and milk products) is calculated as follows (Kindie and Tsegaye, 2012):

$$ATT = E(Y1-Y0/D = 1) = E(Y1/D = 1) - E(Y0/D = 1)$$

Where

Treatment = Dairy technology

Y1 = the outcome in the treated (adopters) condition;

Y0 = the outcome in the control (non-adopters) condition; and

D = indicator variable denoting adoption of technology.

Results and Discussion

The basic reason behind PSM usage was matching of adopter with an identical non-adopter and then calculating of mean differences in the outcome of both categories. The PSM model runs in several steps.

Estimation of Propensity Score

To find out the propensity score is the primary step in the PSM as it was done by using 'Pscore' command in STATA. In estimating the propensity score the explanatory variables jointly conclude the possibility to contribute in the treatment and the outcome. The coefficients from the model show the likelihood of participation with respect to the socio-economic characteristics of the farmers.

Table 1Average propensity score

Variable	Obs	Mean	Std. Dev.	Min	Max
Propensity score	333	.7072	.4076	1.05-10	1

Source: Field Survey (2019).

It is likelihood, so the average in the treatment for all household heads are 70 percent i.e the probability that a particular household heads adopt a crossbreed (treatment) is 70 percent with respect to the outcome variable (productivity and income).

By using the logit regression model propensity scores are generated, matching of the participants' in the interference was based on the closeness of their propensity scores of participation. Differences in productivity outcomes and income among the adopters and non-adopters households were then matched (Ravallion, 2003; Miriam *et al.*, 2013).

Estimating the Impact of Dairy Technology on Livelihood Outcomes

After the estimation of propensity score the dairy technology`s effect (adoption of crossbreed)on adopter households were checked for the following outcome variables like average total milk production per day, availability of total milk for household consumption, total milk sold per day in liter, total income from milk, able to send children to school.

Impact of Dairy Technology on Productivity

The first criterion is the improvement in productivity. This can be measured simply by asking farmers if their milk production has altered during adoption of dairy technologies (cross breed).

The study examined productivity difference between local and crossbreed species in the study area. Table shows the estimates of average effect of dairy technology on production indicators such as average total milk production per day, availability of total milk utilization for family, per day milk market in liter at household level.

Table Estimates of average effect of dairy technology on production indicators

Treatment	Variable	Sample	(Adopters)	(Non-adopters)	Difference	S.E.	T-stat
Crossbreed	AMP	Unmatched	18.242	12.214	6.028	.7458	8.08
		ATT	18.242	13.051	5.191	2.309	2.25*
	MS	Unmatched	16.336	10.673	5.662	.6727	8.42
		ATT	16.336	11.974	4.361	2.172	2.01*
	MCHH	Unmatched	1.931	1.551	.3808	.0946	4.02
		ATT	1.931	1.085	.8468	.4318	1.96**

Source: Field Survey, (2019)

AMP= Average milk production, MS= Milk sold per day at household level, MCHH= Milk consumption at household level,*p<.10; **p<.05; ***p<.01 or .001

For efficient dairy production technology is crucial as it could be possible anywhere as well as conventional hurdles are removed by making improvements in technology (Mosnier and Wiek, 2010). However, with better techniques in feeding, breeding and animal health, milk efficiency is expected to be a key determinant for income making among smallholder farmers.

The result shows that average milk production in dairy technology adopter households was significantly (P<0.05) higher i.e. 28 percent than the non-adopters.

Milk production through crossbred cows and better production technologies could have a positive influence on human nutrition, both directly by increased consumption of milk and dairy products and, indirectly by trade of enlarged output and the purchase of more and improved quality food (Tangka *et al.*, 2002). Regarding to the accessibility of total milk for family utilization was measured by increased consumption of milk at the household level. As the table 4.10.2.1 shows per day consumption was 44percent which is statistically significant (P<0.05) and was more practiced in adopters than non-adopters.

Gryseels (1988) stated that in the mixed farming system of the Ethiopian highlands, sales of livestock and its products report for 83percent of the net revenue per year and 50 percent through sale of livestock goods. As it is cleared from the above table that overall crossbred adopter marketed 4 liters extra milk per day with respect to the non-adopters and this effect is statistically significant (P<0.05). These results are in line with the study of Dehinenet (2014) who observed similar results in his research findings for adopters and non-adopters on adoption of crossbreed.

Impact of Dairy Technology on Income Indicators

Income is also the second criterion which is broadly used as a benefit measure because it is strongly linked with the ability to obtain many things that are related with a better standard of livelihood such as food, clothing, shelter, health care, education, and recreation. Profit gains are a suitable factor of influence because the output gains attributable to the acceptance of superior technologies reasonably should be reflected

in income gains either through increased sales of cows or milk and other byproducts directly, or decreasing the expense on buying of other cows, milk, butter and other byproducts indirectly. Impact of dairy technology on income indicators was measured by average income from milk sale and able to sending children to school, is indicated in Table 4.

Table Estimates of average effect of dairy technology on income indicators

Treatment	Variable	Sample	Adopters)	(Non-adopters)	Difference	S.E.	T-stat
Crossbreed	AI	Unmatched	48944.68	32265.30	16679.37	2010.07	8.30
		ATT	48944.68	35923.40	13021.27	.05008	2.00*
	SCS	Unmatched	.8042	.2959	.5083	.05008	8.42
			.8042	.0638	.7404	.3506	2.11*

Source: Field Survey, (2019)

AI= Average income from milk per month at household level, SCS= Send children to school, * means significant at 5percent probability level

Total income from milk showed that adopters obtained increased income from milk per month than the non-adopters and this variation was statistically significant ($P<0.05$). It was noticed that dairying has considerable share as a sustainable basis of income to the milk producing households' in the vicinity. Households reported that their earnings were sustainable and they got regular income through the adoption of these technologies. Similarly, Mohammed *et al*. (2004) stated that the considerable increase in the household income of smallholder milk growers in the rural Ethiopia is due to the acceptance of market-oriented dairy production with crossbred cows and enhanced dairy technologies. This study also confirms that significant increase in the household income is due to the adoption of cross-breed.

The average effect of adopting cross-breed technology on sending children to school is also mentioned in the similar table and it described that as a consequence of

the high income sending children to school was recorded statistically significant ($P<0.05$) and it was higher in crossbreed adopter families than non-adopters.

CONCLUSIONS AND RECOMMENDATIONS

The results from propensity score matching indicate that income of the farmers was significantly increased and show a strong connection among higher incomes and enhancement in livelihood due to the adoption of dairy technologies most importantly improved breeds. Furthermore, it was found that adoption of crossbreed was an important factor to boost income of rural milk producers. As a consequence of the advanced income from better dairying, the household might spend more on household objects and educating their children. The increase in consumption of milk directly affects nutrition and health in majority of the households. Based on the conclusions of the study, the following recommendations were formulated:

1. It is proposed that government should encourage agricultural extension services of AJK in changing and bringing farmers' awareness regarding the adoption of different dairy technologies (crossbreed).

2. The government should provide credit facilities taking in consideration their socio-economic conditions of the milk producers.

3. Trainings should be arranged for agricultural extension workers on technology adoption and its related issues which will enable them to perform in better way in the field with farmers.

4. Government should allocate funds/resources for smooth running of the regular trainings and other extension activities at village level as a policy on sustainable basis.

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