The Pharma Innovation Journal 2022; SP-11(10): 811-815

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(10): 811-815

www.thepharmajournal.com
Received: 22-07-2022
Accepted: 25-08-2022

Aneetta V Antony
Dairy Economics Statistics and Management Division, ICAR- National Dairy Research Institute, Karnal, Haryana, India

Ajay Verma
ICAR-Indian Institute of Wheat and Barley Research, Karnal, Haryana, India

Udita Choudhary
Dairy Economics Statistics and Management Division, ICAR- National Dairy Research Institute, Karnal, Haryana, India

Biswajit Sen
Dairy Economics Statistics and Management Division, ICAR- National Dairy Research Institute, Karnal, Haryana, India

Anil Kumar Dixit
Dairy Economics Statistics and Management Division, ICAR- National Dairy Research Institute, Karnal, Haryana, India

Corresponding Author:
Aneetta V Antony
Dairy Economics Statistics and Management Division, ICAR- National Dairy Research Institute, Karnal, Haryana, India

Assessment of clean and safe milk production practices on the profitability of dairy farmers in Kerala

Aneetta V Antony, Ajay Verma, Udita Choudhary, Biswajit Sen and Anil Kumar Dixit

Abstract
Endogenous switching regression model was used to assess the economic performance of dairy farmers conditional on the adoption status of clean and safe milk production practices from a total sample size of 210 farmers that selected from three districts, Kollam, Thiruvananthapuram and Palakkad of Kerala. Adopter farmers' mean yield raised by 4.72 percent while adopting practices, whereas non-adopter farmers' mean yield raised by 7.34 percent while adopting practices. Non-adopters daily income from dairy had increased to the tune of 42.72 percent. The majority of adopters sold their milk to dairy cooperatives. In contrast to household consumers who paid Rs. 55–60 /lit for the purchased milk, dairy cooperatives only paid the farmers Rs. 38–40/lit. The study also found that farmers choose dairy cooperatives as a marketing channel under excess in the region. Improving conditions for animals positively influenced the adoption of milk safety measures, which ultimately helped the dairy farmers to increase milk yield and total income.

Keywords: CSMP, endogenous switching model, ATT, ATU

Introduction
Changing consumer preferences resulting from rising living standards is a reason for the growing demand for improved food possessing and good safety standards (Kumar *et al*., 2020) [5]. The production of hygienic milk with good quality standards is one of the biggest concerns in world arena (Thomas *et al*., 2021) [9]. Though the country is the largest producer at global level, even the quality of Indian milk products is often in question, having negative impact on its access to international dairy markets (Kumar *et al*., 2019) [4]. However, in spite of large volume of milk produced, the quality aspects of milk production has not received adequate attention owing to poor technical knowledge of farmers. Quality is the result of a total integrated approach from farm dairy environment to the consumer's door (Kumar *et al*., 2017) [6]. Clean milk production involves cleanliness at different phases of animal handling, processing and transport of milk and milk products (Krishnan and Joy, 2022) [3]. The main aspects of CMP are animal hygiene, milking hygiene, equipment hygiene and processing hygiene (Dongol *et al*., 2017) [1]. Clean milk production results in milk that are safe for human consumption, free from disease-producing microorganisms, holding high keeping quality, high commercial value and high-quality base suitable for processing, resulting in high-quality finished products (Thakur *et al*., 2014) [8]. One of the ways to increase milk yield and profitability is to encourage adoption of FSMs in general and milk safety measures in particular.

Method and Materials
Three districts, Kollam, Thiruvananthapuram and Palakkad were selected from the Kerala state. Chavara and Pathanapuram blocks were chosen from the Kollam district. Nedumangad and Thiruvananthapuram taluks were chosen from the Thiruvananthapuram district. Nelliyampathy and Nemmara villages from the Nemmara block, and Chittur and Nalleppilly villages from the Chittur block, were chosen. From each cluster of villages in each block, a random sample of 35 dairy farmers was chosen, for a total sample size of 210. Endogenous switching regression (ESR) model was used to model the economic performance of dairy farmers conditional on the adoption status (Keay, 2022) [2].
Let us assume the outcome functions where the farmer faces two regimes: (1) to be an adopter, and (2) to be a non- adopter, can be represented as follows:

Regime 1: $Y_{1i} = X_{1i}\beta_1 + \varepsilon_{1i}$, $if\ U_i = 1$.... (1)

Regime 2: $Y_{2i} = X_{2i}\beta_2 + \varepsilon_{2i}$, $if\ U_i = 0$.... (2)

Where Y_{1i} and Y_{2i} are outcome variables, which represent the economic parameter (yield/income) per animal obtained under regimes 1 and 2 and X_i symbolizes a vector of covariates included in Z , and β is a vector of the parameters to be estimated. All the famers having adoption score less than mean adoption score were taken as non- adopters and farmers having adoption score above the mean value were considered adopters (Tesfay, 2020) [7]. The Endogenous switching regression model enable us to compute four expected outcomes, (Equation 3-6): The actual expected outcomes, of the farm households that are adopters (3) and non- adopters (4); and the outcome obtained in counterfactual scenarios. i.e., outcomes of adopters if they had not adopted (5) and that of non- adopters if they had been adopters (6). The conditional expectations for outcome in four cases are defined below:

$E(Y_{1i}\mid U_i = 1) = X_{1i}\beta_1 + \delta_1\eta\lambda_{1i}$	3
$E(Y_{2i}\mid U_i = 0) = X_{2i}\beta_2 + \delta_2\eta\lambda_{2i}$	4
$E(Y_{2i}\mid U_i = 1) = X_{2i}\beta_2 + \delta_2\eta\lambda_{2i}$	5
$E(Y_{1i}\mid U_i = 0) = X_{1i}\beta_1 + \delta_1\eta\lambda_{1i}$	6
$ATT = E(Y_{1i}\mid U_i = 1) - E(Y_{2i}\mid U_i = 1)$	7
$ATU = E(Y_{1i}\mid U_i = 0) - E(Y_{2i}\mid U_i = 0)$	8

The average effect of treatment on the treated (adopters) (ATT) was calculated as the difference between (4) and (6), and the average effect of treatment on untreated (non-adopters) (ATU) as difference between (3) and (5). The heterogeneity effects for the group of farmers to be adopters and those not to be adopters can also be calculated as differences between (3) and (6) (i.e., H1), and (4) and (5) (i.e., H2) respectively. The ESR model has the advantages of controlling unobserved heterogeneity, and of estimating each component of the counterfactual (effects of adoption on the adopters, on non- adopters; and the heterogeneity effects for the adopters and non- adopters).

Results and Discussion

Small farmers constituted majority of the surveyed sample, with the largest proportion in Palakkad (88.57%), followed by Thiruvananthapuram (72.86%) and then Kollam (57.14%) (out of 70 farmers surveyed, in each district). More than 70% of the households in Kollam were of small size. More percentage of households with large household size was found in Palakkad. Largest proportion farmers with dairy only occupation was found in Kollam followed by Palakkad. The largest proportion of farmers observed as possessing agriculture as the main unit of income, while dairy farming was observed in Palakkad. The impact of adoption of adoption of clean and safe milk production practice on output variable, yield per animal per day has been modeled using endogenous switching regression. The famers were divided into adopters and non-adopters based on the mean adoption score of the entire sample. Those farmers whose adoption score was less than mean adoption score was classified as non- adopters and those with adoption score higher than mean adoption score was classified as adopters.

Milk yield affected by clean and safe milk production practices

It can be observed from table 2 that milk yield per animal per day decreases with the increase in livestock number for adopters. The same result can be seen for non- adopters also. With one unit increase in livestock number yield per animal decreases by 0.29 units for adopters and 3.536 units for non-adopters. This is because with the increase in herd size management of herd becomes difficult. Also chances of occurrence and spread of diseases increases with increase in herd size, hence demanding close supervision. It can also be observed from the table that with the increase in livestock numbers by one unit the chances of being an adopter increase by 0.84 units (Thomas *et al*., 2021) [9].

Table 3 represents expected value of yield per animal (litres) under actual and counterfactual conditions. The expected value of milk yield for the treatment group (15.34 lit/animal) was higher than for the control group (14.653 lit/animal). In the counterfactual case, farmers under treatment would have a milk yield that was lower by 0.69 litres if they had not been treated. Similarly control farmers would have increased their milk yield by 1.02 litres if they had been adopters, i.e., they were in the treatment group. The heterogeneity effects for the group of households to be adopters and those not to be adopters can be seen in the table. These results explain unobserved differences such as skills between adopters and non-adopters that result in differences in the output variable (yield per animal), regardless of the adoption status. The results indicate that if adopter farmers adopt practices mean yield increases by 4.72% compared to non- adoption, whereas non-adopter farmers on adoption, yield increases by 7.34 % compared to non-adoption. Therefore, adoption has more impact on non-adopter than adopter farmers. Hence, transitional heterogeneity effect of milk yield is negative.

Income affected by clean and safe milk production practices

From table 4 it can be observed that income from dairy decreases with the increase in livestock number in the case of adopter by Rs.80.69 for every one unit increase. This is because management of farm becomes difficult with the increase in livestock number. The chances of spread of diseases increase and isolation becomes difficult with increase in total livestock number. With the increase in livestock number by one unit the chances of being an adopter increases by 0.085 units. The results indicate that compared to primary, income from dairy is higher for farmers with secondary education in the case of adopters as well as non- adopters (Krishnan and Joy, 2022) [3]. District fixed effect on income from dairy was found to be negative for non-adopters in the case of Palakkad. This is because larger proportion of farmers surveyed from Palakkad was small farmers with total livestock number less than 5. Adoption decreases with decrease in livestock number as discussed earlier.

It can be observed from table 5 that with adoption, in the case of adopters, income from dairy per day decreases by 3.83%, whereas in the case of non- adopters it increases by 42.72%. Majority of the adopters sell their milk to dairy cooperatives as seen in figure 4.10. Dairy Cooperatives pay the farmers only Rs. 38-40/ lit in comparison to household consumers who pay Rs.55-60 / lit for the milk bought. It was also observed during the study that farmers opted dairy cooperatives as marketing channel when the density of dairy farmers was higher in the region and there was excess supply

over demand. This is the reason why for adopters of clean and safe milk production practices, even though milk yield per animal per day increased with adoption, the income from dairy per day decreased with adoption. Transitional Heterogeneity was found to be negative.

Table 1: Different practices of clean and safe milk production

Practices related to Hygiene	Practices related to Storage	Practices related to Animal health and milking environment	Practices related to Risk of contamination hazard
Cattle milked separately from the stall	Milk from diseased animal kept separately	No faeces in the animal body	Floor of stall feed area kept well drained daily
The floor of milking area kept well-drained daily	Milk from seriously diseased/ infected animals discarded	Diseased animals isolated	Floor of stall feed area kept clean daily
Floor of milking area cleaned daily	Milk stored separately from the animal shed	Animals washed regularly	Dung disposed immediately after excretion
Hands washed before milking	Floor of milk storage area dried regularly	Animal drinks clean water	Urine drained immediately after excretion
Hands dried before milking	Milk storage area swept regularly	Dry cow therapy	Chemicals used in dairy area
Hands sanitized before milking	Milk storage area washed regularly		Chemicals used as per instruction
Utensils without joints	Milk storage area kept free of pests		Workers wear suitable clean clothes
Utensils dried before milking	Milk containers used for bulking without joints		Nails trimmed regularly
Utensils cleaned before milking	Milk containers used for bulking washed regularly		Cuts/wounds covered with appropriate waterproof dressing
Utensils sanitized before milking	Powder/ baking soda mixed before selling milk		Dairy farm inspected regularly to ensure safety of overall farm
Utensils washed immediately after milking			Store empty containers/utensils in refrigerator
Milk thrown after use of medicine			
Udders/ teats cleaned before milking			
Udders/ teats dried before milking			
Udders sanitized before milking			
Milk pasteurized and labelled			

Table 2: Impact of adoption of clean and safe milk production practice on milk yield

	Adopter = 1	Non adopter = 0	Adopter =1, Non adopter=0
Dependent variable= Milk yield	**Yield per animal**	**Yield per animal**	**Adopter class**
Total livestock number	-0.292*** (0.071)	-3.536*** (0.162)	0.846*** (0.253)
Total milk production per day	0.020*** (0.004)	0.243*** (0.010)	-0.003 (0.019)
Self-consumption (lit/day)	-0.399 (0.288)	-0.156 (0.115)	0.118 (0.187)
Household size (Base= less than 5)			
• Household size (5-7)	1.141 (1.254)	-0.112 (0.360)	2.073 (4.285)
• Household size (more than 8)	0.784 (1.245)	-0.180 (0.359)	1.958 (4.285)
Occupation dummy (Base = Dairy only)			
• Dairy main with agriculture)	-0.529 (0.485)	-0.062 (0.200)	0.900*** (0.335)
• Agriculture main with dairy)	-0.479 (0.648)	-0.31 (0.204)	0.277 (0.363)
Instrument variable (Cost of compliance on food safety)			0.067*** (0.015)
Intercept	14.165	15.165	-8.573
σ_i	1.61	0.99	
	(0.09)	(0.05)	
ρ_i	0.63	-0.05	
	(0.19)	(0.29)	
N	154	56	210

Figures in parenthesis indicate standard error
***significant at 1%, **significant at 5%, * significant at 10%

Table 3: Treatment and Heterogeneity effect of adoption on milk yield

	Adoption	Non adoption	Treatment Effect	Percent change
Adopter	15.345	14.653	ATT= 0.692	4.72
Non adopter	14.909	13.889	ATU= 1.02	7.34
Base heterogeneity	0.436	0.764	TH= -0.328	

ATT is the average effect of treatment on the treated (adopters), ATU is the average effect of treatment on untreated (non- adopters), TH = TT – TU (Transitional Heterogeneity)

Table 4: Impact of adoption of clean and safe milk production practice on Income

	Adopter = 1	Non adopter = 0	Adopter =1, Non adopter=0
Dependent variable= Income from dairy			Adopter class
Total livestock number	-80.693*	-55.392	0.085**
	(-46.205)	(-48.516)	(-0.041)
Total milk production per day	43.138***	46.143***	0.010***
	(-2.944)	(-3.285)	(-0.003)
Experience in dairy farming (Number of yrs.)	-21.17	4.791	0.018
	(-17.427)	(-3.681)	(-0.015)
Education dummy (Base =Primary education)			
• Secondary	647.579**	110.212**	-0.548**
	(-269.551)	(-54.985)	(-0.241)
• Graduate and above	514.868	73.992	-0.429
	(-446.347)	(-80.833)	(-0.396)
District fixed effect (Base =Kollam)			
• Palakkad	-615.87	-269.208***	-1.248***
	(-424.109)	(-69.314)	(-0.371)
• Thiruvananthapuram	359.036	116.123*	-0.12
	(-265.437)	(-67.003)	(-0.235)
Instrument variable (Total expenditure on food safety)			0.003***
			(0)
Intercept	1,547.669***	-62.601	-1.740***
	(-330.294)	(-94.734)	(-0.314)
σ_i	1127.98	300.77	
	(-95.22)	(-17.14)	
ρ_i	-1	-0.024	
	(-0.01)	(-0.19)	
N	154	56	210

Figures in parenthesis indicate standard error
***significant at 1%, **significant at 5%, * significant at 10%

Table 5: Treatment and Heterogeneity effect of adoption on Income

	Adoption	Non adoption	Treatment Effect	Percent change
Adopter	8683.29	9016.37	ATT= -333.08	-3.83
Non adopter	3511.75	2011.7	ATU= 1500.05	42.72
Base heterogeneity	5171.54	7004.67	TH= -1833.13	

ATT is the average effect of treatment on the treated (adopters), ATU is the average effect of treatment on untreated (non- adopters), TH = TT – TU (Transitional Heterogeneity)

Fig 1: Selection of districts and farmers from Kerala state

Conclusions

The results for heterogeneity effects for the group of households to be adopters and not to be adopters indicated that in comparison to non-adopter farmers, adopter farmers' mean yield raised by 4.72 percent while adopting practices, whereas non-adopter farmers' mean yield raised by 7.34 percent while adopting practices. Adopters' daily income from dairy was declined by 3.83 percent, but it raised by 42.72 percent for non-adopters. The study also found that farmers choose dairy cooperatives as a marketing channel under excess of supply compared to demand in the region and the density of dairy farmers was higher. The milk yield per animal per day grew with adoption, the income from dairy per day for those who adopted clean and safe milk production procedures.

References

1. Dongol P, Thapa G, Kumar A. Adoption of milk safety measures and its impact on milk acceptance by buyers in Nepal. - Agricultural Economics Research Review. 2017;30(347):93103.
2. Keay, Myoung-Jin. An Exponential Endogenous Switching Regression with Correlated Random Coefficients. Econometrics. 2022;10:1.
3. Krishnan A, Joy B. Production practices of milk in

Kerala with special reference to Kottayam district. Muktshabd journal. 2022;9(4):1977-1992.
4. Kumar A, Mishra AK, Saroj S, Joshi PK. Impact of traditional versus modern dairy value chains on food security: Evidence from India's dairy sector. Food Policy. 2019;83:260-270.
5. Kumar A, Mishra AK, Saroj S, Sonkar VK, Thapa G, Joshi PK. Food safety measures and food security of smallholder dairy farmers: empirical evidence from Bihar, India. Agribusiness. 2020;36(3):363-384.
6. Kumar A, Thapa G, Roy D, Joshi PK. Adoption of food safety measures on milk production in Nepal: Impact on smallholders' farm-gate prices and profitability. Food Policy. 2017;70:13-26.
7. Tesfay MG. Does fertilizer adoption enhance smallholders' commercialization? An endogenous switching regression model from northern Ethiopia. Agriculture & Food Security. 2020;9:3
8. Thakur A, Dixit AK, Sharma AK, Kumar S, Sendhil R, Singh AK. Adoption of food safety practices in the informal milk processing units of Haryana, India–A value chain approach. Indian Journal of Dairy Science. 2014;74(6):516-525.
9. Thomas S, Prasad A, Alan Stephen V, Azeez AB. Arunima TS, Johnson D. Efficacy of clean milk production protocol on quality of milk in small holder production system. The Pharma Innovation Journal. 2021;10(7):1193-1196.