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A study of socio-economic profile & communicable behaviour pattern of beneficiary and non-beneficiary dairy farmers of Punjab

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Abstract

The livestock sector plays a major role in Punjab's rural economy, with dairying serving as an important and dependable source of income, employment, and nutrition for farm families. This study was conducted to assess and compare the socio-economic and communication behaviour of beneficiary and non-beneficiary dairy farmers in six districts of Punjab that fall under the GADVASU extension network. A total sample of 480 respondents, consisting of 240 beneficiary farmers from adopted villages and 240 non-beneficiary farmers from non-adopted villages, was selected using a multistage sampling approach. Data were collected through a structured and pre-tested interview schedule and analysed using descriptive statistics. Results showed that most dairy farmers were middle-aged males with education up to the high-school level, medium-sized families, and substantial experience in dairying. The majority possessed marginal or small landholdings and maintained small herd sizes, which corresponded with low household milk production and sales. Beneficiary farmers recorded relatively better milk production and livestock income compared to non-beneficiaries. Interpersonal contact with fellow farmers and veterinary staff remained the main source of information, while mobile phones and the internet were widely used for accessing livestock-related information. However, overall extension contact was still low, even though most farmers reported a moderate level of mass media exposure. The findings emphasize the continuing need for effective and accessible livestock extension services to improve knowledge, adoption of scientific practices, and dairy productivity in Punjab.

Keywords: Extension contacts, interpersonal, marginal farmers, mass media, livestock sector, socio-economic profile

Introduction

The livestock sector forms a vital pillar of the Indian economy, contributing significantly to rural livelihoods, nutritional security, and national income. India ranks among the world's leading nations in terms of livestock strength, with a total population of about 535.78 million animals as reported in the 20th Livestock Census (DAHDF, 2019) ^[1]. Livestock rearing has traditionally been a key occupation in Punjab, complementing its strong agricultural base. The state is home to approximately 25.31 lakh cattle and 40.16 lakh buffaloes and is widely recognized as the "Bread Basket of India" due to its remarkable agricultural productivity (Swaminathan & Bhavani, 2013) ^[13]. Beyond crop farming, the livestock sector in Punjab serves as a major source of gainful employment both full-time and supplementary supporting millions of farmers and rural households (Singh *et al.*, 2016) ^[12]. Punjab produces nearly 14.30 million tonnes of milk annually, ensuring one of the highest per capita milk availabilities in the country, at around 1,283 grams per person per day (20th Livestock Census, 2019) ^[1].

In recent years, the importance of comprehensive livestock service delivery systems has increased manifold to enhance productivity, sustainability, and farmer income. Modern animal husbandry now relies on a wide range of services, including scientific breeding programs, preventive and curative veterinary care, balanced feed and fodder management, marketing support, insurance, and digital advisory platforms. Among these, livestock extension services play a particularly crucial role.

They act as a bridge between research institutions and farmers by disseminating practical knowledge, improved technologies, and best management practices through trainings, demonstrations, field visits, and capacity-building initiatives (Rathod *et al.*, 2012) [8]. Effective extension support not only increases productivity and profitability but also strengthens resilience of smallholder farmers against climatic, market, and disease-related challenges making it a cornerstone of sustainable livestock development.

Dairying has emerged as an increasingly important livelihood activity and a key source of income security for the rural population in Punjab. With a large proportion of households engaged in mixed farming systems, dairy farming not only

supplements agricultural income but also ensures year-round cash flow, nutritional security, and employment for family labour, particularly women and the elderly. In this context, understanding the socio-economic profile of dairy farmers in Punjab becomes essential, as it provides valuable insights into their demographic characteristics, landholding patterns, herd size, resource availability, income structure, and access to extension and veterinary services. Such information is critical for policymakers, development agencies, and researchers, as it helps in designing and implementing need-based support programmes, and capacity-building initiatives aimed at strengthening the dairy sector and promoting inclusive rural development.

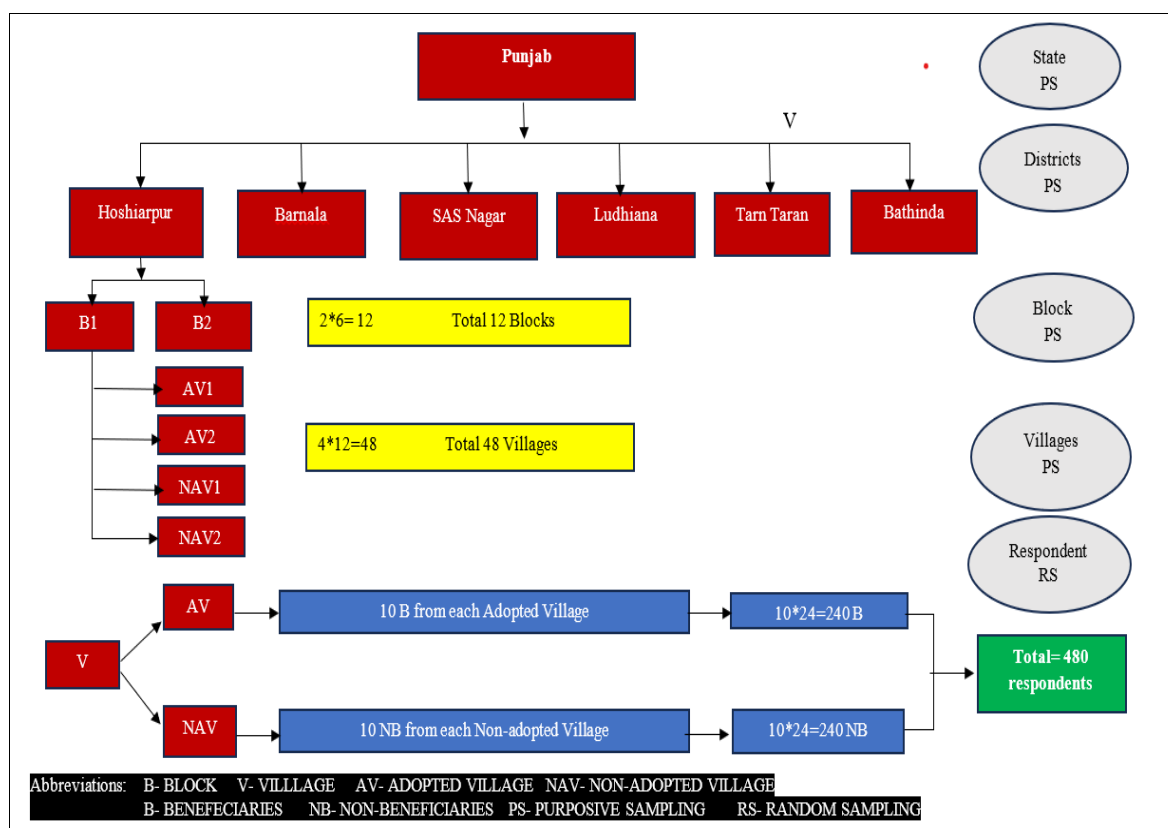


Fig 1: Sampling Plan

The present study, therefore, focuses on assessing the socio-economic profile of dairy farmers in different regions of Punjab. It examines factors such as education level, farming experience, economic status, gender participation, housing and infrastructure facilities, and adoption of improved dairy management practices. The findings of such studies play a pivotal role in formulating region-specific policies to enhance productivity, profitability, and sustainability of dairying in Punjab, thereby contributing to improved livelihoods and rural prosperity.

Research Methodology

The present investigation was carried out in selected districts of Punjab. Six districts-Bathinda, SAS Nagar, Tarn Taran, Hoshiarpur, Barnala, and Ludhiana were purposely chosen because they have an established extension network of GADVASU through Colleges, KVKs, and Regional Research and Training Centres (RRTC's). From each district, two blocks were randomly selected, giving a total of twelve blocks. Further, from every selected block, four villages were chosen at random, including two villages adopted by the university or its outreach units and two non-adopted villages, resulting in a

total of 48 villages. From each village, ten dairy farmers were randomly selected as respondents, provided they owned at least 2-3 milch animals and had a minimum of five years' experience in dairy farming. In this way, 240 beneficiary farmers (from adopted villages) and 240 non-beneficiary farmers (from non-adopted villages) were selected, making a total sample of 480 respondents. Data were collected from the farmers through personal interviews using a well-structured interview schedule. A pre-test of this schedule was conducted with 25 dairy farmers not included in the main study (during the Pashu Palan Mela, September 2023). Based on the feedback, some additional questions were incorporated into the section on constraints. The finalized interview schedule was then used to collect the required information, which was compiled and analyzed using descriptive statistical tools such as frequency and percentage analysis.

Results

General profile of the respondents

Socio-personal profile Age (in years)

Age determines the maturity of an individual and has a bearing on the thinking, experience, and exposure of a person.

Are view of Table 1 showed that the majority of the beneficiaries and non-beneficiaries (55.83% and 52.50%, respectively) were middle-aged, with ages ranging from 36 to

50 years. Around 16.67 percent of beneficiaries and 19.17 percent of non-beneficiaries were in the "young" age category

Table 1: Categorization of respondents on the basis of their socio-personal profile

Characteristics	Categories	Beneficiaries (N=240)	Non-beneficiaries (N=240)
Age	Young (Upto35)	40 (16.67)	46 (19.17)
	Middle-aged (36-50)	134 (55.83)	126 (52.50)
	Old (Above50)	66 (27.50)	68 (28.33)
Gender	Male	231 (96.25)	229 (95.42)
	Female	9 (3.75)	11 (4.58)
Education	Illiterate	9 (3.75)	18 (7.50)
	Primary school	29 (12.08)	25 (10.41)
	Middle school	42 (17.50)	50 (20.83)
	High school	93 (38.75)	87 (36.25)
	Senior secondary	59 (24.58)	54 (22.50)
	Graduate and above	8 (3.33)	6 (2.50)
Family type	Nuclear	105 (43.75)	87 (36.25)
	Joint	135 (56.25)	153 (63.75)
Family size	Small (0-4)	105 (43.75)	87 (36.25)
	Medium (5-8)	135 (54.58)	148 (61.67)
	Large (Above8)	4 (5.00)	5 (2.08)
Dairy farming experience (years)	5-10	22 (9.17)	27 (11.25)
	11-20	60 (25.00)	69 (28.75)
	21-30	100 (41.67)	78 (32.50)
	>30	58 (24.17)	66 (27.50)

Figures in parenthesis indicate percentage of the respondents (up to 35 years).

In contrast, the "old" age group (those over 50) included 27.50 percent of beneficiaries and 28.33 percent of non-beneficiaries. Hundal *et al.* (2016) ^[4] carried out a study to assess the socio-personal characteristics of dairy farmers in Punjab and found that majority of respondents (62.04%) belonged to middle age group. This result was similar to the findings of the present study.

Gender

The study revealed that the majority of the beneficiaries (96.25%) and non-beneficiaries (95.42%) were male. Only 3.75 percent of beneficiaries and 4.58 percent of non-beneficiaries were female as given in Table 1.

Verma *et al.* (2022) ^[17] conducted research across the Majha, Malwa, and Doaba areas of Punjab to assess the socio-personal characteristics of dairy farmers and noted that the majority of respondents (96.67%) were male and this study is in line with present research.

Education status

Education brings desirable changes of individual behavior in terms of Knowledge, Skill, and Attitude. The distribution of respondents, both beneficiary and non-beneficiary, based on their educational attainment is provided. In table1, respondents were divided into six categories based on their education level. More than one-third of beneficiaries were educated up to high school level (38.75%) followed by 24.58% who had education up to senior secondary, and 17.50 percent studied up to middle education level. Around 12.08 percent of beneficiaries had education up to the primary level, the rest 3.75 percent of beneficiaries were illiterate, and merely 3.33 percent beneficiaries were graduated and above. With regard to non-beneficiary respondents, 36.25 percent were educated up to high school level, followed by senior secondary (22.50%), and 20.83 percent non-beneficiary had middle-level school education. Around 10.41 percent of non-beneficiaries were educated up to the primary level. The rest,

7.50 percent of non-beneficiaries were illiterate whereas, 2.50percent of non-beneficiaries were graduated and above.

Chauhan and Kansal (2016) ^[4] examined the socio-personal profile of dairy farmers in Punjab and found that most of the dairy farmers were educated up to the high school level, which is consistent with the findings of the current study.

Family type

The respondents were divided into two groups-nuclear and joint families based on the structure of their families. Table 1showed that the majority of beneficiaries (56.25%) and non-beneficiaries (63.75%) came from joint families, while nuclear families accounted for 43.75 percent of beneficiaries and 36.25 percent of non-beneficiaries. Joint families help in judiciously distribution of house chores and income as well as in social networking. Singh (2019) ^[11] examined the socio-personal aspects of dairy farmers in Punjab and reported that the majority of respondents (66.67%) had joint family setups and this study is consistent with present work.

Family size (in no.)

A perusal of Table 1 showed more than half of the beneficiaries (54.58%) had medium family size (5-8 members), while beneficiaries with small families (0-4 members) and large families (> 8 members) was 43.75 percent and 5.00 percent, respectively. Whereas, the majority of non-beneficiaries (61.6%) belonged to medium family size (5-8 members), 36.25 percent and 2.08 percent non-beneficiary were having small (0-4 members) and large family size (> 8 members). Verma (2021) ^[16] conducted research to observe the socio-personal factors of dairy farmers in Punjab and found that most dairy farmers (58.34%) had medium-sized families (5-8 members). This finding is in accordance with the present study.

Dairy farming experience (years)

Experience is the accumulation of time spent by an individual engaging in a series of activities. In the context of dairying,

experience is a crucial factor in maintaining the high quality of dairy animals. Table 1 revealed that most of the beneficiaries (41.67%) had 21-30 years of experience, while 25.00 percent beneficiaries had 11-20 years of experience in dairying, followed by 24.17 percent and 9.17 percent beneficiaries had >30 years and 5-10 years of experience in the field of dairying, respectively. While, 32.50 percent of non-beneficiaries had the experience of 21-30 years in the

field of dairying, followed by 28.75 percent of non-beneficiaries had 11-20 years of experience, 27.50 percent and 11.25 percent of non-beneficiaries had >30 years and 5-10 years of experience, respectively. Chandrasekhar *et al.* (2017) assessed the socio-personal characteristics of dairy farmers in Karnataka and found that most of the respondents (45.83%) possessed 20-30 years of experience in dairy farming. This finding is in line with the present study.

Table 2: Categorization of respondents on the basis of their socio-economic profile

Characteristics	Categories	Beneficiaries (N=240)	Non-beneficiaries (N=240)
Land holding (in ha.)	Landless (0)	8 (3.34)	12 (5.00)
	Marginal (Up to 1.0)	102 (42.50)	97 (40.41)
	Small (1.0-2.0)	87 (36.25)	94 (39.17)
	Semi-medium (2.01-4.0)	28 (11.66)	25 (10.41)
	Medium (4.01-10)	11 (4.58)	9 (3.75)
	Large (>10)	4 (1.67)	3 (1.26)
Livestock holding (in no.)	Small (<6)	143 (59.59)	145 (60.41)
	Medium (6-12)	87 (36.25)	92 (38.34)
	Large (>12)	10 (4.17)	3 (1.25)
Household milk production (liters/day)	Low (<16)	130 (54.17)	150 (62.50)
	Medium (16-25)	86 (35.83)	78 (32.50)
	High (>25)	24 (10.00)	12 (5.00)
Household milk consumption (liters/day)	Low (<6)	130 (54.17)	126 (52.50)
	Medium (6-8)	104 (43.33)	106 (44.17)
	High (>8)	6 (2.50)	8 (3.33)
Household milk sale (liters/day)	Low (<12)	165 (68.75)	179 (74.58)
	Medium (12-24)	56 (23.33)	53 (22.08)
	High (>24)	19 (7.91)	8 (3.33)
Annual Income from Livestock (Rs/annum)	Low (<1,20,000)	136 (56.67)	167 (69.58)
	Medium (1,20,000-2,40,000)	77 (32.08)	53 (22.08)
	High (> 2,40,000)	27 (11.25)	20 (8.33)
Annual gross Income from all sources (Rs/annum)	Low (<2,80,000)	35 (14.58)	56 (23.33)
	Medium (2,80,000-4,80,000)	118 (49.17)	131 (54.58)
	High (> 4,80,000)	87 (36.25)	53 (22.08)

Socio-economic profile

Land holding (in ha.)

It could be seen from table 2 that 42.50 percent of beneficiaries had marginal land holding (up to 1.0 ha), about 36.25 percent of beneficiaries had small (1.0-2.0 ha.) land holding; further 11.66 percent beneficiaries and 4.58 percent of beneficiaries had semi-medium (2.01-4.0 ha.) and medium (4.01-10 ha.) land holding, respectively. About, 3.34 percent of respondents were landless and only 1.67 percent of respondents had large (>10 ha.) land holding. In case of non-beneficiaries, most of the respondents (40.41%) were having marginal land holding, and 39.17 percent non-beneficiaries were having small land holding, further followed by those having semi-medium (10.41%), landless (5.00%), medium (3.75%) and large (1.26%) land holdings, respectively.

Raksha (2016)^[7] carried out a study to examine the socio-economic aspects of women dairy farmers of Jharkhand and found that most dairy farmers (39.00%) had marginal land holding, which is consistent with present research.

Livestock holding (in no)

It could be seen from table 2 that the majority of beneficiaries (59.59%) and non-beneficiaries (60.41%) were having small herd size (< 6 animals). In case of beneficiaries 36.25 percent and 4.17 percent had medium (6-12 animals) and large (>12 animals) livestock holding, respectively. Whereas, in the case of non-beneficiaries 38.34 percent and 1.25 percent had medium (6-12 animals) and large (> 12 animals) livestock holding, respectively. Sabapara *et al.* (2016)^[10] researched to observe the socio-economic profile of dairy farmers of

Gujarat and noted that the majority of respondents (57.34%) owned a small herd size (1-5 animals), which is in accordance with the present study.

Household milk production (litres/day)

As far as milk production is concerned, table 2 revealed that the majority of the beneficiaries (54.17%) were having low household milk production (< 16 liters/day), whereas 35.83 percent and 10.00 percent were having medium (16-25 liters/day) and high (> 25 liters/day) household milk production, respectively. In case of non-beneficiaries, about 62.50 percent respondents were having low (<16 liters/day) household milk production, whereas 32.50 percent and 5.00 percent non-beneficiaries were having medium (16-25 liters/day) and high (> 25 liters/day) household milk production, respectively.

Kaur (2017)^[5] examined the socio-economic aspects of women dairy farmers of Punjab and unveiled that most dairy farmers (38.75%) had low household milk production (< 15 liters/day), which is consistent with present research.

The pattern of milk production is in accordance with livestock holding status (Table 2).

Household milk consumption (litres/day)

In case of milk consumption table 2 showed that the majority of beneficiaries (54.17%) had low (< 6 litres/day) milk consumption whereas, 43.33 percent and 2.50 percent beneficiaries had medium (6-8 litres/day) and high (>8 litres/day) milk consumption, respectively. In regard with non-beneficiaries, 52.50 percent had low milk consumption,

followed by medium (44.17%) and high (3.33%) milk consumption, respectively.

Household milk sale (litres/day)

A glimpse of table 4.2 showed that the majority of beneficiaries (68.75%) and non-beneficiaries (74.58%), respectively fell into the low (< 12 liters/day) category of milk sale. However, 23.33 percent and 7.91 percent of beneficiaries were under the medium (12-24 liters/day) and high (>24 liters/day) category of milk sale, respectively. Whereas, 22.08 percent and 3.33 percent non-beneficiaries were under the medium (12-24 liters/day) and high (> 24 liters/day) category of milk sale, respectively.

Vitthalrao (2010) [18] assessed the socio-economic profile of dairy farmers of the Ahmednagar district of Maharashtra and indicated that the majority of respondents (69.00%) had low milksale per day and this finding is in line with the present study.

Annual Income from Livestock (Rs/annum)

The term "annual income" refers to revenue from the sale of milk and milk products, Farm Yard Manure (FYM), dung cake, calves, milch animals, hiring of bullocks, and other sources. It was evident from table 2 that the majority of beneficiaries (56.67%) and non-beneficiaries (69.58%), respectively fall under low (Rs <1,20,000 annum) annual income from livestock. Meanwhile, 32.08 percent and 11.25 percent of beneficiaries fall under the medium (Rs 1,20,000-2,40,000/annum) and high (Rs > 2,40,000/annum) level of annual income from the livestock category, respectively. On

the other hand, about 22.08 percent and 8.33 percent non-beneficiaries fall under the medium and high level of annual income from livestock category, respectively.

Thankachan *et al.* (2019) [14] undertook a study in Kerala to investigate the socio-economic characteristics and noted that the majority of farmers (96.00%) were categorized as low-income earner from livestock.

Annual Income from all sources (Rs/annum)

The term refers to the total income (in Rs) earned by the respondent's household in a year from various sources, including agriculture, dairying, horticulture, labor, business, and services. It was illustrated from the table 2 that 49.17 percent of beneficiaries and 54.58 percent of non-beneficiaries, respectively were having medium (2,80,000-4,80,000 Rs/annum) annual gross income. Whereas, 36.25 percent and 14.58 percent of beneficiaries were having high (Rs > 4,80,000) and low (Rs < 2,80,000) annual gross income, respectively. On the other hand, 23.33 percent and 22.08 percent of non-beneficiaries were having low and high annual gross income, respectively.

Nimbalkar (2020) [16] conducted a study to investigate the socio-economic profile of dairy farmers in Punjab and found that the majority of dairy farmers (85.00%) fall under the medium annual dairy income group (from all sources). This finding is in accordance with the present study.

Communication profile

Extension contacts

Table 3: Categorization of respondents on the basis of frequency of their extension contacts

Categories	Sub-categories	Beneficiaries (N=240)	Non-beneficiaries (N=240)
Friends/ Fellow farmers	Never	0 (0.00)	1 (0.42)
	> Month	198 (82.50)	222 (92.50)
	Monthly	32 (13.33)	16 (6.66)
	Weekly	4 (1.67)	0 (0.00)
	Daily	6 (2.50)	1 (0.42)
Veterinary officer/ Para-veterinarian	Never	20 (8.33)	24 (10.00)
	> Month	219 (91.25)	216 (90.00)
	Monthly	1 (0.42)	0 (0.00)
	Weekly	0 (0.00)	0 (0.00)
	Daily	0 (0.00)	0 (0.00)
Village sarpanch	Never	78 (32.50)	111 (46.25)
	> Month	156 (65.00)	129 (53.75)
	Monthly	3 (1.25)	0 (0.00)
	Weekly	1 (0.42)	0 (0.00)
	Daily	2 (0.83)	0 (0.00)

Table 3 showed that the majority of beneficiaries (82.50%) and non-beneficiaries (92.50%) interacted with friends or fellow farmers on a monthly basis. Similarly, 91.25 percent of beneficiaries and 90.00 percent of non-beneficiaries engaged with veterinary officers or para-veterinarians less frequently

than once a month. Additionally, the data showed that most beneficiaries (65.00%) and non-beneficiaries (53.75%) contacted the village sarpanch less than once a month for information.

Table 4: Categorization of respondents on the basis of their extension contacts

Characteristics	Categories	Beneficiaries (N=240)	Non-beneficiaries (N=240)
Extension contacts	Low (0-5)	225 (93.75)	239 (99.58)
	Medium (6-10)	15 (6.25)	1 (0.42)
	High (11-16)	0 (0.00)	0 (0.00)

Figures in parenthesis indicate percentage of the respondents

Table 4 showed that the majority of beneficiaries (93.75%) and non-beneficiaries (99.58%) were in the low extension group (0-5). About 6.25 percent and 0.42 percent of

beneficiaries and non-beneficiaries were in the medium extension group (6-10), respectively. None of the beneficiaries as well as non-beneficiaries were in the high

group (11-16) of extension contact. Rewani and Tochwang (2016) [9] conducted a study to assess the socio-communicable aspects of women dairy farmers and found that majority of women dairy farmers (80.70%) had low extension contact, which is in line with present study.

Mass media exposure

The results in Table 5 revealed that the majority of beneficiaries regularly used mobile phones (98.75%) and the internet (67.08%) to access information. They sometimes

relied on newspapers (72.08%), farm magazines (46.67%), and TV (69.17%) for livestock-related information, while most (90.00%) never used the radio as a source. For non-beneficiaries, the majority also regularly used mobile phones (97.92%) and the internet (63.75%) to gather information. They sometimes turned to newspapers (82.50%) and TV (82.08%) for livestock-related information. However, a significant proportion never utilized farm magazines (61.66%) or radio (89.58%) for this purpose.

Table 5: Categorization of respondents on the basis of frequency of their mass media exposure

Categories	Sub-categories	Beneficiaries (N=240)	Non-beneficiaries (N=240)
Newspaper	Never	30 (12.50)	28 (11.67)
	Sometimes	173 (72.08)	198 (82.50)
	Often	26 (10.83)	12 (5.00)
	Most-often	8 (3.33)	2 (0.83)
	Regularly	3 (1.25)	0 (0.00)
Farm magazine	Never	112 (46.67)	148 (61.66)
	Sometimes	116 (48.33)	91 (37.92)
	Often	12 (5.00)	1 (0.42)
	Most-often	0 (0.00)	0 (0.00)
	Regularly	0 (0.00)	0 (0.00)
Radio	Never	216 (90.00)	215 (89.58)
	Sometimes	22 (9.17)	25 (10.42)
	Often	2 (0.83)	0 (0.00)
	Most-often	0 (0.00)	0 (0.00)
	Regularly	0 (0.00)	0 (0.00)
T.V	Never	5 (2.08)	11 (4.58)
	Sometimes	166 (69.17)	197 (82.08)
	Often	57 (23.75)	30 (12.50)
	Most-often	7 (2.92)	2 (0.83)
	Regularly	5 (2.08)	0 (0.00)
Mobile	Never	0 (0.00)	0 (0.00)
	Sometimes	1 (0.42)	0 (0.00)
	Often	0 (0.00)	0 (0.00)
	Most-often	2 (0.83)	5 (2.08)
	Regularly	237 (98.75)	235 (97.92)
Internet	Never	9 (3.75)	16 (6.67)
	Sometimes	7 (2.92)	8 (3.33)
	Often	23 (9.58)	33 (13.75)
	Most-often	40 (16.67)	30 (12.50)
	Regularly	161 (67.08)	153 (63.75)

Table 6: Categorization of respondents on the basis of their mass media exposure

Characteristics	Categories	Beneficiaries (N=240)	Non-beneficiaries (N=240)
Mass media exposure	Low (0-8)	24 (10.00)	44 (18.33)
	Medium (9-16)	215 (89.58)	196 (81.67)
	High (17-24)	1 (0.42)	0 (0.00)

Figures in parenthesis indicate percentage of the respondents

Table 6 showed that the majority of beneficiaries (89.58%) and non-beneficiaries (81.67%) were in the middle group (9-16) of mass media exposure. Whereas, 10.00 percent and 18.33 percent were in the low category (0-8) of mass media exposure. Only 0.42 percent of beneficiaries were in the high group of mass media exposure (17-24). In contrast, none of the non-beneficiaries belonged to the group with high mass media exposure.

Verma (2012) [15] carried a research to observe the socio-communicable traits of dairy farmers in Uttar Pradesh and indicated that the majority of dairy farmers (54.00%) had medium mass media exposure, which is in accordance with the present study.

Conclusions

The study highlighted that dairy farming in Punjab was largely undertaken by middle-aged, reasonably educated

farmers who possessed long practical experience but limited land and livestock resources. Small herd sizes and marginal landholdings restricted milk output and income generation, particularly among non-beneficiary farmers. Beneficiary farmers who were associated with university and extension programmes performed comparatively better, illustrating the positive influence of structured advisory and support services. The analysis of communication behaviour indicated that farmers relied mainly on personal contacts, especially friends, fellow farmers, and veterinary professionals, while mobile phones and the internet were becoming important tools for obtaining information. Despite this, formal extension contact remained limited, signalling the need for more intensive outreach and engagement.

Overall, the findings stressed the importance of strengthening livestock extension systems, increasing farmers' participation in trainings and demonstrations, and improving access to

credible, region-specific advisory services. Enhancing support particularly for small and marginal dairy farmers could significantly contribute to improved productivity, higher incomes, and better livelihood security in Punjab's rural communities.

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Conflict of Interest / Competing interests

The author declare no conflicts of interest.

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