Knowledge and practices of dairy farmers about environmental health: Need for eco-health approach in Punjab

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Abstract: The dairy industry impacts environmental health in various ways and the extent of the impact depends upon the knowledge and practices of dairy farmers. This research surveyed the knowledge and practices of the dairy farmers (n=300) towards environmental safety from five different agro-climatic zones of Punjab (India). Data were analyzed using SPSS software through descriptive statistics, Chi-square test of independence with Cramer’s V value as measures of effect size. Analysis of variances, followed by Games Howell post hoc test was performed to analyze subgroup differences amongst explanatory variables. The majority of farmers (57.66%) had a low knowledge score on environmental safety. Majority of farmers did not know greenhouse gases emission (81%) from dairy animals/their excreta, the impact of dairy farming on climate change (86.67%), and were not treating farm effluents before discharging them into the environment (92.67%). Climate change (I) followed by air pollution (II), human-animal-environment interaction (III), water pollution (IV), and soil pollution(V) were the rank-wise factors reported to affect dairy farming. Further, socio-demographic and farm characteristics have a positive influence on the farmer's knowledge. The study warrants an extensive awareness campaign on scientific cum eco-friendly dairy farming with an emphasis on measures to reduce environmental pollution and an eco-health approach to bridge the knowledge hiatus.

Keywords: Dairy farmers, Environment health, India, Knowledge, Practices

Introduction

Humans, animals and the environment are interconnected directly and indirectly. Any change in one will pose an effect on the others, this leads to the term “Eco-health”. It examines the changes in the biological, physical, social, and economic environment and correlates these changes with animal and human health (Baum et al. 2017). The environment, both micro and macro have a pronounced effect on the efficacy of humans and animals residing in it. There are many industries/ practices which have a deleterious effect on the environment. Increase in livestock farming and their practices are affecting humans, animals, and the environment through various means making scope for the concept of Eco-health. Livestock interacts with land (which includes soil and vegetation), water, air, and human directly and indirectly. Dairy farming is also considered as a prominent activity among them. Farmers are doing dairy farming from the time of yore, but it came under the environmental lens only one to two decades back. Greenhouse gas emission from dairy animals and their manure contributes to climatic change. Poor handling of farm waste especially dung, urine and washer can degrade the water and soil. The dairy farmers are often unaware of the environmental risks incorporated by their farm waste. The farm waste is polluting air, soil, and water to a very large extent. Improper handling of farm waste (dung, dead animals etc) and lack of scientific waste disposal provisions can cause several vector-borne diseases and contamination of environment with different pathogens can put human and animals at potential risk. The daily seepage of dairy farm effluents is also polluting the surface water (Monaghan and Smith, 2004). Hence effluent management and nutrient run-off were considered important issues on environment management by the dairy farmers (Rogers and Alexander, 2000). The present study was conducted to assess the knowledge level and practices of the dairy farmers of Punjab (India) related to environmental health.
Materials and Methods

Ethical permission

The ethical permission was taken from the Institutional Ethics Committee, Dayanand Medical College and Hospital, Ludhiana, Punjab (Ethics approval number: 10 DMCH/R&D/2018/1007) for the conduct of this study.

Study area

The study was conducted (June 2018 to May 2019) in the Punjab state of India. Punjab comprised of five Agro-climatic zones (named Sub-mountain undulating region, Undulating plain region, Central plain region, Western plain region, Western region) based on river boundaries and flows in these areas (Mahi and Kingra, 2013). After playing a pivotal role in ushering the green revolution in the country, the state is leading to bring the white revolution in the country. Presently, State has 4.01 million buffaloes, 2.4 million cattle and is producing 20.16 million tonnes of milk per annum. The per capita milk availability is highest in the country (1030gm). Nearly 80% of dairy farming is undertaken by smallholders (NSSO, 2013).

Sample size determination and study design

The sample size of 304 was calculated using online “Statulator software” (Dhand and Khatkar, 2014) with 5% precision and 95% confidence. A total of 359 livestock farmers from 10 randomly selected villages with a human population of 15902 from five different agro-climatic zones of Punjab were contacted. Only 300 consented to participate in the survey making the response rate 83%. The comprehensive list of dairy farmers of each selected village was prepared using the vaccination register of the Civil Veterinary Hospital in the locality. The respondent was selected randomly from each list and the selection of each respondent was made based on the possession of dairy animal(s) at the time of the survey and the willingness of the farmer to participate in the study. On the unavailability or unwillingness of the selected farmer, the next farmer from the list was chosen. No data about the respondent’s identity was collected. The survey comprised of socio-demographic characteristics (gender, age, education, family type, occupation, and dairy farming experience) and dairy farm characteristics (herd size, farm distance from the residential area, and management of farm) and knowledge and practices on environment safety (Five aspects: Climate change, Air pollution, Water pollution, Soil pollution, and Human, animal and environment interactions). The respondent’s overall knowledge of environment safety was calculated using 42 dichotomous questions on five above said aspects. The responses to these questions were combined to generate a knowledge score ranging from zero to 42. A score of 1 was given to correct responses and 0 was used for an incorrect response. The questions having more than two choices were condensed into two categories for analysis. Based on the mean score of the dependent variable, the responses were categorized as high (a score above the mean value) and low (a score below the mean value). Additional information related to the above 42 questions was also explored and discussed. Each respondent was asked to rank the factors affecting environmental quality and safety from 1 (Most important) to 5 (Least important) scale.

The questionnaire was drafted in the local language (Punjabi) and was pretested on 25 randomly selected dairy farmers. Accordingly, necessary modifications were made in the body of the questionnaire to make it more convenient and easy for respondents. The results of this work are not used in the final data analysis. The Cronbach’s alpha value of the final questionnaire on environment safety was 0.873.

Statistical analysis

Data was entered and analyzed using a statistical package for the social science (SPSS) version 20.0. Descriptive statistics including frequencies, percentages, and means were run for continuous/categorical variables. Due to the categorical nature of variables, the Chi-square test of independence was applied to determine the association between outcome and explanatory variables with Cramer’s V value as measures of effect size. Where the sample size per strata was less than five, Fisher’s exact test was used as it gives an accurate and unbiased p-value for a small sample size. Analysis of variances (ANOVA) was performed to analyze subgroup differences with the Games Howell post hoc test for comparisons as Levene’s test for equality of variance indicated unequal variance. All results were considered statistically significant when p<0.05. Garrett’s ranking technique was used to quantify ranks.

Results and Discussion

Socio-demographic and farm characteristics of respondents

Respondent’s information (age, gender, education, main occupation, experience) and farm characteristics (herd size, type of dairy animals, farm management, and distance from the residential area) is depicted in Table 1. The majority of farms (64%) were found located inside the human residential area.

Dairy farmers’ knowledge and practices on environmental safety

Climate change

The majority of respondents accepted that climate is changing (96%) and there is a relationship between environmental pollution (air, water, and soil), food, and health problems (71.33%). The majority of the farmers (86.67%) were not aware of the impact of the dairy sector on climate change but interestingly most (84.33%) agreed that changing climate has a pronounced impact on dairy animals. Change in milk production due to climate change was
reported by (92.67%) farmers and it was the result of human activities accepted (92.67%) respondents. The majority of farmers (91.67%) were aware of the deteriorating environment, soil, and water quality in the state of Punjab but only one-third of farmers (33.33%) accepted that their dairy farms were causing any environmental pollution. Moreover, nearly 60% of farmers in the study reported that climate change would lead to increased farm input costs, whereas, rest farmers said that it will only affect the commercial farms. The majority of respondents (80.33%) believed that dairy farms contribute to the environmental pollution through dung, urine, gases and there was a need to minimize the pollution arising from the dairy sector, whereas other (19.67%) respondents reported that it is necessary to control pollution from other sectors rather than dairy.

### Table 1 Socio-Demographic and farm characteristics of dairy farmers

| Parameters                  | Category                     | n  | %    |
|-----------------------------|------------------------------|----|------|
| Age (A- in years)*          | ACZI                         | 55 | 18.34|
|                             | ACZII                        | 60 | 20.00|
| Agro-Climatic Zone(ACZ)     | ACZIII                       | 60 | 20.00|
|                             | ACZIV                        | 55 | 18.34|
|                             | ACZV                         | 70 | 23.33|
|                             | AI (19-30)                   | 40 | 13.33|
|                             | All(31-40)                   | 40 | 13.33|
|                             | AllI (41-52)                 | 75 | 25.00|
|                             | AllV (53-76)                 | 145| 48.33|
| Gender                      | Male                         | 291| 97.00|
|                             | Female                       | 9  | 3.00 |
| Education(ED)               | EDI(Illiterate)              | 80 | 26.67|
|                             | EDII(10th)                   | 108| 36.00|
|                             | EDIII(12th)                  | 87 | 29.00|
|                             | EDIV(Graduation & above)     | 25 | 8.33 |
| Type of occupation          | Agriculture                  | 283| 94.33|
|                             | Dairy farming                | 17 | 5.67 |
| Family type                 | Joint                        | 196| 65.33|
|                             | Nuclear                      | 104| 34.67|
| Dairy farming experience (EX)| EXI(1-5)                     | 34 | 11.33|
|                             | EXII (6-10)                  | 55 | 18.33|
|                             | EXIII (11-20)                | 46 | 15.33|
|                             | EXIV (More than 20)          | 165| 55.00|
| Dairy herd size             | Marginal (1-2 animals)       | 27 | 9.00 |
|                             | Small (3-7 animals)          | 187| 62.33|
|                             | Medium (8-15 animals)        | 75 | 25.00|
|                             | Large (16 or more than 16 animals) | 11 | 3.67 |
| Breed of dairy animal       | Cattle (n=226)               | 203| 89.82|
|                             | Holstein Friesian/ Cross-bred|    |      |
|                             | Sahiwal                      | 23 | 10.18|
|                             | Murrah                       | 157| 63.31|
|                             | Nili-Ravi                    | 31 | 12.50|
|                             | Non-descript                 | 60 | 24.19|
| Dairy farm                  | MI(Men)                      | 258| 86.00|
| Management(M)               | MII(Labourer)                | 11 | 3.67 |
|                             | MIII(Women)                  | 31 | 10.33|
| Dairy farm                  | DI(Inside the residential area) | 191| 63.67|
| distance from the residential area(D)| DII(100 meters to 1 km) | 99 | 33.00|
|                             | DIII(More than 1 km)         | 10 | 3.33 |

* Average age (41.53 ±12.99 SD)
The majority of the farmers (81%) in the study did not know the greenhouse gases and only a small proportion of the respondents (14.67%) knew the role of methane in increasing environmental temperature. Furthermore, the majority (92.33%) of the respondents were taking no measures to control methane emission from their respective dairy farms and only 23 (7.67%) farmers were unknowingly utilizing this methane arising from the dung of the dairy animal in the form of biogas for cooking of food, running generators, or were utilizing the dung in the compost pit hence controlling the emission to some extent. Interestingly, the majority of the farmers (78.33%) were still using smoke to repel flies and mosquitoes from their farms in the summer season that can be a contributing factor in decreasing the air quality index especially in the micro-environment of the farm (Table 3).

**Water pollution**

| Parameters                                                                 | Category | n   | %   |
|---------------------------------------------------------------------------|----------|-----|-----|
| According to you, is there any relation between environmental pollution (air, water, and soil), food, and health problems? | Yes      | 214 | 71.33 |
| Do you believe the climate is changing?                                   | No       | 86  | 28.67 |
| Do you know about dairy farming’s impact on climate change?               | Yes      | 288 | 96   |
|                                                                           | No       | 12  | 4    |
| Do you know that climate change has an impact on the dairy sector?        | Yes      | 253 | 84.33 |
|                                                                           | No       | 47  | 15.67 |
| Is there any change in milk production at your farm due to climate change?| Yes      | 278 | 92.67 |
|                                                                           | No       | 22  | 7.33 |
| Do you believe human activities are responsible for the change in climate?| Yes      | 269 | 89.67 |
|                                                                           | No       | 31  | 10.33 |
| Do you believe environmental temperature will rise in the future?         | Yes      | 283 | 94.33 |
|                                                                           | No       | 17  | 5.67 |
| Do increasing environmental temperature, deteriorating soil and water quality are serious problems in Punjab? | Yes | 275 | 91.67 |
|                                                                           | No       | 25  | 8.33 |
| Is your dairy farm causing any environmental pollution?                    | Yes      | 100 | 33.33 |
|                                                                           | No       | 200 | 66.67 |
| Do you believe climate change will lead to increased farm input costs?    | Yes      | 174 | 58   |
|                                                                           | No       | 126 | 42   |
| Is there any impact of climate change on the profitability of dairy farms?| Yes      | 200 | 66.67 |
|                                                                           | No       | 100 | 33.33 |
| Does your dairy farm have any impact on the surrounding human population? | Yes      | 56  | 18.67 |
|                                                                           | No       | 244 | 81.33 |
| Is it important to control environmental pollution from the dairy sector?  | Yes      | 241 | 80.33 |
|                                                                           | No       | 59  | 19.67 |

### Table 2 Knowledge and practices on climate change

| Parameters                                                                 | Category | n   | %   |
|---------------------------------------------------------------------------|----------|-----|-----|
| Do you know greenhouse gases?                                             | Yes      | 57  | 19  |
|                                                                           | No       | 243 | 81  |
| Do you know dairy animals release greenhouse gases in the environment?    | Yes      | 32  | 10.67 |
|                                                                           | No       | 268 | 89.33 |
| Do you know methane is considered responsible for increasing environmental temperature? | Yes | 44  | 14.67 |
|                                                                           | No       | 256 | 85.33 |
| Do you use dung cakes for cooking food?                                   | Yes      | 214 | 71.33 |
|                                                                           | No       | 86  | 28.67 |
| Are you using any measure to scientifically handle the dung?              | Yes      | 23  | 7.67 |
|                                                                           | No       | 277 | 92.33 |
| Do you use smoke to repel mosquitoes from your dairy farm?                | Yes      | 235 | 78.33 |
|                                                                           | No       | 65  | 21.67 |

### Table 3 Knowledge and practices on air pollution

| Parameters                                                                 | Category | N   | %   |
|---------------------------------------------------------------------------|----------|-----|-----|
| Do you know greenhouse gases?                                             | Yes      | 57  | 19  |
|                                                                           | No       | 243 | 81  |
| Do you know dairy animals release greenhouse gases in the environment?    | Yes      | 32  | 10.67 |
|                                                                           | No       | 268 | 89.33 |
| Do you know methane is considered responsible for increasing environmental temperature? | Yes | 44  | 14.67 |
|                                                                           | No       | 256 | 85.33 |
| Do you use dung cakes for cooking food?                                   | Yes      | 214 | 71.33 |
|                                                                           | No       | 86  | 28.67 |
| Are you using any measure to scientifically handle the dung?              | Yes      | 23  | 7.67 |
|                                                                           | No       | 277 | 92.33 |
| Do you use smoke to repel mosquitoes from your dairy farm?                | Yes      | 235 | 78.33 |
|                                                                           | No       | 65  | 21.67 |
Water is the most essential source for life for both humans and animals and is the most exploited element on the planet. The groundwater levels of the state are falling day by day, many other states of the country are facing droughts, and where available, arises the question of its quality. Interestingly, nearly 2/3rd of respondents get the farm water quality checked but the majority of respondents are not aware of the dairy sector’s contribution to water pollution, presence of pathogens like *E. Coli*, *Salmonella Spp*, *Brucella Spp* in the water source, and water eutrophication. Sewerage followed by agriculture fields and nearby water bodies were the ways to discard the farm runoff water/effluent. Nearly, all the respondents (93%) discarded the

### Table 4 Knowledge and practices on water pollution

| Parameters                                                                 | Category        | N   | %    |
|----------------------------------------------------------------------------|-----------------|-----|------|
| Where do you discard water after washing the farm and bathing the animal? |                 |     |      |
| Sewerage system                                                          | 188             | 62.67 | |
| Water bodies                                                              | 26              | 8.67 | |
| Agricultural fields                                                       | 86              | 28.67 | |
| Do you treat your dairy effluents before releasing them into the environment? | Yes             | 22  | 7.33 |
| No                                                                        | 278             | 92.67 | |
| Do you know about water eutrophication (excessive growth of flora in water due to excessive enrichment of water by minerals/nutrients through dairy effluent)? | Yes             | 11  | 3.67 |
| No                                                                        | 289             | 96.33 | |
| Is there any water source around your farm where you discard dairy farm’s waste? | Yes             | 48  | 16  |
| No                                                                        | 252             | 84  | |
| Have you ever checked your dairy farm’s water for a quality check?         | Yes             | 220 | 73.33 | |
| No                                                                        | 80              | 26.67 | |
| Do you know about the dairy sector’s contribution to water pollution?      | Yes             | 69  | 23  |
| No                                                                        | 231             | 77  | |
| Do you know about the presence of *E. coli*, *Salmonella*, and *brucella* in polluted water? | Yes             | 32  | 10.67 | |
| No                                                                        | 268             | 89.33 | |

### Table 5 Knowledge and practices on soil pollution

| Parameters                                                                 | Category                   | n   | %    |
|----------------------------------------------------------------------------|---------------------------|-----|------|
| Do you know about soil acidification?                                      | Yes                       | 48  | 16  |
| No                                                                        | 252                       | 84  | |
| What do you do with the dung of the animal?                               | Throw on dung heaps       | 269 | 89.67 | |
| Use in the biogas plant                                                   | 8                         | 2.67 | |
| Use in the composite pit                                                  | 4                         | 1.33 | |
| Make dung cakes/patties                                                   | 19                        | 6.33 | |
| Do you know about the ill-effects of dung heaps in the open?              | Yes                       | 133 | 44.33 | |
| No                                                                        | 167                       | 55.67 | |
| What is the distance of dung heaps from the human population? (n=297)      | <500 meters               | 252 | 84.84 | |
| >500 meters                                                               | 45                        | 15.15 | |
| When do you clear dung heaps? (n=296)                                     | After 2 months            | 4   | 1.35 |
| After 6 months                                                            | 218                       | 73.65 | |
| After 1 year                                                              | 74                        | 25  | |
| Do you believe dung management should be improved to lessen environmental pollution? | Yes                       | 295 | 98.33 | |
| No                                                                        | 5                         | 1.67 | |
| Do you use any insecticide on dung heaps to control the vector population? | Yes                       | 34  | 11.33 | |
| No                                                                        | 266                       | 88.67 | |
| Where do you clear the dung heaps?                                        | Agricultural fields       | 300 | 100 |
| Dung heaps                                                                | 47                        | 15.67 | |
| Water bodies                                                              | 29                        | 9.67 | |
| Bury in ground                                                            | 219                       | 73  | |
| Haddarori                                                                 | 1                         | 0.33 | |
| In the open isolated place                                                | 4                         | 1.33 | |
| Do you use lime or salt while burying a dead animal or placenta in the ground? | Yes                       | 186 | 62  |
| No                                                                        | 114                       | 38  | |

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runoff water/effluent as such, without giving any treatment (Table 4).

**Soil pollution**

The study found that the majority of farmers (>80%) had no knowledge about the acidification of soil and were disposing of farm’s dung/solid waste in the open areas resulting in big heaps of dung. Further, the majority (55.67%) farmers did not know the ill impact of dung heaps on the human, animal, and environment. Moreover, the majority of dung heaps (84.84%) were within the radius of 500-meter of the human population and these dung heaps were cleared every six months by the majority of farmers (73.65%) and were used in agriculture field as manure. The study further showed that the majority of farmers (73%) buried placenta and aborted fetuses in-ground, while 15.67% throw it on the dung heap, 9.67% in water bodies, and rest in kneckeryard (locally known as haddarori) or in open places respectively (Table 5). Majority of farmers (98.33%) revealed that improved dung management can lower its deleterious impact on the environment.

**Human-animal-environment interaction**

The majority of respondents (86.33%) revealed that environmental pollution will lead to increased productivity losses due to more disease incidences in dairy animals, through an increase in the vector population like flies (83.67%). Regarding stray animals causing environmental pollution, majority of respondents (78.33%) believed that these animals were polluting the environment and were also spreading diseases among the healthy dairy animals. They demanded some stringent policies to address the issue of stray animals. Furthermore, respondents reported that they let their male cattle calves stray (35%), let them die through over or underfeeding or sell them, or sent them to gaushala. The majority of respondents (77.67%) did not know zoonotic diseases and farmers in dairy farming had been handling the dung without any proper precautions. Dung cake was solely made by women reported almost all respondents (Table 6), but surprisingly 98% never tested for brucellosis.

**Dairy farmer knowledge score on environmental safety**

Majority farmers (57.66%) had low knowledge score (Average score: 19.97, Min: 7, Max: 39) on environment safety. Agro-climatic zone of the state, education and occupation were significantly (P d” 0.05) associated with knowledge score on environment safety (Table 7).

### Table 6: Knowledge and practices on human, animal, and environment interaction

| Parameters                                                                 | Category    | N  | %  |
|---------------------------------------------------------------------------|-------------|----|----|
| Do you believe environmental pollution will increase productivity losses  | Yes         | 259| 86.33 |
| in animals due to increased diseases?                                      | No          | 41 | 13.67 |
| Does the changing environment have any impact on the vector population?    | Yes         | 251| 83.67 |
|                                                                           | No          | 49 | 16.33 |
| Do you believe the changing environment has resulted in the emergence    | Yes         | 259| 86.33 |
| of new diseases in humans and animals?                                    | No          | 41 | 13.67 |
| What do you do with the male calf?                                        | Let him die | 83 | 27.67 |
|                                                                           | Sale        | 67 | 22.33 |
|                                                                           | Gaushala    | 35 | 11.67 |
|                                                                           | Let him stray| 102| 34 |
|                                                                           | Used for draught| 13| 4.33 |
| Do you believe stray animals pollute the environment?                     | Yes         | 235| 78.33 |
|                                                                           | No          | 65 | 21.67 |
| Do you believe stray animals spread diseases among healthy animals?       | Yes         | 232| 77.33 |
|                                                                           | No          | 68 | 22.67 |
| Do you have any knowledge about zoonotic diseases?                        | Yes         | 67 | 22.33 |
|                                                                           | No          | 233| 77.67 |
| Do you know about the diseases that can occur due to dung?                | Yes         | 34 | 11.33 |
|                                                                           | No          | 266| 88.67 |
| Who makes dung cake at your farm?                                         | Female members of the family | 122 | 40.67 |
|                                                                           | Female laborer | 139| 46.33 |
|                                                                           | Do not make dung cakes | 39 | 13 |
| Is the person making dung cakes tested for brucellosis?                   | Yes         | 6 | 2 |
|                                                                           | No          | 294| 98 |
Climate change was perceived as the most impactful factor in the dairy sector (1st rank), followed by air pollution (2nd rank). Human-animal-environment interaction, water pollution, and soil pollution were ranked 3rd, 4th, and 5th respectively.

Climate change is taking place at a tremendous rate affecting all life forms around the globe. The majority of farmers in the present study accepted that climate change is happening and there is a need to act on this. Greenhouse gas emission from excreta of dairy animals affects the environment. The majority of the farmers in the study were not aware of the greenhouse gases and their effect on the dairy sector as well as on the climate. The deteriorating air quality index can lead to numerous problems and there is a dire need to control the emission of these gases from the dairy sector as these are contributing to the pollution. The total methane emission including enteric fermentation and manure management of Indian livestock was estimated at 11.75 Tg/year for the year 2003. Further dairy buffalo and indigenous dairy cattle together contribute 60% of the methane emission (Chhabra et al. 2013). The present study found that only a small proportion of the respondents knew the role of methane in increasing atmospheric temperature and the majority 256 (85.33%) did not know about it. In contrary to this, a study conducted among Scotland dairy farmers indicated that they agreed that temperature would raise in the future (Barnes and Toma, 2012).

The majority of the farmers in the present study believed that climate change would lead to increased farm inputs and at the same time will put the burden on the farmer with an increase in the production cost also. There is a dire need to control the methane emission from the dairy sector by various means to reduce its impact on the environment. Biogas technology besides supplying energy and manure provides an excellent opportunity for mitigation of greenhouse gas emission and reducing global warming through substituting firewood for cooking, kerosene for lighting and cooking, and chemical fertilizers (Pathak et al. 2009).

Major proportions of the farmers in the present study were unaware of the ill effects of the dung heaps in the open and acidification of soil. The majority of the farm’s waste was also found to be dumped on the dung heaps and farmers lacked information regarding proliferating vector population on these dung heaps. Farm waste and its dumping site provide an ideal habitat for fly breeding, which creates menace not only for animals but also for nearby human residents. Surprisingly, 88.67% of respondents in the present study never spray any insecticide on the dung heap/ dumping site to control fly control. However, previously, (Khan et al. 2013) reported that farmers use many measures like insecticide, flypapers, fans, sanitation, planting mint, using neem oil, electric fly killer to control the flies at the farm. Farmers in the present study reported that there would be an increase in vector population as well as increased disease incidence in both humans and animals due to changing environment. Changing environment, alleviation of temperature and precipitation may result in a spread of disease and parasite into new regions or enhance the disease incidence which in turn lowers the productive performance of animals (Singh et al. 2017).

The majority of the farms’ runoff water was found to be entering the sewage without any treatment. The majority of the water sources in Punjab have lost their purity status and become a place to dump the household/farm/industry waste. Continuous leaching of farm waste into the water body, enrich the water with many nutrients which leads to excessive algae growth, which may result in oxygen depletion. Martinz-Suller et al. (2010) reported that considerable quantities of dirty water composed of milking parlor wash-water, milk spillages, runoff from cattle-yard area, possibly effluent from silage and manure are produced on dairy farms. It has huge potential to cause water pollution due to its high pH, 5-day biochemical oxygen demand, and nitrogen (N) and phosphorus (P) concentrations.

### Table 7 Chi-Square analysis between knowledge score and explanatory variables

| Characteristics                  | Chisquare(\(\chi^2\)) Value | Degree of freedom (d.f) | P-value (two-sided) | Cramer’s V value |
|----------------------------------|------------------------------|-------------------------|---------------------|------------------|
| Agro-climatic zone               | 50.811                       | 4                       | .000                | .412             |
| Gender                           | 2.250                        | 1                       | .134                | .087             |
| Education                        | 9.874                        | 3                       | .020                | .181             |
| Age (Years)                      | .042                         | 3                       | .998                | .012             |
| Occupation                       | 6.898                        | 1                       | .009                | .152             |
| Family type                      | 5.52                         | 1                       | .457                | .043             |
| Experience in dairy farming (Years) | 2.986                      | 3                       | .394                | .100             |
Stray cattle management remains an issue of every government in the country. The majority of the respondents in the present study revealed that stray animals were also contributing to the environmental pollution and at the same time were responsible for disease transmission to the healthy animals. An increase in the population of both food-producing animals and stray animals in cities exacerbates public health hazards like transmission of zoonotic diseases, vector-borne diseases; environmental pollution as well as compromising animal welfare (Singh et al. 2013). Further, Hundal et al. (2005) quoted 9.25% seroprevalence of brucellosis among stray cattle in Ludhiana city, Punjab. So, they can spread the disease to healthy animals. The modernization has brought humans, animals, and the environment nearby and with closeness, many new health issues have emerged both in humans and animals. The results from the present study revealed that the majority of farmers lacked information on zoonotic diseases. The farmers in dairy farming had been handling the dung without any proper precautions as many diseases can be transferred to humans through dung.

**Conclusions**

Overall the study found a low knowledge score of dairy farmers about environmental health. Farmers should be made aware of the role of the dairy sector on eco-health, along with technical knowledge. Environmental friendly technologies should be developed and propagated among farmers. The present study though has the limitation of being focused on one area, does not limit its application at the national level as such conditions are prevailing in the leading and progressive state of Punjab. We recommend an extensive awareness campaign through mass media along with a village-level scientific training program on dairy farming covering environmental safety and other aspects to bridge the knowledge gap. A sustained extension campaign is needed to make farmers aware of the role of dairy farming in environmental pollution, its ameliorating measures, and Eco-Health.

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Dhand NK, Khatkar MS (2014) Evaluating environmental pollution and at the same time were responsible for disease transmission to the healthy animals. An increase in the population of both food-producing animals and stray animals in cities exacerbates public health hazards like transmission of zoonotic diseases, vector-borne diseases; environmental pollution as well as compromising animal welfare (Singh et al. 2013). Further, Hundal et al. (2005) quoted 9.25% seroprevalence of brucellosis among stray cattle in Ludhiana city, Punjab. So, they can spread the disease to healthy animals. The modernization has brought humans, animals, and the environment nearby and with closeness, many new health issues have emerged both in humans and animals. The results from the present study revealed that the majority of farmers lacked information on zoonotic diseases. The farmers in dairy farming had been handling the dung without any proper precautions as many diseases can be transferred to humans through dung.

**Conclusions**

Overall the study found a low knowledge score of dairy farmers about environmental health. Farmers should be made aware of the role of the dairy sector on eco-health, along with technical knowledge. Environmental friendly technologies should be developed and propagated among farmers. The present study though has the limitation of being focused on one area, does not limit its application at the national level as such conditions are prevailing in the leading and progressive state of Punjab. We recommend an extensive awareness campaign through mass media along with a village-level scientific training program on dairy farming covering environmental safety and other aspects to bridge the knowledge gap. A sustained extension campaign is needed to make farmers aware of the role of dairy farming in environmental pollution, its ameliorating measures, and Eco-Health.

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