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Socio-Behavioural Attributes Regarding Detection of Milk Adulteration in Barnala District of Punjab

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ABSTRACT

The study was undertaken in Dhaner village of Barnala district of Punjab in which beneficiary farmers were selected for investigating their socio-behavioural attributes regarding detection of milk adulteration. The results elucidated that the mean age of farmers was 44.16 yrs, majority of the farmers were functionally literate whereby able to read and write Punjabi, had both agriculture and dairying as their occupation with mean land holding of 2.75 ha and herd size of 5.16 animals. Majority of farmers were having high level of perception and medium level of knowledge regarding detection of milk adulteration. There was a wide range of constraints which were analyzed using Garrett's Ranking Technique. Relational analysis suggested that perception varied significantly ($p<0.05$) with experience in dairy farming, herd size and per animal milk production. In case of knowledge, significant relationship ($p<0.05$) was established between age, education, experience in dairy farming, herd size and per animal milk production. The study concluded that detection of milk adulteration is not only vital for consumers but for producers as well for quality assurance. For building capacities of the farmers regarding detection of adulteration, multifarious extension activities may be carried out.

Key Words: Adulteration, Dairy, Detection, Farmer, Socio-behaviour.

INTRODUCTION

Detection of milk adulteration is influenced by socio-behavioural attributes that shape the perceptions, knowledge, and practices toward identifying and addressing the issue. These attributes involve social, cultural, economic, and psychological factors that affect awareness and action regarding milk adulteration. Many people, especially in rural or economically disadvantaged areas, may lack awareness about milk adulteration and its health risks. Higher awareness levels are often found in urban populations, who may have better access to information. Individuals may not know simple detection methods, such as using lactometer or household tests (Das *et al,* 2016). Education on these tests significantly impacts the ability to detect adulteration. People with high income and education may be more inclined to purchase branded milk products that are perceived to be safer and may also invest in testing kits or equipment. The intention to test milk for adulteration depends on the perceived ease and importance of testing (Kumari *et al,* 2020). In this study, the socio-behavioural attributes of the respondents regarding detection of milk adulteration have been investigated to understand their perception, knowledge and constraints regarding detection of milk adulteration.

MATERIALS AND METHODS

An *ex-post facto* research design was used to investigate the various socio-personal attributes of the respondents regarding detection of milk adulteration. A village namely Dhaner from Barnala district of Punjab was selected as the interventions related with value addition of milk was undertaken only in the said village. The random sampling method was used to select a total of 30 respondents which were investigated for the various socio-behavioural attributes like age, education, occupation, land holding, experience in dairying, perception, knowledge and constraints faced by them regarding detection of milk

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Table 1. Distribution of respondents according to age, education and occupation.

Sr. No.	Parameter	Frequency (N=30)	Percentage
1.	**Age (Years)**		
	Young 20-40	11	36.67
	Middle 40-60	17	56.67
	Old More than 60	2	6.67
2.	**Education**		
	Illiterate	3	10.00
	Functionally literate	16	53.33
	Primary	5	16.67
	High School	6	20.00
3.	**Occupation**		
	Agriculture only	3	10.00
	Agriculture and dairying	18	60.00
	Dairying only	9	30.00

adulteration. The primary data were collected using a pre-tested semi-structured interview schedule. The data were analyzed using various statistical tests like frequency, percentage, mean, standard error, mean score, etc. The mean score was calculated by the formula used by Singh *et al* (2023) in equation 1.

$$Mean\ Score = \frac{Obtained\ Score}{Total\ Obtainable\ Score}$$

The relationship between the variables was established using correlation and regression. Furthermore, Garett's Ranking Technique was used to rank the felt constraints. The Garrett's Ranking Technique was used in which formula given in equation 2 was used to calculate the percent position

$$Percent\ Position = \frac{100(Rij-0.5)}{Nj}$$

Where,

Rij = Rank given for the i^{th} variable by j^{th} respondents

Nj = Number of variables ranked by j^{th} respondents

Further, subjected to calculation of scores using Garrett Table.

RESULTS AND DISCUSSION

Socio-personal attributes

The results revealed that the mean age of the respondents was 44.16 yrs (Table 1). The majority of the respondents (56.67%) were middle aged followed by 36.67 per cent young and 6.67 per cent old aged respondents. The results were in concurrence with those reported by Singh *et al* (2020a) in which the mean age was found to be 47.78 yrs. Further, the results were in partial concurrence with those reported by Shelly *et al* (2024).

It was found that majority of the respondents (53.33%) were functionally literate which means that they were able to read and write in local language which was Punjabi. Around 20 per cent of the respondents were high school graduates and only 10 per cent were illiterates. It was inferred from the results that the respondents can be made more aware about the detection of milk adulteration by providing them literature in local language. The same fact was reported by Singh *et al* (2024a) wherein it was suggested that education and awareness can lead to accelerated adoption of technologies.

Further, majority of the respondents (60%) were having the combination of agriculture and

Table 2. Distribution of respondents according to type and size of family.

Sr. No.	Parameter	Frequency (N=30)	Percentage
1.	**Type of family**		
	Joint	5	16.67
	Nuclear	25	83.33
2.	**Size of family**		
	Small (2-4 members)	10	33.33
	Medium (5-7 members)	16	53.33
	Large (7-10 members)	4	13.33
	Mean±SE, 5.40±0.29		
3.	**Landholding** (in ha)		
	Landless, Nil	10	33.33
	Marginal, <1	10	33.33
	Small, 1-2	9	30.00
	Semi-medium, 2-4	0	0.00
	Medium, 4-10	1	3.33
	Large, >10	0	0.00
	Mean±SE, 2.75±0.13		

Table 3. Distribution of respondents according to experience in dairy farming

Sr. No.	Experience in dairy farming	Years	Frequency (N=30)	Percentage
1.	Low	0-7	2	6.67
2.	Medium	8-14	8	26.67
3.	High	15-21	20	66.67
4.	Mean±SE	15.00±0.98		

Table 4. Distribution of respondents according to herd size.

Sr. No.	Parameter	Number of animals	Frequency (N=30)	Percentage
A.	**Herd size**			
	Small	0-4	13	43.33
	Medium	5-8	16	53.33
	Large	9-12	1	3.33
	Mean±SE	5.16±0.43		
B.	**In-milk animals**			
	Low	0-1	10	33.33
	Medium	2-3	18	60.00
	High	3-6	2	6.67
	Mean±SE	2.00±0.17		

dairying as their primary occupation. This combination was common in many agrarian states of the country as livestock provides daily income to the farmers and supports the rural economy and the results were in line with those reported by Singh *et al* (2020a) and Joshi *et al* (2022).

Table 5. Milk related statistics

Sr. No.	Parameter	Mean±SE (l)
1.	Milk produced per animal /day	8.80±0.42
2.	Milk produced on farm /day	17.70±0.67
3.	Milk produced per animal /lactation	2684.00±130.30
4.	Milk sold /day	14.06±1.34
5.	Milk retained /day	3.33±0.15
6.	Annual income /farm from sale of milk (in Rs.)	205373±19673

Table 6. Distribution of respondents according to their perception regarding detection of milk adulteration.

S.No.	Perception Item	Agree	Neutral	Disagree	OS	MS	Rank
1	The milk adulteration kit is easy to understand and use.	30 (100)	0 (0.00)	0 (0.00)	60	1.00	I
2	Milk adulteration can be checked rapidly using the kit.	30 (100)	0 (0.00)	0 (0.00)	60	1.00	I
3	The reagents in the test kit are easy to store and long - lasting.	30 (100)	0 (0.00)	0 (0.00)	60	1.00	I
4	The awareness camps organized by the Veterinary University, Ludhiana helped in understanding and using milk adulteration kits.	28 (93.33)	2 (6.67)	0 (0.00)	58	0.97	II
5	Milk adulteration is a serious problem during festivals.	27 (90.00)	3 (10.00)	0 (0.00)	57	0.95	III
6	It is easy and economical to test milk adulteration at home.	27 (90.00)	3 (10.00)	0 (0.00)	57	0.95	III
7	The milk available in the market is safe for consumption.	0 (0.00)	30 (100)	0 (0.00)	30	0.50	IV
8	The test kit is easily available.	0 (0.00)	30 (100)	0 (0.00)	30	0.50	IV
9	The test results can be replicated again and again.	2 (6.67)	28 (93.33)	0 (0.00)	28	0.47	V
10	Milk vendors distribute safe and unadulterated milk.	0 (0.00)	22 (73.33)	8 (26.67)	22	0.37	VI

Figures in the parenthesis denotes percentage; OS: Obtained Score; MS: Mean Score

Likewise, majority of the respondents (83.33%) were dwelling in nuclear family which was prevalent type of family structure in the country (Table 2). The mean number of family members in a family in the study area was found to be 5.40. The results revealed that majority of the

respondents (53.33%) had medium size of family with 5 to 7 members which primarily included husband, wife, children and one or both of the parents. The findings were in line with those reported by Singh *et al* (2018a) and Singh *et al* (2024a).

The perusal of land holding of the respondents revealed mean landholding to be 2.75 ha. Around 33.33 percent of respondents were landless and similar number were found to be marginal with land holding of less than one ha. Only 3.33 per cent of the respondents were having medium size of land holding (Table 2). The findings were in line with those reported by Singh *et al* (2020a) and Shelly *et al* (2024).

The study was conducted regarding milk adulteration and the experience in dairy farming was also taken as a variable. After analysis, it was found that the mean experience of the respondents was 15 years and majority of the respondents (66.67%) were having high level of experience of more than 15 years in dairy farming (Table 3). This may be due to the fact that in rural set-ups agriculture and dairy farming are still the age-old occupations and the herd owned by a family is transcended from one generation to another.

As far as herd size of the respondents was concerned, the mean was calculated to 5.16 animals (Table 4). Majority of the respondents (53.33%) were having medium level of herd size. Reduction in number of farm families rearing livestock and number of livestock heads in rural areas of Punjab is a matter of concern.

In-milk animals refer to the dairy animals which were giving milk during the investigation. The perusal of Table 4 revealed that the majority of the respondents (60.00%) were having 2 to 3 animals in milk. However, the mean number of in-milk animals in the study area were calculated to 2.00. The data were collected for milk production attributes as well and presented in Table 5. The means of production attributes were calculated and was found that the average milk produced per animal per day in the study area was 8.80 l. The average milk produced on one farm per day was 17.70 l. In one lactation cycle of 305 d, the average milk produced per animal was 2684 l. The respondents reportedly sold 14.06 l of milk per day whereas around 3.33 l of milk was retained per farm family. The annual income per farm family from sale of milk was Rs. 205373/-. The milk related statistics are in line with those reported by Singh *et al* (2024b), wherein the income of the dairy farmers was calculated taking into consideration the milk production by the animals and the mean income of the small dairy farmers were calculated to be around Rs. 2.75 lakh.

Behavioural attributes

Perception regarding detection of milk adulteration

The respondents were asked regarding their perception on detection of milk adulteration and found that all the respondents agreed to the fact that milk adulteration kit was easy to use, adulteration can be checked rapidly using the kit and reagents in the kits were easy to store and long lasting. These perception items were ranked I with Mean Score (MS) of 1.00 (Table 6). All the respondents were having neutral perception for the fact that milk available in the market was safe for consumption and test kit was easily available. The MS for both the items was 0.50. Further, among all the perception items, lowest perception was calculated for the fact that milk vendors distribute safe and unadulterated milk.

The level of perception was also calculated for the respondents and results revealed that majority of the respondents (60%) were having level of perception regarding detection of milk adulteration, followed by 30 percent with low and 10 percent with high perception. Perception is one behavioural attribute which gives the reflection about an individual. Perception form opinion and opinion leads to acceptance of a technology (Singh *et al,* 2023), therefore, an agreeing perception for any technology gives an indication about its acceptance which in the present case is milk adulteration kit.

Table 7. Distribution of respondents according to their knowledge regarding detection of milk adulteration

S.No.	Knowledge Item	Obtained Score	Mean Score
1	Hydrogen peroxide is permitted as a preservative in milk.	0	0.00
2	How many drops of reagent are added to the milk sample to be tested for starch?	0	0.00
3	Adulterated milk can be checked by smell and appearance.	8	0.27
4	Stripes can be used to test milk adulteration.	26	0.87
5	Name the colour obtained if milk is adulterated with urea?	27	0.90
6	Sugar upon confirmation gives a yellow colour in the milk.	27	0.90
7	Name the colour obtained if milk is adulterated with starch?	28	0.93
8	Whether heating of milk is required for starch or not?	28	0.93
9	What are the sources of starch contaminants in milk from a household?	30	1.00
10	Name two commonly used milk adulterants?	30	1.00

Knowledge regarding detection of milk adulteration

An analysis regarding knowledge on milk adulteration was done and Mean Score (MS) was calculated for the knowledge items, the results of which are presented in Table 7. Items with high MS signifies high correct responses for that knowledge item. A MS of 1.00 was calculated for two commonly used milk adulterants and sources of starch contaminants in milk, which means that all the respondents correctly replied to this knowledge item. However, zero MS was calculated for knowledge item on hydrogen peroxide as preservative in milk and drops of reagent added to the milk for testing starch which means that none of the respondents replied these items correctly.

The overall knowledge regarding milk adulteration was calculated and it was found that majority of the respondents (70%) were having medium level of knowledge followed by 23.33 percent with high knowledge and 6.67 percent with low level of knowledge. The results obtained was found to be good as the Farmer FIRST Project was being implemented in the said village since 2016 and respondents visited the camps and trainings organized. Moreover, Shelly *et al* (2024) has commented that trainings play a vital role in augmenting the knowledge of the beneficiaries. Further supplemented by studies by Kumari *et al* (2020) and Brar *et al* (2021). Induja *et al* (2024) has reported that the lack of information on value addition of milk is also one of the felt constraint when milk processing is considered.

Constraints regarding detection of milk adulteration

For analyzing the constraints perceived by the respondents regarding detection of milk adulteration, around 10 constraints were documented and analyzed, for which the results are presented in Table 8. The Garrett Analysis was done for better understanding of the perceived constraints. It was found that limited shelf life of kits with Garrett Mean Score (GMS) of 75.20 was highly perceived constraint followed by detection of few adulterants by the test kits, unavailability of other testing material like stripes, difficulty in interpretation, lengthy test procedures, inability of test kits to detect adulteration in milk products, difficulty in obtaining test kits, difficulty in using test kits, cost of the kit and less number of trainings and literature on milk adulteration. In general, the

Table 8. Constraints faced by the respondents regarding detection of milk adulteration

S.No.	Constraint	TGS	GMS	Garrett Rank
1.	Limited shelf life of kits.	2256	75.20	I
2.	Test kits detect very few adulterants.	1923	64.10	II
3.	Unavailability of other testing material like stripes	1873	62.43	III
4.	Tests are difficult to interpret.	1632	54.40	IV
5.	Test procedures are lengthy.	1570	52.33	V
6.	Test kits do not detect adulteration in milk products.	1514	50.47	VI
7.	The test kit is not easily accessible.	1206	40.20	VII
8.	A test kit is difficult to use.	1134	37.80	VIII
9.	The test kit is costly.	933	31.10	IX
10.	Less trainings and literature on milk adulteration	540	18.00	X

TGS: Total Garrett Score; GMS: Garrett Mean Score

detection of milk adulteration in itself is a constraint due to unavailability of test kits as reported by Singh *et al* (2018b).

Relational analysis

As the current study was based on the perception of the respondents, a relational analysis was made between the dependent and independent variables presented in Table 9. It was found that all the independent variables viz. age, education, type of family, size of family, land holding, experience in dairy farming and herd size except per animal milk production was having positive correlation with the dependent variable i.e. perception regarding milk adulteration. Experience in dairy farming, herd size and per animal milk production were having significant correlation and regression with the dependent variable. The herd size is positively regressing on perception which means that if the herd size increases by 0.083 units, the perception regarding milk adulteration becomes more favourable and increases by one unit.

The relationship analysis was also calculated between independent variables and knowledge regarding detection of milk adulteration (Table 9). A positive correlation was found between all the variables and perception. A significant correlation was found between age, experience in dairy farming, herd size and per animal milk production. A highly significant correlation was found between education and knowledge. The regression for all the variables on perception was found to be positive. Education, experience in dairy farming and per animal milk production was found to be significantly regressing on perception regarding milk adulteration. The results revealed that increase in education by 0.220, experience in dairy farming by 0.407 and per animal milk production by 0.242 units increases perception by one unit.

CONCLUSION

Socio-behavioural factors significantly influence the detection of milk adulteration. Addressing these attributes through education, awareness programs, community initiatives, and providing affordable detection tools can enhance public engagement and empower consumers to take active steps in ensuring milk safety. Moreover, the detection of adulteration is not only important for consumers but also for the producers to meet up the quality requirements. Although the respondents in the study area were sensitized and trained for detection of milk adulteration using

Table 9. Relational analysis of dependent and independent variables

Parameter	Perception		Knowledge	
Independent variable	r	B	r	B
Age	0.043	0.012	0.330*	0.031
Education	0.024	0.026	0.374**	0.220*
Type of family	0.098	0.090	0.098	-0.235
Size of family	0.065	0.196	0.059	-0.258
Land holding	0.150	0.086	0.158	0.212
Experience in dairy farming	0.205*	0.033*	0.211*	0.407*
Herd size	0.309*	0.083*	0.386*	0.065
Per animal milk production	-0.183*	-0.182**	0.242*	0.294*

**Significant at 5% level of significance;*
*** significant at 1% level of significance; r: Correlation coefficient; B: Regression coefficient*

adulteration kit developed by Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana, Punjab, there is need to replicate the same model to other villages of the region as well, through multifarious extension activities.

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