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Economic Impact of Mastitis in Dairy Cows: Case Study of Tehran Province, Iran

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Abstract

Objective- Mastitis is the most important and costly health disorder in dairy farms around the world. The aim of this study is to estimate the economic impact of mastitis in dairy herds in Tehran province.
Design- Data triangulation.
Procedures- Data of this study were gathered using a questioner which was collected by 135 farmers in Tehran province together with 25 faculty members and DVSc graduations of the faculty of veterinary medicine of university of Tehran. Using former studies, the imposed costs of mastitis were included as milk disposal, milk decline, cost of veterinarian to exam and treat affected cows, cost of medicine, increase in day open due to mastitis, income due to declining the consumption of food.
Results-The economic damage of mastitis is in average 491.86 dollars will be imposed every year on industrial dairy farms located in Tehran province. The most important components of this damage are milk decline (62.18%), milk loss in 7 days after affection (24.09%) and drug due treatment (6.77%).
Conclusion and Clinical Relevance- Based on the results of this study, mastitis plays an important role on the economy of dairy farms in Iran.
Key Words- Economic impact, Mastitis, Dairy cow, Tehran province.

Introduction

Dairy herd economics is an important factor in decision making by farmers or veterinarians. Lack of knowledge in the role of economics in animal health is an important obstacle in veterinary medicine and farmers. The first goal of economics of animal health is to generate understanding of the costs associated with health disorders (HDs). The next goal of the study performed in animal health economics aims at decision making in the most cost-effective methods to reduce animal diseases. [1, 2]

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Mastitis is one of the most important and costly HD in the dairy herds around the world which has been specified as one of the crucial factors in reproductive disorders. This HD has considerable effects on the husbandry economy; the effects of mastitis on husbandry economy divides into two significant categories: direct effects (death from mastitis, veterinarian and medicinal costs) and indirect effects (decline in milk production, milk protein and milk quality, increase in days open, shortening the life expectancy and increase culling).[3-5]
However, farmers do not always identify mastitis as being costly, or underestimate its cost. Due to the chronic nature of mastitis, economic damage is spreading out over the production period. Moreover, the most important cost factors, such as decreased milk production and increase the risk of culling, are not directly observable. By calculating the costs of mastitis, awareness of the economic losses can be increased. This may lead to an increased motivation of dairy farmers to consider improving udder health in their farms. The understanding of economic aspects of mastitis is crucial for veterinarian and farmers for decision making regard to udder health.[3, 6]

Although the prerequisite for most practical researches in veterinary section is paying attention to the function and importance of the health disorders, unfortunately few studies have been done in this era and has there also been little attention to the rate of quantifying economic damage of this HD. It seems the lack of such studies is a loss in planning and policy making in order to achieve the aim of the country's production section. Despite the importance of mastitis on farm economics in Iran, to the best of our knowledge there is no relevant study in Iran to calculate the economics of this HD in dairy farm. The present study has been tried to find out the estimation of economic damage of mastitis by collecting information from dairy farms in Iran together with the members of boards of trustee in university of Tehran.

Material and Methods

The present study is practical from the point of purpose and a data triangulation study from the point of implementation. Firstly it is necessary to mention we convert Rial to Dollar by using 1Dollar=26706 Rials.
Using former studies [7-8], the imposed costs of HD were included as below:

- The cost of milk disposal during cure (7 days),
- The cost of milk decline in the months after cure (5 months after recovering from the disease is examined as the time to decline milk),
- The cost of the veterinarian to examine and treat affected cow,
- The cost spent for the medicine during the treatment (7 days),
- Declining the consumption of the ill cow's feeding as a piece of income for the production unit,
- In order to estimate the costs of the HD more accurately, the economic damage leading from the increase of open days were also considered. According to studies done by Bahonar et al. [9] it was perceived that coping with mastitis, open days will increase to 11 days. Supposing these 11 days lead to obtain the benefits from the sale of the calf, on the base of bank interest, this case will be counted as 1.35 dollars.

In order to study the economic cost in the production life of a cow it was supposed that this period is eight parity, hence the achieved information were modeled for eight parity; with this supposition the cow will get mastitis every year. First, on the base of statistics made by central bank, the average rate of costs (milk, medicine, veterinarians, workers and food) in last 10 years were collected and the counted inputs were modeled for the next eight years. Declining evaluation methods for plans were applied so as to evaluate the rate of damage method is based on the present pure benefit value method. In this method all incomes and disease costs change into their value in the present time by using a discounting rate. Then the total sum of costs of the plan is subtracted from the total sum of the incomes. In this way, the rate of disease damage will be counted. The equation is as follows: [5, 10]

$$NPV = \sum_{t=0}^{n} \frac{R_t}{(1+i)^t} - \sum_{t=0}^{n} \frac{C_t}{(1+i)^t}$$

In this equation C_t is the cost of mastitis in the year t, R_t is the income from the decline of cow feeding which has mastitis in the year t and I is the rate of discount.
In order to estimate 5 rates of considered costs a questionnaire was used which was collected by farmers of Tehran province together with the faculty members and DVSc graduations of the faculty of veterinary medicine of university of Tehran. Dairy farms were divided into four sections according to the number of cows kept there: the farms with less than 50 cows, the farms with cows between 50 to 100, the farms with 100 to 200 cows and lastly the farms over 200 cows. After that on the base of sample size coordinated with the number of cows, the considered sample from each section was selected using stratified sampling. Using Cochrane sample size, the considered sample size was estimated 135 dairy herds. On this basis, 20 farms from stratum one, 45 ones from stratum two, 58 ones from stratum three and 12 ones from stratum four were recruited, in which 135 dairy farm in Tehran province were chosen randomly based on veterinary office registry information. These dairy herds were chosen in order to study the considered costs in this era from this HD from January 2013 to June 2014.
By referring to the faculty members and DVSc students of the faculty of veterinary medicine of university of Tehran, 25 ones of them were selected and the required data were collected.
In this study, the present data were collected supposing the treatment period is 7 days, the whole of produced milk be thrown away from the dairy farm and on the average 20-30 percent of the cow's milk decline be observed.
For analysis of data and modeling Microsoft Office Excel (2010) and SPSS (version 16) were used.

Results

According to table 1, the minimum cost from the thrown away milk during 7 days in the HD period on the base of the achieved statistics is 14.97 dollars and the maximum is 149.77 dollars in which the average cost for the farmer is 109.01 dollars; showing the rather high share of this cost in the farm.

Table 1- Minimum, maximum, mean and standard deviation (Std) of different items related to economic damage of mastitis in dairy herds of Tehran province

Statistics Variable	Min	Max	Mean	Std
The cost of milk loss	14.97	149.77	109.01	32.46
The cost of milk decline	44.93	281.29	224.66	36.81
Drug cost (Cost drug, in $ per mastitis case)	26.21	41.18	33.37	5.77
Veterinarian cost (Veterinary cost in $ per cow and year)	0	56.16	27.28	18.73
Cost labor (Labor cost in $ per cow and year)	1.87	13.1	43.41	4.747
Income from the reduction in feed consumption	9.36	14.97	12.24	2.37

The other effect which is from mastitis is decline of cow's milk in five months after recovering which can continues to more months, but have supposing the milking period of a cow in 10 months; we studied five months after recovery as time period for the decline of the milk. According to the achieved data, the minimum and maximum damage from the decline of the milk during 5 months after recovery are 44.93 dollars and 281.29 dollars in order in which the farmer on the average in 5 months after recovery from mastitis has 224.66 dollars loss due to milk decline.

In this study, treatment period for the cow in average and based on the achieved data was considered in seven days, in which the lowest rate of cost for treatment was 26.21 dollars, and the highest rate was 41.18 dollars and the average cost for seven days was 33.37 dollars.

The minimum cost which was paid for the veterinarian so as to examine the cow with mastitis during the treatment was zero for the farmers who do not refer to the veterinarian in the time the cow is afflicted to mastitis and maximum was 36.16 dollars and on the average approximately 27.28 dollars must be paid to the veterinarian to treat mastitis in an afflicted cow.

The workers' costs are applied to ones which are spent on looking after the sick cow, continual rising the cow, current disinfecting teats and also giving medicine by the worker. The minimum cost for the worker was 1.87 dollars and the maximum was 9.41 which were 5.96 dollars in average for a worker during treatment.

Another effect of mastitis is the decline of cow's feeding during the disease which is not considered as an economic damage for the farmer, but it is a sort of income, in which the minimum and maximum of income from the decline of feeding were 9.36 dollars and 14.97 dollars in order which is in average 12.24 dollars.

The proportion of economic damage in table 1 obviously illustrates that more than 86 percent of the cost is related to the decline and removing milk of which the considerable point is the 62 percent rate of milk decline in the months after the recovery of mastitis.

On the base of average costs and the income achieved from consuming the foods given for eight future years for mastitis were modeled and its results were reported in table 2.

Table 2- The present value of the costs resulting from mastitis in dairy farms of Tehran province during next 8 years in dollars

Discount rate	The extent of the damage is caused by mastitis disease over the course of 8 years	The extent of the damage is caused by mastitis disease per cow in year
%5	7088.26	886.03
%20	3934.93	491.86
%25	3505.98	438.24
%30	2925.92	365.74

According to the collected data from central bank on the base of the rate of the growth of cost related to the decline of milk, the omission of milk, medicine, veterinarian, worker, feeding and other costs during 10 years, the taken average together with numbers and rates of the first year were used as an index for predicting damage in the next eight years and the results were as follows:

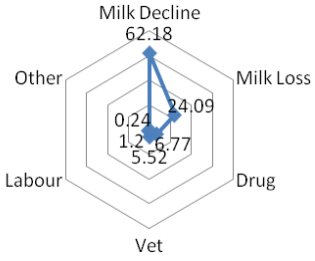
According to the results achieved in table 2, the results from the total economic damage happened from mastitis during 8 years of economical life of a dairy farm for each cow (the cost of feeding has been subtracted) on the base of the considered discount rate has been evaluated throughout sensitive analysis. On the basis 5%, 20%, 25% and 30% discount rate of the damage rate estimated in the table 3 were reported.

Table 3- The economic damage caused by the mastitis in 8 years on the base of various discount

Cost Year	Milk loss	Milk Decline	Drug	Veterinarian	Labor	Feed consumption reduced	Other*	Total cost	Interest rate	Discount rate	Present value
0	109.018	281.29	33.38	27.28	5.96	12.24	1.35	446.05	0.2	1	**446.05**
1	130.45	336.71	39.19	32.00	7.01	14.38	1.49	532.50	0.2	1.2	**443.75**
2	156.22	403.04	46.01	37.53	8.21	16.88	1.63	635.76	0.2	1.44	**441.50**
3	186.98	482.44	54.01	44.03	9.63	19.82	1.80	759.07	0.2	1.73	**439.28**
4	223.80	577.49	63.40	51.64	11.30	23.27	1.98	906.36	0.2	2.07	**437.09**
5	267.90	691.25	74.44	60.58	13.25	27.31	2.18	1082.29	0.2	2.488	**434.95**
6	320.68	827.43	87.39	71.06	15.54	32.07	2.40	1292.44	0.2	2.985	**432.83**
7	383.84	990.43	102.6	83.35	18.23	37.65	2.64	1543.46	0.2	3.583	**430.75**

* The calf, on the base of bank interest

Graph 1 shows the cobweb chart of the contribution of each cost in total economic damage of mastitis. Based on this chart, the most important components of this damage are milk decline (62.18%), milk loss in 7 days after affection (24.09%) and drug due treatment (6.77%).



Graph 1- The cobweb chart of the contribution of each cost in total economic damage of mastitis

Discussion

As the results of this study shows, mastitis plays an important role on the economy of dairy farms in Iran. If we consider 20% discount rate as a rational discount rate for the present economical conditions of the society, about 3934 dollars for each single cow afflicted to mastitis in eight years and in average 491.86 dollars will be imposed every year on industrial dairy farms located in Tehran. In this study, the decline of milk in five months, the thrown away milk, medicine, veterinarian and other costs include 62.18, 24.09, 6.77, 5.52, 1.2 and 0.24 percent, respectively, of the whole damage because of mastitis for each cow.

In various studies a range between 111 to 811 dollars in a year due to mastitis has been reported. In Belottis study in 1991 in Sweden, the cost of clinical mastitis for each cow was estimated 656 dollar.[11] In Miller's study in 1993 in USA the cost from clinical mastitis for each cow was 222 dollars.[12] In Sandgren and Emanuelson's study in 1994 in Sweden the cost from mastitis for each cow was estimated 547 dollars.[13] In Kossaibati and Esselmont's study in 1997 in Britain the cost of mastitis in cows was counted equal to 655 dollars.[14] Swinkels et al. showed in 2006 in Netherland, the damage from sub-clinical mastitis was estimated 181 dollars.[15] Wolfová et al. in 2006 in Czech republic estimated mastitis in each cow 111 dollars.[8] In Bar's study (2007) in Switzerland the average cost for mastitis in cattle was estimated 179 dollars.[16] Bar et al. in 2008 in USA estimated mastitis in each cow 228 dollars.[17]

In this study, damage for the decline and remove of milk in average was approximately 400 dollars. Bar (2008) has reported the damage of estimating the cost of milk decline in different parity and cows.[17] He reported the amount of damage from 3 to 403 dollars in different cows and parity and also reported the average rate of damage in each sick cow as 179 dollars from which the number 72% was the damage related to milk and 28% was related to the treatment of the sick animals. Nelson (2008) has reported the decline of milk resulted from mastitis in Switzerland's dairy farms vary from 100 to 750 liters.[16] He also states that with counting average 85 dollars. For each cow and also considering 350,000 cows in Switzerland to have around 29,705,244 dollars yearly damage for mastitis and has reported a range between 429 to 669 dollars for yearly cost of a sick cow resulting mastitis.

Bar [17] 2008 and Wolfová [8] 2006 believed milk decline in cows afflicted by mastitis is not mostly considered because milk production of other healthy cows compensates the milk decline in the dairy farm. Nelson 2008 warns out that due to the high rate of the cost of milk thrown away, the farmer tend to sell the decayed milk because of mastitis and enter it the community's consumption cycle which can itself put the security of people's health at risk.

Conclusion

According to the importance of mastitis in managing dairy farms and based on the results of this study, there must be suitable solutions and attitudes in making farmers aware and in the next step making an accurate and suitable policy as well as a correct planning so as to decline and control the damage from this health disorder.

References

1. Harman J, Gröhn Y, Erb H, Casella G. Event-time analysis of the effect of season of parturition, parity, and concurrent disease on parturition-to-conception interval in dairy cows. *Am J Vet Res* 1996; 57: 640-645.
2. Stevenson M. Disease incidence in dairy herds in the southern highlands district of New South Wales. *Prev Vet Med* 2000; 43: 11-19.
3. Ansari-Lari M, Abbasi S. Study of reproductive performance and related factors in four dairy herds in Fars province (southern Iran) by Cox proportional-hazard model. *Prev Vet Med* 2008; 85(3-4): 158-165.
4. Nielsen C, Ostergaard S, Emanuelson U, Andersson H, Berglund B, Strandberg E. Economic consequences of mastitis and withdrawal of milk with high somatic cell count in Swedish dairy herds. *Animal.* 2010;4(10):1758-1770.
5. Nitzan J, Bichler S. Capital as Power. A Study of Order and Creorder., RIPE Series in Global Political Economy, New York and London: Routledge 2009.
6. Dohoo I, Martin Ian S. Disease production and culling in Holstein-Friesian cows II. Age season and sire effects. *Prev Vet Med* 1984; 2(5): 655-670.
7. Henri S, Chiristine F, Francois B. Production effects related to mastitis and mastitis economics in dairy cattle herds. *Vet Res* 2003; 34: 475-491.
8. Wolfová M, Štípkov M, Wolf J. Incidence and economics of clinical mastitis in five Holstein herds in the Czech Republic. *Prev Vet Med* 2006; 77(1): p. 48-64.
9. Bahonar A. Factors Affecting Days Open in Holstein Dairy Cattle in Khorasan Razavi Province, Iran; A Cox Proportional Hazard Model. *J Anim Vet Adv* 2009; 8(4): 747-754.
10. Bichler S, Nitzan J. Systemic Fear, Modern Finance and the Future of Capitalism, *Jerusalem and Montreal* 2010: 8–11.
11. Belotti C. economic evaluation of disease in Swedish. SLU/info economy 5 Swedish University of Agricultural Sciences, Uppsala 1991.
12. Miller GY, Bartlett PC, Lance SE, et al. Costs of Clinical Mastitis and Mastitis Prevention in Dairy Herds. *J Am Vet Med Assoc* 1993; 202(8), 1230-1236.
13. Sandgren C, Emanuelson U. Ekonomiskt effektiv mjölkproduktion hög mjölkmängd ocheller god hälsa. *Memo Swedish Dairy Association* 1994.
14. Kossaibati MA, Esslemont RJ. The Costs of Production Diseases in Dairy Herdsin England. *Vet J* 1997; 154(1): 41-51.
15. Swinkels JM, Hogeveen H, Zadoks RN. A Partial Budget Model to Estimate Economic Benefits of Lactational Treatment of Subclinical Staphylococcus aureusmastitis. *J Dairy Sci* 2005; 88(12): 4273-4287.
16. Bar D, Tauer LW, Bennett G, González RN, Hertl JA, Schukken YH, Schulte HF, Welcome FL, Gröhn YT. The cost of generic clinical mastitis in dairy cows as estimated by using dynamic programming. J Dairy Sci. 2008 Jun;91(6):2205-14.
17. Bar D, Gröhn YT, Bennett G, Gonzalez RN, et al. Effects of Repeated Episodes of Generic Clinical Mastitis on Mortality and Culling in Dairy Cows. *J Dairy Sci* 2008; 91(6): 2196-2204.

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چکیده

ارزیابی اقتصادی ورم پستان در گاوداری‌های شیری استان تهران: مطالعه موردی استان تهران، ایران

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هدف- ورم پستان مهم‌ترین و اقتصادی‌ترین بیماری در گاوداری‌های شیری در سراسر دنیا است. هدف این مطالعه ارزیابی اثر اقتصادی ورم پستان در گاوداری‌های شیری استان تهران است.

طرح- تلفیق داده‌ها

روش‌کار- داده‌های این مطالعه با استفاده از پرسش‌نامه‌ای که توسط ۱۳۵ گاودار استان تهران و ۲۵ عضو هیات علمی و دانشجوی دکتری تخصصی دانشکده دامپزشکی دانشگاه تهران جمع‌آوری گردیدند. با استفاده از مطالعات قبلی، اثر ورم پستان شامل دور ریختن شیر، کاهش تولید شیر، هزینه دامپزشک برای معاینه و درمان دام‌های بیمار، هزینه دارو، افزایش روزهای باز ناشی از ورم پستان، درآمد ناشی از کاهش خوراک دام.

نتایج- ضرر اقتصادی ناشی از ورم پستان به‌طور متوسط ۴۹۱/۸۶ دلار برای هر دام مبتلا در هر سال برآورد گردید. مهم‌ترین فاکتورهای تاثیرگذار این اثر اقتصادی به ترتیب عبارتند از: کاهش تولید شیر (۶۲/۱۸٪)، دور ریختن شیر ۷ روز پس از ابتلا (۲۴/۰۹٪) و داور برای درمان دام‌های بیمار (۶/۷۷٪).

نتیجه‌گیری و کاربرد بالینی- بر اساس نتایج این مطالعه، ورم پستان نقش اساسی در اقتصاد گاوداری‌های شیری در ایران ایفا می‌کند.

کلمات کلیدی- اثر اقتصادی، ورم پستان، گاو شیری، استان تهران.