O 10. STRUCTURAL FEATURES OF THE SHELTER SYSTEM WITH ROBOTIC MILKING SHELTER SYSTEM AND PARALLEL MILKING UNIT SHELTER SYSTEM AND THEIR COMPARISON IN TERMS OF ANIMAL WELFARE

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ABSTRACT: Robotic systems have been successfully used instead of human labor in many areas with the development of modern technology. One of the major problems encountered in the livestock sector in recent years is the demand for qualified human labor. In dairy cattle breeding, this need is further increased, especially in regular and hygienic practices of milking. For this reason, Robotic milking systems have been used in the livestock sector in recent years. However, the advantages and disadvantages of the system have not been evaluated. In this study, dairy cattle enterprises with robotic milking system and parallel milking system were compared in terms of animal welfare and breeding characteristics. For this purpose, the farm, which has 20 robotic milking systems with a 1000 head milk cow capacity in Konya Region and farm farms with 12 * 2 parallel system milking units having 1000 cow milk capacity were examined as material. In the study, the general characteristics, technical characteristics, farming system, efficiency parameters of animals were examined and compared in terms of animal welfare. As a result of the study, it was determined that the use of robotic systems largely eliminated the dependence on the labor force. Animal welfare has increased since it provides animals with the time and number of milking they want during the day. In addition, increased milk quality and yield was observed in robotic milking system compared to other systems. In spite of this, not planning the open navigation courtyard in the shelters where robotic milking system is used in the world and in Türkiye is undesirable and needs to be solved in terms of animal welfare.

Keywords: Free-standing dairy cattle shelters, structural properties of shelters

1. INTRODUCTION

In order to ensure a healthy and balanced diet, it is of great importance and benefit to have animal foods in their daily foods. In animal foods, meat and milk are the most important products (Uğurlu and Uzal, 2004). Dairy cattle farming is an important sector in Türkiye has contributed to the development of the country (Boz, 2013).

Konya in Türkiye has great importance in animal breeding. Availability of suitable pasture and forage crop production areas in Konya animal breeding, existence of land of appropriate size for animal husbandry the lack of processing and marketing difficulties provides an advantage for the sector.

Today, technology has become an indispensable part of our lives. One of them is robotic systems used in dairy cattle breeding. Use of robotic systems in dairy cattle; decrease in milking time, increase in milk yield and quality, gain from the labor force, it makes the animals quieter and more docile and provides more effective control of the animals (Van't Land et al. 2000; Helgren and Reinemann 2003; Alıç and Yener 2006; Demir and Öztürk, 2010).

In our researches on this subject for years, one of the major problems encountered in the livestock sector is the need for qualified human labor. Robotic systems are used to meet the demand for this workforce. Use of robots in animal breeding, especially the use of milking robots is increasing rapidly.

Konya, 921,572 head of cattle and cattle Türkiye (17,220,903) having 04.05% (Tüik, 2018). Sheep, with goats and dairy cattle being Konya Türkiye constitutes the health share of 13.90% (Tüik, 2018). Türkiye 6.8% of the total milk production is achieved from Konya. Konya to meet milk consumption Türkiye takes first place in the last five years (Anonymous, 2019 a).

The aim of animal breeding; high level of productivity and to make a profitable livestock. This situation, it is possible by increasing the yield per animal (Uzal, 2008). Increasing the animal yield, it will be possible to prepare a more suitable ration program for high-yielding animals and to improve the hosting factors of the animals in addition to proper nutrition. Improving the hosting factors of these is extremely important (Mundan et al., 2018).

Livestock enterprises; structures and facilities, tools and equipment, live animals that make up herd projection, including caregiver and manager the personnel consists of four main elements (Mundan et al., 2018). Animal shelters, it is designed to eliminate stress factors in animal welfare as well as animal welfare. Stress factors are examined under four groups; climatic, structural, social and other factors (dust, noise etc.) (Uğurlu and Uzal, 2004).

Open shelters with free stops, it is a shelter system where cows are allowed to move freely. It is known that animals are not affected much by cold climatic conditions (Mundan et al., 2018). Determination of suitable shelter type for animal comfort in the shelter, the natural behavioral characteristics of the animal (movement, lying, ruminating, eating and drinking, etc.), determination of the dimensions of all criteria within the shelter to ensure animal health, optimum conditions are necessary for the execution of daily tasks such as irrigation, feeding, milking and fertilizer cleaning. Keeling and Jensen (2002), animal welfare 'adaptability to the environment in which they live' definition of, they are one of the most accepted approaches today (Uzal, 2008).

The purpose of the free stops; comfortable to cattle, to provide a clean and dry individual rest area (Bewley, 2010). Cows should be able to get in and out of the stalls easily and be able to lie down without any hindrance (Bickert, 2000). Well-designed and regularly maintained free station reduce standing time, improves ruminating efficiency, makes cattle and stations cleaner, minimizes injuries (Graves et. al., 2009).

Dairy cattle barns were built in Türkiye, in different climatic zones, different climatic conditions of each region, new models should be developed according to their structural and technical characteristics and larger scale studies should be carried out (Uzal, 2008).

During the planning of animal shelters, the level of mechanization should be determined and dimensioned very well considering the current situation. In dairy cattle farms, the percentages of the workforce used in various jobs vary depending on the type of shelter and the level of automation applied. The approximate labor force required in dairy cattle 50% to obtain milk, 25% clean fertilizer, 15% feeding and 10% is used for other animals (Claesson, 1977; Mutaf ve Sönmez, 1984; Ayık, 1985). As the mechanization level increases, the share of labor used to obtain milk increases in the total labor force, whereas feeding, fertilizer cleaning etc. the percentage shares of jobs are decreasing (Alkan, 2015).

Operating capacity in large shelters, the use of conventional milking systems is not very effective. In these systems, in addition to the availability of fast and inefficient equipment, milking takes a lot of time despite the low cost (Steevens, 1992). Robotic milking system technology, it allows more cattle to be milked per unit time without much labour (Alıç and Yener, 2006).

Robotic systems, which have started to be used in recent years, have been developed in terms of both animal welfare and milking processes in dairy cattle breeding, it is seen that the demand for hygienic and qualified labour force is met.

This work, general characteristics of robotic milking shelter system and shelter system with parallel milking unit managed in Konya region as two different enterprises within the same enterprise management, technical specifications, aquaculture system and yield parameters evaluation in terms of for the purpose. In addition, the proposed systems were evaluated in terms of animal welfare and productivity and solutions were proposed to the problems.

2. MATERIAL METHOD

This work, 2018-2019 yılları arasında Konya'da faaliyet gösteren Laranda Tarım ve Hayvancılık İşletmesinde yapıldı. Laranda Agriculture Plant which first applied robotic milking system in Konya Region, it was established in 2012 and has been using the robotic milking system since 2018.

The study area was established on an area of 11.000 da and the total area covered by roads and buildings is 25.050 m^2. Operating, one free-standing shelter where one robotic milking system is applied, two parallel milking free-standing milk cattle shelter and one calf shelter, one young animal shelter, infirmary and administrative buildings it is formed.

In research Planning principles of Robotic milking shelter system and parallel milking unit shelter system in Laranda Agriculture and Livestock Enterprise and animal welfare in terms of assessment was carried out. The shelter planning system examined, building type and milking system has different features.

The study was conducted, shelter systems operate in the form of two different enterprises where the same management practices are carried out within a single enterprise. The milk produced in both milking systems is collected in different tanks and sold without mixing. The quality characteristics of the milk differ.

In order to identify the structures within the enterprise to determine the current situation in the selected enterprises measurement sketch, observation and photo shootings were performed. Use of labour force in the enterprise, animal welfare, adaptation of animals to the system, information on increase in milk quality and yield it was obtained. General characteristics of shelter systems in the enterprise, technical specifications, aquaculture system, planning parameters by examining yield parameters and animal welfare in terms of Noton (1982), Ekmekyapar (1991), Olgun (2011), Uzal Seyfi (2013 a), Uzal Seyfi (2013 b) from evaluated using. In addition, in dairy cattle breeding of enterprises, especially milking operations are carried out in comparison with regular and hygienic execution.

3. RESEARCH RESULTS AND DISCUSSION

The characteristics of robotic milking and parallel milking unit shelter systems examined in the study are determined and given in Table 1.

Table 1. Characteristics of Shelters Using Different Milking Systems

	Systems used	
Features	**Robotic Milking Shelter**	**Parallel Milking Shelter**
Total Area of Business	5.500 da	5.500 da
Area Covered by Roads and Buildings	21.000 m2	4050 m2
Production time	1.5 yıl	4 yıl
Shelter Type	Free Standing (Folding screen)	Free Standing (with backyard)
Business Capacity	1500 animal	400 animal
Number of Milking Cows	433	427
Shelter Dimensions (width x length x ridge height)	55 x 370 x 1500 cm	27 x 150 x 1000 cm
Side Wall Height	120 cm	170cm
Stop Dimensions (width x length x height)	120 x 190 x 125 cm	120 x 190 x 125 cm
Rest area placement frequency	2,3 m2/animal	2,3 m2/animal
Service Path Width	350 cm	280 cm
Shelter floor	Concrete grid	Concrete grid
Stall floor	Rubber bed on concrete	Rubber bed on concrete
Shelter Wall material	Press bricks	Concrete
Roof frame material	Steel	Steel
Roof Tilt Angle	36^0	32^0
Navigation courtyard dimensions and settlement frequency	No navigation yard	18 m x150 m
Frequency of navigation yard placement	No navigation yard	13,5 m2/baş
Backyard courtyard floor	No navigation yard	Cobblestone
Dimensions of the central feed path number	2 piece5 x 350 m	1 piece 5 x 150 m
Feed Path Width	5 m	5 m
Feeding length	50 cm	75 cm
Feed distribution	Fodder distribution trailer	Fodder distribution trailer
Number of feeds (repeat / day)	3 times / day	2 times / day

Drinker length	15 cm/animal	15 cm/animal
Number of milkings (repeat)	2-7 times / day	2 times / day
Milk Quality Values		
Milk yield	28 lt/animal	30 lt/animal
Somatic Cell Number	96.000	120.000
Electrical Conductivity	4	4,5
Other Quality Parameters	Oil:3,94, protein:3,46, YKM:9,09, SH:6,61,	
How many skilled manpower are needed	3	2
Midden	80 cm diameter corrugated pipe is transported to the fertilizer pool	
Dimensions of fertilizer	7,5 m depth x 18 m diameter and 3 m depth x20mx 50m	
Evaluation of Fertilizer	Used in our land as solid-liquid	
Maturation Time of Fertilizer	24-72 hours in composting machine	
Separator	There is	There is

When both milking systems were evaluated in terms of milk quality; somatic cell count of milk obtained by robotic milking 96.000 while in the other system is 120.000. The electrical conductivity of the milk is four in the robot milking system and 4.5 in the other system. Fat and protein ratios are higher than the other system with 3.94 and 3.46. The milk yield was 30 l / animal in the robotic system and 28 l / animal in the other system. (Table 1) When the parameters which are the criteria of milk quality are taken into consideration, it is determined that the robotic milking system produces much better quality milk than the other system.

Main benefits of robotic milking in the enterprise, milk yield increases due to the high frequency of milking, decrease in labour force, no need to have staff working to regulate milking times in the study (Van't Land et al., 2000; Anonymous 2004 b). Milk quality is very important in terms of milk production. Milk pricing systems and consumer requirements, it is quite large and constitutes the basis of milk production (Klungel et al., 2000; Hogeveen et al., 2000a; Justesen and Rasmussen 2000; Pomies and Bony 2000; Van der Vorst and Hogeveen 2000; Rasmussen and Madsen 2000; Billon 2001).

Both shelters because it is a free-stop system animal welfare and farming system, in terms of. In the shelter where the robotic system is applied, no navigation yard was used. As the shelter where the robotic system is used is more suitable for animal welfare, animals can survive without stress. However, integration of the navigation yard into the system animals on natural soil floor and benefit from solar radiation considering will be more advantageous. In the shelter where robotic milking is applied, animals are milked 2-7 times a day. Milking process takes 7-8 minutes. Milking robots allow animals to be milked at any time of the day and in any number of times. Milking process is carried out by 2 people with robots without the need for qualified personnel. It is only checked 2-3 times during the day the system operates regularly. This control requires only half an hour of labour due to the new installation of the system. In the shelter where parallel milking system is used, milking is performed twice a day as 4.00 in the morning and 16.00 in the evening. Parallel milking is also needed, and milking of animals twice a day occurs. Automatic milking nozzle cleaning to prepare for milking, attaching milking heads, it is responsible for controlling milk flow and cow during milking. Reduction of labour force in robotic milking shelter system compared to parallel milking shelter system and working staff per more free time provided. There is no need for robotic milking and the installation and control of milking heads. There is no need for robotic milking and the installation and control of milking heads. As robotic milking is carried out regularly and hygienically both animal health and milk quality in terms of it was found to be more suitable in terms of animal breeding. Robotic milking, increase the milk yield and quality of cows owned by a company improves the quality of life of the owner (Helgren and Reinemann 2003).

Shelter widths are 55m in robotic milking system, length 370m, ridge height 15m and side wall height is 5m. The wall height of the side wall is 120cm press bricks are open. A portable folding screen system is planned to be closed only in cold weather. Building width is 55m, 10 in-line finding free stops, two 5.0m wide central feed paths, service roads are explained by the fact that it is quite wide as 3.50m. Although the building is quite spacious side wall height and ridge height to be as high as 5.0 - 10.0m,

lighthouse roof system and 3.80m of the side wall is open prevents the formation of bad odours in the shelter. Because of these advantages, it is well ventilated compared to other system air of a clean shelter it was determined.

Ventilation in animal shelters, establishing adequate health conditions for animals, increasing production, ensuring proper working conditions, necessary to extend the service life of equipment and buildings (Sallvik and Bartussek 1989). The side wall height of the shelter with robotic milking system is 120 cm and the wall material is press brick. The rest is open. The side wall height is 170 cm in the shelter where the parallel milking system is applied. It provides the animals with healthier and cleaner air and provides quality living opportunities but it is planned not to affect their performance.

In addition, the fact that the building length is 370m in the robotic milking system is due to the longitudinal planning of the system to be managed by robots. Due to ventilation problems, animal shelters are allowed to be planned to be 30-60m long and up to 100m long (Ekmekyapar, 1991; Olgun, 2011).

However, since the planning of the shelter with the robotic system is quite smooth, and since most of the side wall is open, no ventilation problems were encountered. The shelter is made of pressed bricks and has a good aesthetic appearance as well as the advantage of thermal insulation.

Stall dimensions examined in the research were measured the same (120x190x125) in both systems. Olgun (1989 a), The purpose of making a free stop, to create a clean resting place where each cattle can use and sleep without harming themselves and each other. In free stop system; the free stall should be planned to ensure that the cattle are in an appropriate position while lying and standing at the stall (Olgun, 1989 b). The free stall design for dairy cattle; cows entry and exit to the stops, stall and to lift adequate space and appropriate stop surface should be provided (Nordlund and Cook 2003). Noton (1982), free stall width 1.00-1.10 m for cattle greater than 15 months, the length of the stall is 1.90-2.10 m for cattle older than 15 months. Research, stall sizes reserved for animals are in accordance with literature reports.

In both of the studied shelter systems, shelter floor concrete grid, the stall floor was found to be rubber bed material on concrete.

Bickert et al., (1995), as stall base material in free shelters; compacted soil, concrete coating, limestone, brick and insulated rubber surfaces can be used. Dumelow (1995), In his study on dairy cattle, the thin bed material is better, it reports the best performance of a 45 mm thick rubber backing material. The use of rubber is more suitable for animal welfare. Rest time for animals at the stops and considering the comfort of animals it can be said that both shelter systems are advantageous in terms of animal welfare.

Area for animals for shelters in the shelters, the promenade is not planned in the robotic milking shelter and is planned to be planned in the future. In other system navigation courtyard (18x150m) for each animal 13.5m^2 / animal area is falling. It was found out that the parquet flooring of the parquet flooring system in the parallel milking unit system was cobblestone floor.

Uğurlu and Uzal (2004), in the case of navigation yard soil, 24 m^2 area per animal of separation will be appropriate. Ekmekyapar (1999), navigation area requirement for coated floors at least 5.5-6.5m^2 / animal or equal to the rest area, if the possibilities allow 9-10 m^2/animal should be taken as. Our work walked Robotic milking in the shelter there is no navigation courtyard. Parallel milking unit system is applied in shelters per yard and per animal 13,5m^2/animal as the navigation courtyard is separated animals under the optimum conditions of navigation yard is not enough.

Feeding length in robotic milking system 50 cm / animal feeding area whether feeding is done three times a day. Feeding length in parallel milking, another system 75cm / animal feeding area is and twice daily feeding it was determined that the process occurred.

Feeding length is reported to be between 60-80 cm / animal values (Ekmekyapar, 1999). Feeding area, easy transportation, easy to clean, business economics and labour force utilization will be planned to provide (Uzal and Uğurlu, 2007).

Dimensions of fertilizer (20mx50m) the same fertilizer pool is used in both systems and both systems manure as solid-liquid used on their land used in their own land. Since both shelter floors are concrete for the convenience of animals in cleaning the fertilizer providing a clean and healthy environment it is also important for the health of the workers working in the shelter.

As a result, milk quality and increasing animal welfare, with the aim of eliminating labor dependency use of robotic milking systems it has been found to be quite useful. However, robotic milking shelter system design of the navigation yard is an important issue that needs to be meticulously studied.

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