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RESEARCH ARTICLE

The Effects of Factors on Death Rate in the Broiler Farms

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Summary

The objective of this research is to determine the effects of factors on the death rate in the Broiler farms in Mersin province, Turkey. The data of this study is obtained in the 87 Broiler farms in 2012. The chi-square test has been applied to the acquired data. The results have shown that the fewer death rates of animals are observed while the budget for the production period increases. Besides, it is also found out that the enlargement on the field of the management, 7 days long of curtain opening procedure and selection of the chicks regarding average weight as 40 g are among the factors, reducing the death rate of the animals. Moreover, usage of the fully equipped vehicles determined by the EU standards for the transportation of animals, heating the coops and 21 days of relaxation period of the coops would have statically significant effects on the decrease of the death rates. The average death rate has been found as 9.68. With the possibility 7% reducing, the average production increase 508 kg/period for each management.

Keywords: *Broiler farms, Death rate, Chi square test, Mersin*

Broiler İşletmelerinde Ölüm Oranı Üzerine Etkili Olan Faktörler

Özet

Bu çalışma Broiler işletmelerinde, hayvanların ölüm oranını etkileyen üretici ve işletmeye ait faktörlerin belirlenmesi amacıyla yapılmıştır. Çalışmanın verileri 2012 yılında 87 Broiler işletmesinden elde edilmiştir. Elde edilen verilere Ki kare testi uygulanmıştır. Yapılan test sonucunda bir üretim dönemine ayrılan bütçe artıkça kümeslerdeki ölüm oranının azaldığı tespit edilmiştir. Bunun yanı sıra işletmenin alanının genişlemesi, perde açma süresinin yaklaşık 7 gün olması, işletmeye gelen civcivlerde ortalama 40 g ağırlığın tercih edilmesinin de ölüm oranını azalttığı belirlenmiştir. Ayrıca civcivlerin taşınmasında tam donanımlı AB mevzuatına uygun araçların kullanılması, otomatik sobalarla kümesin ısıtılması ve kümes dinlenme sürelerinin en az 21 gün olmasının ölüm oranlarını azaltıcı yönde etki yapacağı tespit edilmiştir. İşletmelerde ortalama ölüm oranı 9.68 olarak bulunmuştur. Bu oran %7'ye düşürüldüğünde işletme başına üretim ortalama 508 kg/dönem artacaktır.

Anahtar sözcükler: *Broiler işletmeleri, Ölüm oranı, Ki-kare testi, Mersin*

INTRODUCTION

All people need protein, carbohydrate, vitamin and mineral, so that they can live a healthy life. Animal originated foods are one of the main elements of the balanced nutrition. People compensate their needs for these foods through meat, milk and egg. Among these proteins, with its high level of nutrition rate and lower rates of fat and cholesterol, and comparing to the red meat its cheapness and easy digestibility, the consumption of chicken meat is increasing regularly. This makes the poultry an important sector among the other meat producing sectors. The poultry is still an important economic activity and a source of food in developing countries [1].

With 35-45 days of production period, intensive producing opportunity in unit area, high rate of transformation of animal feeds into the meat and lower need of workforce comparing to the other agricultural managements, broiler production has a special place in the animal production [2,3].

Besides the advantages mentioned above for the producer, broiler has also several disadvantages. The poorly modernized conditions for chick transportation, inappropriate set up of the coops [4] and the other circumstances of the coop such as temperature, lightning,

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ventilation and noise [5] could be the counted reasons of these disadvantages.

The poultry production in Turkey has begun in 1930 with the establishment of the Ankara Central Poultry Institution. In 1963, the imported hybrid broiler and layer type of chickens, which were kept for breeding, have been delivered to the commercial managements. After the 1980s, poultry production has become a really important sector [6-10], which meets the national demand for the chicken meat. The broiler institutions have tried to enlarge their market shares by modern farms. However, some external factors have affected the sector negatively. For instance, the bird flu also known as influenza or bird plague has quite large negative effects starting with 2005. In the city of Mersin, in which 14.74% (23 million number) of Turkey's yearly broiler poultry production (162 million number) have been supplied, because of the spreading bird influenza there has been detected 20 million of decrease on the production. Later that year, broiler consumption have started to increase slowly again and in 2011 in Turkey 3.40% (5 million number) of the production were performed in Mersin [11]. Not only in the world but also in Turkey, many studies have been carried out to increase the broiler production. The usage of pads on the effectiveness of broiler production [12], poultry place preference and its effects [13], free breeding system and its effects [14], the cost of production [15], the density of the poultry (population) [16], the death incidents during the transportation of the chickens [17,18], the economic analysis of the broiler institutions [19], factors affecting profits of broiler enterprises [20], financial effects of avian influenza [21] and the factors on the performance of the producers have been surveyed [22]. Yet, about the factors for the broiler death rate there has not been any research has been conducted. This study attempts to fill this void by analyzing the effects of factors on the death rate in the broiler farms in Mersin.

MATERIAL and METHODS

The primary findings of the study have been acquired by the questionnaire with the broiler farms in Mersin. The secondary findings have been obtained by the research on the records in the Province Municipality of Mersin.

The number of the questionnaires has been decided with the Proportional Sampling Method. The formula for the finite population there is an example below on the known or estimated rate. On the occasions, on which P is unfamiliar, it would be better to work with the maximum sample volume by approving the P=0.5, so that we can reduce the possible mistake [23,24].

$$n = \frac{N * p * (1-p)}{(N-1) * \sigma_p^2 + p * (1-p)}$$

According to the formula; n: Sample Size, N: Operating number in the population, σ^2_p: Variance of the rate, r: Deviation from the average (10%), p: The rate of the operations to the population.

$$\sigma_p^2 = \frac{0.1}{1.96} = 0.051$$

$$n = \frac{896 * 0.5 * 0.5}{895 * (0.051)^2 + 0.5 * 0.5} = 86.89 \cong 87$$

In this formula the sample consumer for the survey has been determined as 87 with the 95% of confidence parameters (z=1.96) and 10% of average deviation.

Chi Square Test

Chi square test is a nonparametric statistical analyzing method often used in experimental work where the data consist in frequencies or counts as distinct from quantitative data optained from measurement of continuous variables such as age, income, budget, and so on. The most common use of the test is to assess the probability of association or independence of facts. Managements have been divided into 2 by the death rates, which have been decided by the companies as 7% regarding whether they are below or above the death rate. In this study, for the determination of the effects belonging to the producer in broiler farms, the Chi-square test has been applied to the work. Chi-square test is being used for the exact determination between the relations of intermittent variables and also the systematic relations among the frequency based variables, which are pictured on a cross-table. The chi-square test is based mainly on the resolving of the difference between the estimated and observed frequencies regarding if they are expressive or not [25].

RESULTS

The 92% of the broiler producers participating in the questionnaire are male. The age of the participants is varied from 22 to 70 years and the average has been calculated as 45.39. The education years of the participants are varying from 5 to 15 years and the average is 6.16 years. This shows that approximately 72% of the broiler producers have been graduated from only primary school. Averagely, there are 4.03 individuals living in the producer's household and the helping individuals are detected as 1.53. The duration of stay or in other words, aging until the poultry time for the chicks can differ 35 to 45 days. Average cutting age of the chicken is calculated as 42.69 days. The producers have produced from 4 to 7 times a year and the average is 5.53 times. The average income of the producers is conducted as 6979,31 Turkish liras (TL) and their average budgets are 1922,41 TL *(Table 1)*.

In over populated coops, the best capacity for

Table 1. *Descriptive statistics*
Tablo 1. *Tanımlayıcı istatistikler*

Variables	Min.	Max.	$X \pm S_x$
Gender (female:0, male:1)	0	1	0.92±0.27
Age (year)	22	70	45.39±9.79
Education (year)	5	15	6.16±2.22
The number of household members	1	6	4.03±1.07
Household members helping the broiler production	1	3	1.53±0.52
Cutting Age (days)	35	45	42.69±1.08
The number of yearly periods	4	7	5.53±0.59
Income (TL/period)	1.000	20.000	6979.31±4891.74
Budget (TL/period)	250	8.000	1922.41±1704.18
Coop area (m^2)	180	1.600	768.10±377.94
Capacity of the coop (number)	2.000	25.000	11318.39±6154.85
The number of chickens for each m^2	11	17	14.47±1.55
The distance of chick transportation (km)	20	950	349.63±331.09
Species of the chick (Hubbard: 0, Ross: 1)	0	1	0.86±0.35
Curtain opening time (day)	4	11	6.72±2.26
Heating system (Classical stove: 0, Automatic stove:1)	0	1	0.22±0.42
The weight of the chick in the broiler man. (g)	35	43	38.75±1.85
Live chicken weight for cutting (g)	2.000	2.700	2391.72±131.15
Provender transformation rate (FCR)	1.06	2.86	1.67±0.23
Coop relaxation time (day)	10	36	23.57±4.29
Death rate of the management (%)	3	20	9.68±3.60
Preferred death rate by the comp. (%)	5	7	6.76±0.61

preventing the deceleration and increment of the death rates is decided as 14-18 chicken per m^2 in the coop [26]. The average production area of the participants is 768.10 m^2 and the 11318.39 chickens for each farm. The average chicken number for each m^2 is 14.47. The chicks cover 349.63 km distances until they have been brought to the management. In the 86% of the managements is breeding the Ross type and 14% of them is breeding the Hubbard kind of chicks. In order to make the heating easier, the coops have been divided into by the curtains. These curtains have been opened up, when the chicks have grown adequately. The average curtain opening time is calculated as 6.72 days. For the providing the heating in the coops, classical and automatic stoves have been used. The 22% of these managements have chosen the automatic stoves. The average weight of the chicks is 38.75 g and averagely after 43 days of growing up they weigh 2391.72 g and ready to be cut and to be eaten. The coops relaxation period has been described as the time between the cleaning of the units and the interval of the period for each unit. The coops relaxation time could vary between 10 to 36 days and the average calculated is 23.57 days *(Table 1)*. By splitting the average weight of chick until they are ready to be cut and the amount of the provender, the Feeding Change Ratio hereafter FCR is calculated [27,28]. FCR could vary from 1.60 to 1.75 and the average is 1.67. The death rate in the managements is changing from 3% to 20% and the average is 9.68%, on the other hand the wished or desired death rate is 6.36%, also among the other companies around the death rate is limited max 7% *(Table 1)*. With the possibility 7% reducing, the average production increase 508 kg/period for each management.

The socioeconomic and demographic factors of the producers on production have quite a big role for the decreasing of the death rate. The chi-square test results have been shown in the *Table 2*. The budget for one producing period ($P<0.01$), transportation of the chicks to the facility ($P<0.01$), the coop area ($P<0.05$), coop relaxation time ($P<0.05$), curtain opening time ($P<0.05$), the weight of the chicks($P<0.10$), the age of the producer ($P<0.10$), the number of the family members helping the production process ($P<0.10$) and the heating system ($P<0.10$) have been found statically important.

There has been a positive oriented relation between the age of the producer and the death rate. Usually the producer, who are more than 50 years old, do not pay mostly any attention for modernizing the coops and produce through the old classical methods. Just as in the producers under the age of 50 years there has been lower death rate observed. There has been also a negative oriented relation between the helping family members and the

Table 2. *The results of Chi Square Test*
Tablo 2. *Ki kare test sonuçları*

Variables		Death Rate		Chi-square	P-value
		Less than %7	%7 or more		
Age	<50	26.15	73.85	2.803	0.094
	50+	9.09	90.91		
Education	Primary	25.40	74.60	1.710	0.425
	Jun. High	13.33	86.67		
	High school	11.11	88.89		
Household members helping the broiler prod.	No	14.29	85.71	2.714	0.099
	Yes	28.89	71.11		
Income (TL/term)	<5000	14.71	85.29	1.906	0.386
	5000-9500	24.24	75.76		
	10000+	30.00	70.00		
Budget (TL/term)	<1000	5.00	95.00	10.845	0.004
	1000-2500	18.75	81.25		
	3000+	47.37	52.63		
Coop area (m^2)	<550	12.12	87.88	6.340	0.042
	550-1000	21.05	78.95		
	1050+	43.75	56.25		
Heating system	Stove	17.65	82.35	3.206	0.073
	Automatic stove	36.84	63.16		
Coop relaxation period (day)	<21 days	8.82	91.18	5.539	0.019
	21+	30.19	69.81		
Curtain opening time	<6	36.67	63.33	5.928	0.052
	6-9	14.63	85.37		
	10+	12.50	87.50		
The kind of the chicks	Haverd	25.00	75.00	0.081	0.775
	Ross	21.33	78.67		
The average weight of the chicks (g)	<40	15.09	84.91	3.614	0.057
	40+	32.35	67.65		
The transportation distance of the chicks (km)	<70	11.11	88.89	6.285	0.012
	70+	33.33	66.67		

death rate. The more the family members help with the producing process; the lower becomes the death rate in broiler farms. There has been also a negative oriented compound between the death rate and the producer's budget. The more budget means the more quality and amount of chicken baits and also a better maintenance. It covers producing labor, disinfection, pad, lime, chicken feed or bait, medication, heating and lightning. Another negative relation has been observed between the coop area and the death rate. The larger the coop becomes, the less chicken on every m^2 locate, which decreases the death rate. Just as the relation between the heating system of the coop and the death rate.

The death rate in the coops with automatic heating system has been less than the ones with the classical stove system. The automatic systems are sensible to the heating changes and work precisely, that is why they protect the coop against the sudden temperature alterations. The coop relaxation period covers the cleaning-disinfection period and the time for the relaxation and lasts 3 weeks averagely. In this time (21 days) the fertilizer is removed from the coop and the curbs and mangers are washed and disinfected. After the coop is washed and dried off, it is disinfected and conducted the liming process [29]. There is a negative oriented relation between the relaxation period and the death rate as well. In the coops with the relaxation period of 21 days or more, the death rate has been detected less than the other coops. Relaxation period enables the coop and its equipment to be cleaned and disinfected for a longer time. The curtain opening time has affected the death rate also negatively. The longer the curtain opening

time has been, the chicks have grown and their range of motion has been narrowed down and this results with the more death rates. Another negative oriented relation has occurred between the weight of the chicks and the death rate. If the chicks weigh are 40 g or more, it is not likely to encounter the death incidents. The chicks weighing 40 g or more, could accommodate themselves more easily to a new living circumstances than the others and their survival rate has increased *(Table 2)*.

According to the EU regulations or legislations, it is required that all the containers and their equipment must protect the animals from suffering and wounding and provide their security against the harsh weather conditions such as extreme cold or hot and other climate conditions. They must be also easy to be cleaned and disinfected [27]. The transportation distance has also effects on the death rate of the chicks. If the transportation distance is more than 70 km, the death rate decreases since such transportation has been provided with the high equipped vehicles, which enables the chick comfort. For lower distances most of the time old or downgraded vehicles have been used for the transportations *(Table 2)*.

DISCUSSION

The poultry, as a sub-branch of livestock, has an increasing importance on the national economy regarding the procurement for the protein deficiency, due to the lack of production in the red meat sector, which has minor share in the agriculture production of Turkey. The objective of this study is to determine the factors which have effects on the death rate in the broiler farms. According to the results of the survey, there has been an average 5.53 production periods in a year. This results resemble the findings in İstanbul (5-6 periods/year) [30] and in South Georgia, USA (6 periods/year) [31]. However, the average production periods have been found high in Czechoslovakia (3.6-4.7 periods/year) [32].

The number of chickens in the coops for a square meter has a vital importance in terms of productivity. In crowded coops the development decreases and the death rate increases. The most suitable amount is decided as the 14-18 chickens in a square meter during the cutting ages [26]. In this research the average number of chicken has been decided as 14.47 chicken/m^2. There is a parallel relation between the density and the death rate in the coops. In the farms, where the density is around 13, 15 and 17 chicken/m^2, the bait consumption and utilization has been conveyed more useful and the death rate has been detected as less than 1% [33]. The similar results have occurred in the surveys in Saudi Arabia [34] and Turkey [35] as well.

In broiler farms the death is a really vital factor, which affects the success and the income of the manufacturer directly. In these researched farms, the death rate has been found as 9.68% but the desired rate by the firms is 6.76%. The results of the high death rate in the farms could be lined up basically as the weight of the chick, the transportation and the heating of the coops. In a management the death rate is 8.86% [36], in another between 6.2% to 8.2% [37]. According to a research made in Bangladesh, the death has the third place among the important problems [38].

According to the results of the Chi-square test; the age of the producer, the number of the family members helping the producing, the budget for a producing term, the area of the management, heating system, coop relaxation time, curtain opening time, weight of the chicks in the broiler and the transportation distance have been found statistically significant.

The broilers need a certain budget provide for their expenditures such as heating, lightening and work-labor. In the research area, it has been observed that the more the budget increases, the less the death rates become. According to the research in Bangladesh, the improvement regarding the yearly income of the families in broiler farms, have affected the performance of the manufacturers positively [38].

In the previous researches, the sudden altering on the temperatures has raised the death rates obviously [39-41]. According to the analysis results of this research, in the broiler farms with the automatic heating system the death rate is relatively less in comparison to the other farms. The automatic heaters are sensible to the temperature in the coop and as they function sensitively they prevent and obstruct the temperature changes. This is the reason of the necessity for building modern coops with automatic closed heating systems in Turkey.

The research shows us that if the transportation distance of the chicks is less than 70 km away, the death rate decreases in the coops. The research in the Czech Republic claims that the transportation distance of over 50 km increases the death rate among the chicks [42]. The reason of that are the deficiencies in the transportation trucks, which should protect the chicks against the harsh climate conditions, be eligible to be cleaned and disinfected. The regulations should be implemented in regards to the European Union for the transportation of the animals in general.

As a result, the decreasing of the death rates and increasing of the productivity provide for the manufacturers with the higher incomes, better life standards and contribution on the national economy.

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