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Influence of Transfer to High Salinity on Chloride Cells, Oxygen and Energy Consumption in Common Carp *Cyprinus carpio*

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ABSTRACT

This study was presented at the 10th International Animal Science Conference in Antalya on 25-27 October 2018.

Research Article

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Key Words

Salinity
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The present study was conducted to investigate the effect of high salinity on some stress parameters of common carp (*Cyprinus carpio*), which gradually exposed to salt concentrations of 5, 10 and 15 g/L, as well as tap water (control 0.1g/L) for 90 days. 80 fish were randomly distributed on eight glass tanks with 2 replicates as 10 fish /tank at average weight of 15 ± 3 g to study the effects of salinity on the number and percentages of the chloride cells in gills, beside the effect of salt concentrations on metabolism and the cost of the energy spent for osmoregulation through studying the oxygen consumption. Chloride cells in the gills were increased to 10.36, 14.80, 11.95×10^5 cell /g scraped matter. While the percentage of the chloride cells, increased to 11.34, 12.14 and 11.90% in the salt concentration of 5, 10 and 15 g/L, respectively, in comparison with the control treatment (8.42%). The rise in salinity was accompanied with an increase in the average of the oxygen consumed by common carp as it amounted 150,181.25 and 196.87 mg O₂ /kg/h when the salinity increased to 5,10 and 15 g/l respectively, in comparison with the control treatment (85.93 mg O₂ /kg/ hour), and this increase in the oxygen consumption resulted in an increase in the average of the energy consumed by fish that reached 0.50, 0.6 and 0.66 kcal (kg/h) with the increase of salinity to 5,10, and 15 g/L, respectively, in comparison to control (0.28 kcal/kg/h).

Introduction

Aquaculture plays an important role in solving famine and malnutrition nutrition problems in whole world through providing fish and other marine animals which are rich in protein, vitamins, minerals and amino acids. The rapid development in Aquaculture resulted in producing more than 123 of fish species in intensive and non-intensive culture systems. For achieving good growth rate, fish must have good health and resists diseases as well as the availability of good quality water (Fazio

et al., 2013). The quantity and quality of the feed are insufficient to obtain high fish production, as the environmental factors also play a vital role to obtain a high production, salinity is one of the important factors beside the oxygen and the temperature, it has a direct effect on fish growth (Mommsen, 1998). The Iraqi internal water is exposed to continuous increase in salinity ratio for some reasons, for example; the lack of water scarcity in Tigris and Euphrates rivers, the effect of salty drains entering Iraq, the drying of vast areas of lakes, the decrease in rains and the regression of

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ivers. The salinity of the lakes in the southern areas of Iraq is about 2.20 to 3.82 g/L and it's in a continuous increase as well as the increase in vaporization rates due the increase in temperature rates and the increase in global warming rates (Al-Faiz et al., 2009). As we became in a due need to exploit the water which suffer a continuous change in salt concentrations in fish culture because of the lack of fresh water and the availability of brackish water sources which has few uses so the fish must be adapted to raise its ability to bear the salinity in this kind of water as most of the fish living in the fresh water including *Cyprinus carpio* do not bear the high salinity because they are Stenohaline fish and suffer from failures when moving to saline water due to what's known by Osmosis Shock (Jackson, 1981). It was found that it's possible to raise the level of salt durability for fish through the gradual moving to water with gradual salt concentrations (Bardach et al., 1972), The chloride cells present in the gills are responsible for the process of ion transmission and ion equilibrium as well as their participation in the process of acid and base equilibrium (Kaneko and Hiroi, 2008). Thus, chloride cells play an important role in the adaptation process in environments with different osmoses as they have evolved in a way that allows them to obtain large amounts of energy in order to complete the transfer of sodium and potassium ions with the help of ATPase (Shikano and Fujio, 1999), where the change in respiratory rate of fish is one of the common physiological responses to face the salt

stress. The change in oxygen consumption is usually used to estimate the change in metabolic rate under environmental imbalance conditions (Dube and Hosetti, 2010) Since the *Cyprinus carpio* fish is considered the first rearing fish in Iraq and due to the increase of salinity rates in the southern areas and some of the middle areas which threaten the survival and the growth of the fish. This study aims to investigate the effect of the increase in the salinity of the osmoregulation of the *Cyprinus carpio* through the study of some physiological indicators which is considered an indication of the negative effects of salinity increase like stress and deficiency of ionic and osmoregulation process. This is reflected in both consumption of the feed and growth, which is the main objective of fish cultivation.

Material and methods

Common carp at the average weight of 15 ± 3 g were obtained from a local fish farm, south of Iraq. They were safely brought to the laboratory and acclimatized for 14 days in a large plastic tank (80×40×55 cm) prior to the experiment. During the acclimatization period, fish were fed on artificial diet once daily (Table 1), fish were distributed on four different salinity treatments (0.1, 5, 10 and 15 g/L) and tested in two replicates for each salinity treatment. There were 10 fish in each tank, fed on a diet with 31% protein content (Table 1) at a ratio of 4% of body weight, twice a day. Salt concentrations were prepared by

dissolution of specific of salt in litter of tap water, and fish were exposed to gradual salt concentration of 5, 10 and 15 g/L. while the tap water concentration (0.1 g/L) was represented control treatment.

Table 1. Chemical analysis of diet, %

Chemical parameters	Values
Crude protein	31.00±0.90
Ether extract	9.00±0.20
Moisture	8.66 ± 0.21
Crude ash	11.40 ± 1.20
Crude fiber	40.88 ± 0.12

Chloride cell

To determine the ratio and number of gill chloride cells, the fish gills were dissected and fixed in 10% formalin for 48 hours. After dehydration, clarification, and paraffin immersion, gill paraffin blocks were prepared, and then 5 µm sections were prepared and stained with hematoxylin-eosin. The number and ratio of chloride cells were observed using light microscopy and photographed (Sargent et al., 1978).

Oxygen consumption

Oxygen consumption of common carp at various salinities and oxygen concentrations was measured in closed, opaque chambers as in (Nordlie and Leffer, 1975). A single, post-absorptive fish which had been acclimated to the initial test salinity and temperature was placed in a test chamber containing air-saturated water. The chamber was sealed and placed in a water-bath at 25°C. Approximately 5 min later (the fish became quiescent almost immediately in

the dark chamber) water samples were drawn from the chamber. Additional samples were taken at 1 h intervals for 3 h. Oxygen concentrations in the samples were determined using a Radiometer p0, electrode. Following metabolic determinations, the fish were removed and weighed. The mean weights of fish run at each salinity were maintained at between 15 and 18 g so that salinity effects would not be confounded with body size effects.

Statistical analysis

Experiment was conducted in a completely randomized block design.

Data were analyzed by Windows version of SPSS software (Release 21.0). Results were analyzed using a t-test for comparison between treatment. Results were shown as means ± standard error. Significant differences between means were calculated using least significant differences (LSD). Statistical significance was set at $p < 0.05$.

Results

Table 2 shows that the number of chloride cells in gills of common carp was increased to 10.36×10^5 , 12.14×10^5 and 11.95×10^5 cells/g scraped matter in salt concentration of 5,10 and 15 g /L compared to control treatment (8.18×10^5 cells / g scraped matter). The decrease in the number of chloride cells is observed at the concentration of 15 g / L compared with the saline concentration of 10 g / L. Results of the statistical analysis showed significant differences ($P \geq 0.05$) in the number of chloride cells between the control

sample and saline concentrations of 5, 10 and 15 g / L, as well as among salt

concentration 5, 10 and 15 g /L.

Table 2. Shows that the number of chloride cells in gills in different salt concentrations of common carp (mean ± standard error)

Salt concentrations (g/L)	Number of chloride cells in gills (cells/g scraped matter)
0.1	$8.18 \times 10^5 \pm 1.08 \times 10^5$ b
5	$10.36 \times 10^5 \pm 1.05 \times 10^5$ b
10	$12.14 \times 10^5 \pm 1.03 \times 10^5$ a
15	$11.95 \times 10^5 \pm 1.06 \times 10^5$ a

g, gram; L, liter

On the other hand, Table 3 shows that the ratio of chloride cells from the total cells of the common carp was increased to 11.34%, 12.14% and 11.90% at the saline concentrations of 5, 10 and 15 g / L respectively, compared with the control sample (8.42%). A decrease in chloride cell ratios is observed at salt concentration of 15 g / L, compared with

saline concentration of 10 g / L. The statistical analysis showed significant differences ($P \geq 0.05$) in chloride cell ratios between control treatment and saline concentrations of 5, 10 and 15 g / L and between saline concentrations 10 and 15 g / L.

Table 3. Shows the ratios of chloride cells in different salt concentrations of common carp (mean ± standard error)

Salt concentrations (g/L)	The ratio of chloride cells (%)
0.1	8.42 ± 0.86 c
5	11.34 ± 0.90 b
10	12.14 ± 1.30 a
15	11.90 ± 1.12 a

Effect of salinity on oxygen and energy consumption rate

Table 4 shows the increase oxygen consumption in common carp to 150, 181.25 and 196.87 mg / kg / h with increase in salinity to 5, 10 and 15 g / L, respectively, compared with the control sample (85.93 mg / kg / h) Results of the statistical analysis showed significant difference ($P \geq 0.05$) in the oxygen consumption rate between the control sample and each of the saline

concentrations 5, 10 and 15 g / L, among all of saline concentrations.

Table 5 shows the amount of energy consumed (kcal/kg/h) in common carp, resulting from the conversion of the amount of oxygen consumed to energy. with an increase in energy consumption to 0.50, 0.61 and 0.66 kcal per kg with the increasing in salinity to 5, 10 and 15 g / L respectively, compared to the control treatment (0.28 kcal / kg / h). There were significant differences ($P \geq 0.05$) in the amount of

energy consumed between the control sample and each of the concentrations 5,

10 and 15 g / L, and among all saline concentration.

Table 4. Shows the oxygen consumption in different salt concentrations of common carp (mean \pm standard error)

Salt concentrations (g/L)	Oxygen consumption rate (mg / kg / h)
0.1	85.93 \pm 3.26 d
5	150.00 \pm 4.06 c
10	181.25 \pm 4.46 b
15	196.87 \pm 5.06 a

g, gram; L, litter; mg, milligram; Kg, kilogram; h, hour

Table 5. Shows the amount of energy consumed (kcal / kg / h) in different salt concentrations of common carp (mean \pm standard error)

Salt concentrations (g/L)	The amount of energy consumed (kcal / kg / h)
0.1	0.28 \pm 0.001 d
5	0.50 \pm 0.004 c
10	0.61 \pm 0.007 b
15	0.66 \pm 0.012 a

g, gram ; L, litter ; kcal, kilocalorie; Kg, kilogram ; h, hour

Discussion

Chloride cells are considered the main key for the osmoregulation success, where the increase in their numbers, in the current study is due to the exposure to high salt concentrations, for the fish to be able to adapt to the gradual increase in salinity, It increases the number of chloride cells to raise the ability of the gills to regulate the ionic exchange process and reach internal stability, the decrease in their numbers in the concentration of 15 g/L compared to 10 g/L is due to the decrease in the fish ability to complete the ionic regulation process and just tried to survive. The increase in Sodium ions may support these results as the ATPase/Na/K enzyme exists mainly in gills and the

chloride cells play an important role in its secretion, which is responsible for the exchange of sodium, potassium and chlorine ions. The increase in the number of chloride cells in the gills is an evidence of an increase in the activity of the enzyme due to the increase in the number and size of the chloride cells that secrete it. The chloride cells present in the gills are responsible for ions transmission and ions equilibrium, as well as the participation in the process of acid and base equilibrium (Kaneko and Hiroi, 2008). Therefore, chloride cells play an important role in the adaptation process in different environments with different osmoses. As it evolved in a way that allows it to obtain large amounts of energy to complete the transfer of sodium and potassium ions

with the help of ATPase (Shikano and Fujio, 1999), and that exposure to high salinity leads to an increase in the number of chloride cells as well as an increase in the activity of ATPase to transfer Sodium and potassium ions (Carmona et al., 2004). Freshwater fish contain less chloride cells than marine fish, although they have a high ability to absorb salts from the surrounding environment (Fielder et al., 2007). The changes in the shape and size of chloride cells and their increasing numbers are part of the adaptation phase which the freshwater fish follow in response to the increase in environmental salinity (Gahremanzadeh et al., 2014). Several studies have shown that the increase in salinity is usually accompanied by an increase in the number, size, and ratio of chloride cells in the gills (Evans et al., 2005). Numerous studies have been conducted on *Tilapia Oreochromis mossambicus* to identify the changes that occur during the process of osmoregulation. Fish is used as an important example in the study of salinity endurance for fish and endocrine studies (Hiroi et al., 2005). The location of ATPase enzyme has been frequently diagnosed in chloride cells and is indirectly responsible for chloride secretion by these cells (Epstein et al., 1980). An increase in number of chloride cells in freshwater fish was observed during their adaptation to salt water (Mangum and Towle, 1977). The differences in shape, size and number of chloride cells reflect the responses by fish to adapt to different saline environments (Gulácsi et al., 2003). The present study showed that the exposure

of *Cyprinus carpio* to a gradual increase in saline concentrations resulted in an increase in the numbers and proportions of chloride cell in the gills. This shows the effect of the increase in salinity on stimulating the increase in the number and proportions of chloride cells as they play an important role in the necessary effective transmission process to eliminate the salt accumulation that occurs by diffusion due to increased salinity of the external ambient and thus maintaining the internal stability. The ionic equilibrium process is associated with the chloride cells which is rich in mitochondrial for its ability to extract ions against concentration gradient by active transport process which requires energy, obtained from $\text{Na}^+ / \text{K}^+ \text{ATPase}$ enzyme (McCormick et al., 1991). Mancera and McCormick (2000) showed that the $\text{Na}^+ / \text{K}^+ \text{ATPase}$ enzyme increases in gills exposed to sea water, also Mylonas et al. (2009) mentioned an increase in the effectiveness of $\text{Na}^+ / \text{K}^+ \text{ATPase}$ in gills by decreasing environment osmosis. Chloride cells have been shown to be the effective location of ionic exchange and their increase is a physiological response to saline stress which causes ion loss. Eddy (1982) observed that Freshwater *Salmo gerdnairy* has few chloride cells and low levels of $\text{Na}^+ / \text{K}^+ \text{ATPase}$, and cells number are increasing and their shape changes with increasing salinity. This is done under the control of cortisol, prolactin and growth hormone (McCormick et al., 1991). The result of this study is matching with many previous studies which noted an increase in numbers and proportions of chloride

cells once they exposed to an increase in salinity levels. Azizi et al. (2010) mentioned an increase in the number of chloride cells in *Cyprinus carpio* exposed to a gradual increase in salinity to 9 g/L. Al-Khshali (2011) also observed an increase in the number of chloride cells to 12×10^5 , 7.8×10^5 , and 6.55×10^5 cells / g of scraped matter with a gradual increase in salinity to 4, 8 and 12 g / L respectively, compared with its control sample (2.88×10^5 cells / g scraped matter in *Carassius auratus*. Lee et al. (2000) mentioned an increase in the number of chloride cells in *Oreochromis mossambicus* exposed to salinity of seawater. An increase in the number and proportion of chloride cells in gills of *Liza abu* was recorded after 14 days of salinity elevation to 7 and 15 g / L (Ahmed et al., 2004). This indicates a strong correlation between the number of chloride cells with the salinity of the external ambient (Pereira and Caetano, 2009) showed an increase in the number of chloride cells when fish were exposed to inappropriate environmental conditions causing stress.

Effect of salinity on oxygen and energy consumption The increase in oxygen consumption showed in the present study is resulting from the increase in the metabolic rate to confront the high energy requirements corresponding to the osmosis situation due to exposing the fish to high levels of salinity. This is a natural condition due to saline stress and increased demand for energy by fish for the purposes of osmoregulation. That is can prove through the increase in the number of chloride cells, which is the main location

of ionic exchange, whose increase indicates in energy need for the active transport of ions. Oxygen has the largest role in energy production by breaking down the bonds in the food and converting them into energy, and because the body needs amounts of energy in order to reach the state of internal stability, fish need more oxygen to provide greater energy and as fish get farther away from the stable osmosis environment, this led to an increase in energy needs trying to get back to the state of the original equilibrium it was before the exposure to the stress factor. Metabolism includes, chemical reactions occurring in living organisms and the measurement of oxygen consumed is the most common method of indirectly detecting metabolic rate. The energy needed by the body to adapt to changes in saline concentrations can be identified by changing in the oxygen consumption rate (Tseng and Hwang, 2008) which change in respiratory rate of fish is one of the common physiological responses to face saline stress. The change in oxygen consumption rate is usually used to estimate the change in metabolic rate under conditions of environmental imbalance (Dube and Hosetti, 2010). The reason for the change in the oxygen consumption rate following the change in salinity levels is due to increased activity in the active transport of ions and the activity of the Na / k / ATPase in gills, which increases the energy needs for the completion of osmoregulation process (Sangiao-Alvarellos et al., 2003). Morgan and Iwama (1991) Showed increased metabolic rate in *Oreochromis mossambicus* with higher

salinity levels in the fish environment to meet energy requirements for osmoregulation process. the reason for increasing the need for energy is the entry of some hormones in some interactions, as well as the increase in the need of some organs, which are not responsible of the osmoregulation process of energy, such as the brain, (Sangiao-Alvarellis et al., 2007). Thus, the measuring the rate of oxygen consumption at different concentrations of salinity is an approach to determine the cost of energy for osmoregulation (Morgan et al., 1997). Also, oxygen consumption on different metabolic processes has been described previously (Peck et al., 2005). Studies indicate that the difference in the rate of oxygen consumption due to salinity change varies depending on the fish species and duration of exposure to salinity, the design of the experiments and the details of the measurement method used (Gracia-Lopez, 2006). The results of several previous studies of different species fish have shown that an increase in oxygen consumption is corresponding to the increase in the salinity of the environment which is in line with the results of the current study. Al-Khshali (2011) reported that the average oxygen consumption in *Ctenopharyngodon idella* was 132.11, 197.08 and 241.77 mg / kg / h at saline concentrations 4, 8 and 12 g / L, respectively, compared to control sample (102.72 mg of O₂ / kg / h), while the amount of energy consumed was 0.44, 0.66 and 0.81 kcal / kg / h at saline concentrations of 4, 8 and 12 g / L, respectively, compared to control sample (0.34 kcal/kg/h). Ahmed

(2005) showed an increase in the oxygen consumption rate to 256.5 and 262.0 mg of O₂ / kg / h in *Liza abu*, with salinity increase to 7 and 15 g / L respectively, compared to fish in freshwater (151.0 mg of O₂ / kg / h). Wang et al. (1997) showed that the average oxygen consumption in *Cyprinus carpio* decreased in fresh water, which was 134.1 mg / kg / h and salinity of 2.5 g / L was 123.8 mg of Oxygen / kg / h compared to salinity 8.5 and 10.5 g / L whose the consumption rate was 175.2 and 183.0 mg oxygen / kg / h, respectively. In a study conducted by (McKenzie et al., 2001) on *Acipenser Naccarii*, an increase in oxygen consumption was observed with an increase in salinity from 0-11 g / L, so the consumption rose from 112. to 146.4 mg / kg / h then rose to 216 mg / kg / h during 70 days. Other studies indicated high metabolic rate when fish were subjected to high saline concentrations, resulting in an increase in routine oxygen consumption (Fischer, 2000; Keddy, 2001). The effect of different salinity levels (1.5, 7.5, 15 and 30 g / L) was studied on *Liza carinata*, it was found that fish in salinity 1.5 and 30 g / L consumed 15.5% and 20.4% more oxygen respectively, fish in 15 g / L salinity. Some results were different from the current study as Grøtan et al.(2012) reported no change in the oxygen consumption rate and metabolic rate of *Acanthopagrus latus* when exposed to three environments (fresh water, brackish water and saline water) during rapid exposure to high or low salinities when transported from marine water to fresh and from salty water to

brackish water, this was attributed to the fact that these fish have genes that are responsible for conserving energy when the saline concentration changes over a short period of time as part of the adaptation phase to the saline concentration. Awal et al. (2012) reported that the decrease in the oxygen consumption of *Tilapia* was 2.14, 0.71, 1.43, and 1.42 mg O₂ / kg / h when exposed to salinity 0, 10, 20 and 30 g / L, respectively.

Conclusion

The researcher attributed the decrease in oxygen consumption to the decrease in fish activity due to increased salinity and so their exposure to stress.

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Farklı Yaşlardaki Anadolu Mandalarında Polinomiyal Regresyon Modeli ile Laktasyon Eğrisi Parametrelerinin Tahmini

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MAKALE BİLGİSİ

ÖZET

Araştırma Makalesi

Geliş : 23 Aralık 2019

Kabul : 27 Aralık 2019

Anahtar Kelimeler

Anadolu mandası

Laktasyon eğrisi

Test günü

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Bu araştırma, Anadolu mandalarında laktasyon eğrisi parametrelerinin polinomiyal model (AS) ile tespit edilmesi amacı ile yapılmıştır. Araştırma materyali olarak 190 baş Anadolu mandasına ait 1092 adet test günü süt verim kayıtları kullanılmıştır. Bu amaçla, 2017 yılında laktasyona başlayan 3 ve 4 yaşındaki Anadolu mandalarının verileri kullanılmıştır. Test günü verileri yaş gruplarına göre gruplandırılmıştır. Laktasyon eğrisi parametrelerinin tahmininde STATISTICA programından faydalanılmıştır. Üç yaşlı Anadolu mandaları için laktasyon eğrisi parametreleri (a, b, c, d ve g) sırasıyla 4.82 ± 0.809 , 1.61 ± 0.052 , 0.71 ± 0.249 , 7.31 ± 1.811 ve 2.93 ± 0.059 olarak saptanmıştır. Belirleme katsayısı ve hata kareler ortalamaları da üç yaş grubu için sırasıyla 98.17 ve 0.032 olarak hesaplanmıştır. Dört yaşındaki Anadolu mandaları için laktasyon eğrisi parametreleri (a, b, c, d ve g) sırasıyla 5.31 ± 0.647 , 1.07 ± 0.049 , 0.62 ± 0.413 , 6.11 ± 0.988 ve 2.15 ± 1.740 olarak belirlenmiştir. Belirleme katsayısı ve hata kareler ortalaması dört yaşındaki Anadolu mandaları için sırasıyla 99,46 ve 0,013 olarak tespit edilmiştir.

Estimation of Lactation Curve Parameters with Polynomial Regression Model in Different Aged Anatolian Buffaloes

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ABSTRACT

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Keywords

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This investigation was conducted to determine lactation curve parameters in Anatolian buffaloes by polynomial model (AS). As a research material, 1092 test days milk yield records belonging to 190 head Anatolian buffaloes were used. For this purpose, the data of 3 and 4 year old Anatolian buffaloes that started lactation in year 2017 was used. The test day data were grouped according to age groups. Lactation curve parameters had established by via STATISTICA program. Lactation curve parameters (a, b, c, d and g) were determined as 4.82 ± 0.809 , 1.61 ± 0.052 , 0.71 ± 0.249 , 7.31 ± 1.811 and 2.93 ± 0.059 , respectively, for three year old. The coefficient of

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determination and mean square error were estimated 98.17 and 0.032, respectively for three year old. Lactation curve parameters (a, b, c, d and g) were determined as 5.31 ± 0.647 , 1.07 ± 0.049 , 0.62 ± 0.413 , 6.11 ± 0.988 and 2.15 ± 1.740 , respectively, for four year old. The coefficient of determination and mean square error were estimated 99.46 and 0.013, respectively for four year old.

Giriş

Türkiye İstatistik Kurumu verilerine göre Türkiye’de 180.826 baş manda yetiştirilmekte olup, mandalardan 75 842 ton süt elde edilmektedir (Anonim, 2019). Türkiye’de yetiştirilen mandalar Anadolu mandası olarak adlandırılmakta olup, nehir mandalarının alt kolu olan Akdeniz mandasından köken almaktadır. Anadolu mandalarının süt verimlerinin 654-943 kg arasında değiştiği yapılan bazı araştırmalarda saptanmıştır (İzgi ve Asker, 1988; Şahin ve Ulutaş, 2014). Malaklama ile başlayıp manda ineğinin kuruya çıkarılması ile sonuçlanan laktasyon süresi uzunluğunun mandalarda 220 ile 225 gün arasında değiştiği bildirilmiştir (İlaslan ve ark., 1983; İzgi ve ark., 1989; Özenç ve ark., 2008). Diğer hayvanlarda olduğu gibi mandalarda da malaklama ile birlikte başlayan süt salgılanması manda ineğinin kuruya çıkarılması ile tamamlanmaktadır (Soysal, 2009; Lombaard, 2006). Malaklama ile kuru dönem arasındaki bu periyot türler, ırklar ve aynı ırkın farklı sürüleri arasında dahi çeşitlilik gösterebilmektedir. Diğer süt hayvanlarında olduğu gibi mandalarda da malaklamayı takip eden dönemde süt verimindeki değişim laktasyon eğrisi olarak tanımlanmaktadır (Soysal ve ark., 2005; Macciotta ve ark., 2005; Singh ve ark., 2017). Laktasyon eğrisi test günlerinde saptanan süt verimlerinin, test

günlerine göre grafiği çizilerek elde edilmektedir. Laktasyon eğrileri mandanın laktasyon süt veriminin tespit edilmesinde, sürü sevk ve idare plan veya programlarının oluşturulmasında yaygın olarak kullanılabilir (Prasad, 2003; Macciotta ve ark., 2005; Gürcan ve ark., 2011; Çankaya ve ark., 2011; Sahoo ve ark., 2015). Bugüne kadar birçok (Wilmink, Dave, Wood, Cobby ve Le Du, Ters Polinomiyal, Dhanoa) eşitlik laktasyon eğrisi parametrelerinin tahmininde kullanılmıştır. Bu eşitliklerden biri de Ali ve Schaeffer (1987) tarafından geliştirilen polinomiyal regresyon modelidir.

Laktasyon eğrisi parametrelerinin tahmini ile ilgili çalışmalar özellikle süt sığırcılığında günümüze kadar yaygın olarak kullanılmaktadır. Değişik ülkelerde farklı manda ırklarının laktasyon eğrileri ve eğri parametrelerinin saptandığı araştırmalar olmasına rağmen (Barbosa ve ark., 2007; Anwar ve ark., 2009), Türkiye’de Anadolu mandaları üzerinde bu konuda sınırlı sayıda çalışma yapılmıştır.

Çalışmada, Tokat ili ve ilçelerinde 2017 yılında malaklayan 190 baş Anadolu mandasına ait 1092 adet test günü süt verimleri polinomiyal regresyon modeli ile değerlendirilerek laktasyon eğrisi parametreleri tahmin edilmiş ve üç, dört ve tüm yaş

gruplarındaki Anadolu mandası inekleri için laktasyon eğrileri oluşturulmuştur.

Materyal ve Metot

Materyal

Bu çalışmada kullanılan veriler 2017 yılında Tokat ili ve ilçelerinde malaklayan 3 ve dört yaşlı 190 baş Anadolu mandasına ait 1092 adet test günü süt kayıtlarından oluşmuştur. Araştırma verileri Tokat ilinde yürütülen Halk Elinde Manda Islahı Ülkesel projesi kapsamında, Tokat ili damızlık manda yetiştiricileri birliği elemanları tarafından tutulan kayıtlardan temin edilmiştir. Anadolu mandalarının süt verimleri kontrol gününde belirlenerek kayıt altına alınmıştır. Araştırma verilerini alındığı işletmelerde birer ay aralıklarla süt verimi kontrol edilmektedir. Tokat ili ve ilçelerinde bu araştırmanın verilerinin alındığı işletmelerde manda yetiştiriciliği genel olarak ekstansif koşullarda yapılmaktadır. Kış mevsiminde yetiştiriciler tarafından elinde bulunan yemler ile ek yemleme yapılmaktadır. Bu işletmelerde, mandalar sabah sağımını takiben meraya çıkarılmakta olup, sağım genel olarak elle yapılmaktadır. Bu çalışmada en az beş test günü verim kayıtları olan mandaların verileri incelenmiştir (Cruz ve ark., 2009; Torshizi ve ark., 2011).

Metot

Bu çalışmada, 3 ve 4 yaşlarındaki Anadolu mandalarının laktasyon eğrisi parametreleri polinomiyal regresyon modeli (Ali Schaeffer, 1987) ile tahmin edilmiştir.

Bu eşitlik aşağıda verilmiştir;

Polinomiyal Regresyonon (AS):

$$Y(t) = a + b\delta t + c\delta t^2 + d\beta t + g\beta t^2$$

$$\delta t : t/300, \beta t : 300/t$$

Yukarıdaki eşitlikte; a: pik süt verimi, d ve g: başlangıç ile pik verim arasındaki eğimi, b ve c: pikten sonraki eğimi açıklayan laktasyon eğrisi katsayılarıdır (Brotherstone ve ark., 2000; Silvestre ve ark., 2006).

Çalışmada, laktasyon eğrisi parametrelerinin (a, b, c, d ve g) tahmin edilmesinde STATISTICA 5.0 programından faydalanılmıştır.

Araştırmada verileri değerlendirilen yaş gruplarına göre laktasyon eğrisi parametrelerinin durumunu ortaya koymak amacı ile test günü süt verimleri 3 ve 4 yaş gruplarına göre gruplandırılmıştır. Her bir manda ineğinin test günü verileri ayrı ayrı eşitliğe konularak parametreler tahmin edilmiş ve ortalamaları alınarak yaş guruplarına göre laktasyon eğrisi parametreleri saptanmıştır. Laktasyon eğrisi grafikleri, elde edilen gözlenen ve beklenen değerlerin test günlerine göre değişimlerinden faydalanılarak oluşturulmuştur. Bu çalışmada ayrıca yaş guruplarına göre belirtme (R^2) katsayısı ve hata kareler ortalamaları (HKO) hesaplanmıştır (Tablo 2).

Bulgular ve Tartışma

Araştırmada, 3 ve 4 yaşlı Anadolu mandalarının 1092 adet test günü kayıtları polinomiyal regresyon eşitliği kullanılarak tahmin edilmiştir. Bu çalışmada polinomiyal regresyon modeli ile belirlenen a, b, c, d ve g katsayıları Tablo 1’de belirtme (R^2) katsayısı ve

hata kareler ortalamaları Tablo 2’de özetlenmiştir. Ayrıca, gözlenen ve beklenen süt verimlerine ait laktasyon eğrileri 3 yaşlı Anadolu mandaları için

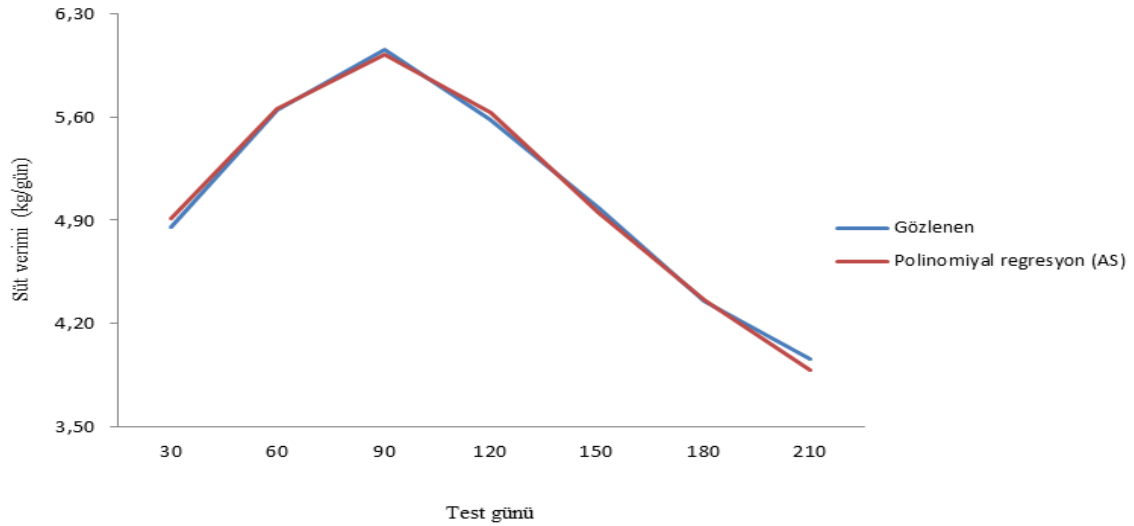
Şekil 1’de 4 yaşlı Anadolu mandaları için ise Şekil 2’de ve tüm yaş gruplarındaki Anadolu mandaları için ise Şekil 3’te gösterilmiştir.

Tablo 1. Yaş gruplarına göre laktasyon eğrisi parametrelerinin değişimi

Yaş grupları	A	$S_{\bar{x}}$	b	$S_{\bar{x}}$	c	$S_{\bar{x}}$	d	$S_{\bar{x}}$	G	$S_{\bar{x}}$
3	4.82	0.809	1.61	0,052	0.71	0.249	7.31	1.811	2.93	0.059
4	5.31	0.647	1.07	0.049	0.62	0.413	6.11	0.988	2.15	1.740
Genel	5.01	0.481	1.33	0.735	0.68	0.363	7.13	0.023	1.90	0.925

Tablo 2. Yaş gruplarına göre belirtme (R^2) katsayısı ve hata kareler ortalamalarının değişimi

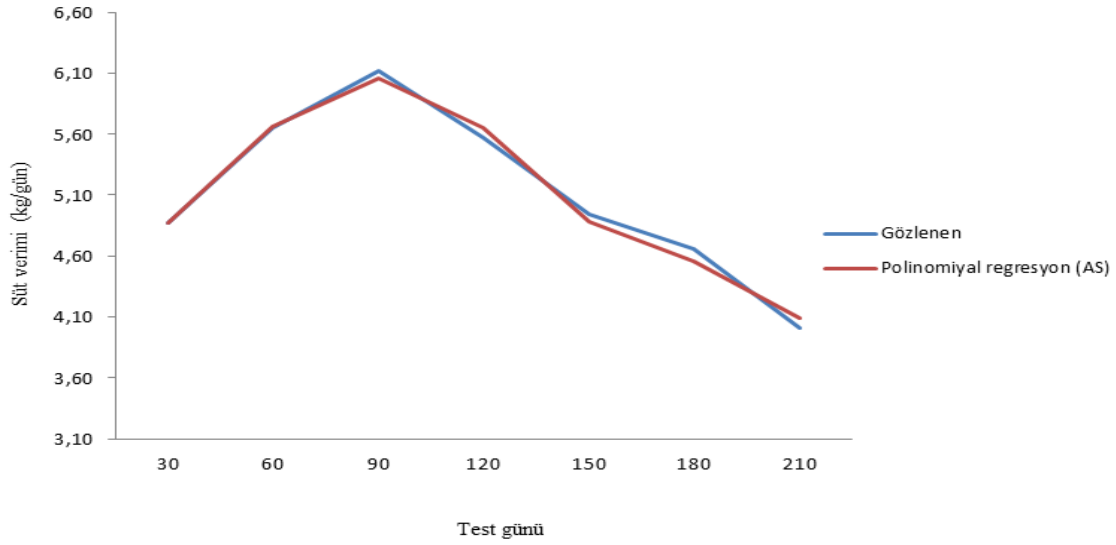
Yaş grupları	Belirtme (R^2) katsayısı	Hata kareler ortalamaları
3	99.73	0.050
4	99.46	0.013
Genel	99.52	0.002



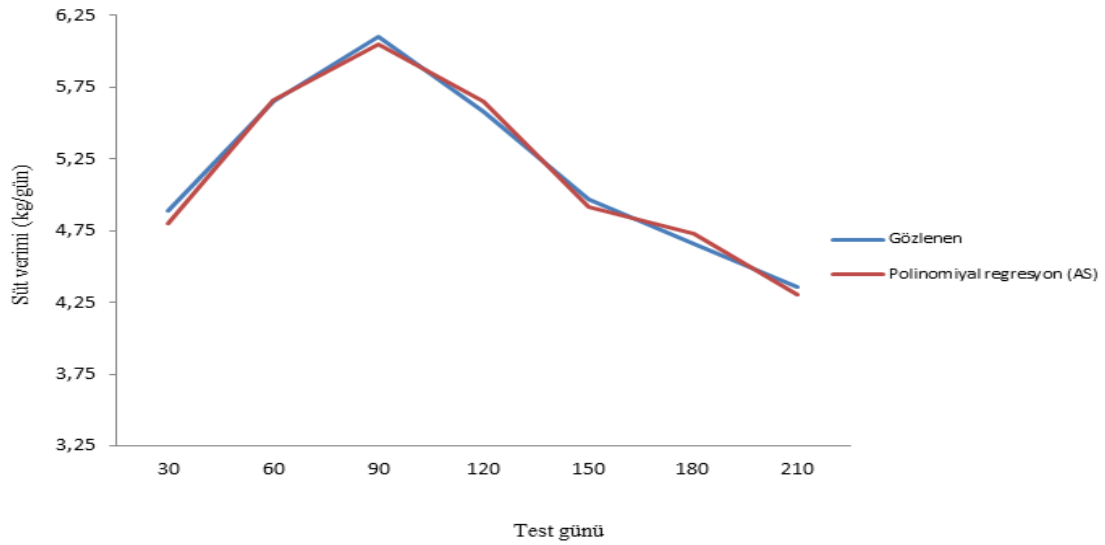
Şekil 1. Üç yaşlı Anadolu Mandaları için laktasyon eğrisi grafiği

Araştırmada, 3 yaş grubundaki Anadolu mandaları için laktasyon eğrisi parametreleri ve standard hataları (a, b, c, d ve g) sırası ile 4.82 ± 0.809 , 1.61 ± 0.052 , 0.71 ± 0.249 , 7.31 ± 1.811 ve

2.93 ± 0.059 olarak tespit edilmiştir. Aynı yaş grubu için belirtme (R^2) katsayısı ve hata kareler ortalamalarının (HKO) ise sırası ile 99.73 ve 0.050 olduğu belirlenmiştir.



Şekil 2. Dört yaşlı Anadolu Mandaları için laktasyon eğrisi grafiği



Şekil 3. Tüm yaş gruplarındaki Anadolu Mandaları için laktasyon eğrisi grafiği

Araştırmada, 4 yaşlı mandalar için a, b, c, d ve g parametreleri sırasıyla 5.31 ± 0.647 , 1.07 ± 0.049 , 0.62 ± 0.413 , 6.11 ± 0.988 ve 2.15 ± 1.740 olarak tahmin edilmiştir. Bu çalışmada, 4 yaşlı mandalar için belirtme (R^2) katsayısı ve hata kareler ortalamaları ve standart hataları 99.46 ve 0.013 olarak saptanmıştır.

Bu çalışmada tüm yaş gruplarındaki (3 ve 4 yaşlı) mandalar için a, b, c, d ve g parametreleri sırasıyla 5.01 ± 0.481 , 1.33 ± 0.735 , 0.68 ± 0.363 , 7.13 ± 0.023 ve 1.90 ± 0.925 olarak tahmin edilmiştir. Bu çalışmada, 4 yaşlı mandalar için belirtme (R^2) katsayısı ve hata kareler ortalamaları ve standart hataları 99.52 ve 0.002 olarak

saptanmıştır. Tüm yaş gruplarındaki Anadolu mandaları için çizilen laktasyon eğrisi grafiği Şekil 3'te görülmektedir.

Bu çalışmada 3 ve 4 yaşlı Anadolu mandaları için belirlenen belirtme katsayıları (R^2) Catillo ve ark. (2002) tarafından 534 baş İtalyan mandasının test günü süt verimleri incelendiği bir çalışmada saptanan değerler ile benzerlik göstermektedir.

Bu araştırma da test günü verim kayıtları değerlendirilen 3 ve 4 yaşlı Anadolu mandaları için belirlenen a katsayılarının hem 3 ve 4 yaş grubundaki Anadolu mandaları hem de benzer yönde yapılan araştırmalarda saptanan bulgulardan farklılık gösterdiği belirlenmiştir. 3 ve 4 yaş grubunda a parametresinde görülen farklılık mandalarda da süt verimi laktasyon sırası dolayısı ile yaş arttıkça arttığı için doğal kabul edilebilir.

Diğer manda sürüleri ile bu çalışmada saptanan a katsayısını farklı olması ise araştırmada diğer araştırmalarda verileri incelenen sürülerdeki manda ırklarının, her işletme veya sürüde uygulanan sürü sevk ve idaresinde uygulanan yöntemler ile besleme rejiminin değişik olmasından kaynaklanabilir. Diğer taraftan diğer araştırmalarda kullanılan test aralıklarının farklı olması da bu durumun ortaya çıkmasına neden olabilecektir.

Sonuç

Sonuç olarak; bu araştırmada, polinomiyal regresyon modeli ile tahmin edilen parametreler ve laktasyon eğrisinin şekli, Anadolu mandaları üzerinde yürütülebilecek seleksiyon

çalışmalarında kriter olarak kullanılabilir.

Teşekkür

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Importance of Dietary Fiber in Poultry Nutrition

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ABSTRACT

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The scientific term of fiber is comprised of very diverse group of polymers having various physicochemical properties. The dietary fiber can contribute remarkably to the nutritive value of poultry diets both directly, as energy source, and indirectly, through its effects on digestive and metabolic processes going on in the poultry bird. In order to more accurately predict the nutritive effect of fiber from raw materials, a better characterization of fiber fractions, their degradation in the chicken, and their physiological effects are required. Traditional analytical methods to analyze fiber, as crude fiber (CF) and neutral detergent fiber (NDF), recover only a changeable fraction of fiber and are hence unfit for evaluation fiber fractions in raw materials and poultry diets. In poultry feeding the fiber gives less amount of energy because of its limited role in digestion however its slight increased proportion (up to 50 g/kg) can be productive for GIT development, thereby improving the digestion of nutrient and also posing good impact on growth and performance. A better understanding on the relation between specific fiber fractions and factors as GIT development, digesta retention time, and microbial colonization will help to develop nutritional strategies using specific fiber fractions to steer GIT health and function to enhance performance, especially under suboptimal environmental conditions.

Introduction

The fiber is a natural component of plant derived feedstuff and is of great importance in poultry feed. Regarding the daily intake, growth performance and digestibility of nutrients, studies trials conducted in previous years have shown negative impact (Jorgensen et al., 1996; Sklan et al., 2003). The research trials conducted in recent past have elaborated the role of fiber in improving the growth of broilers (Jimenez-Moreno et al., 2009; Gonzalez-Alvarado et al., 2010). The GIT development and overall growth depends

on quality and quantity of fibers in the diet (Owusu-Asiedu et al., 2006). In this regard, the soluble fibers are composed of pectin which makes the digesta viscous in GIT to accelerate the absorption of nutrients (Iji et al., 2001; Forman and Schneeman, 2018). On the other hand the insoluble fiber e.g. rice hulls poses good impacts on gizzard and GIT, which improves nutrient digestion (Hetland et al., 2004). There have been some findings on the impact of soluble and insoluble non starch polysaccharide on physiology and morphology of digestive system of broilers (Banfield et al., 2002; Iji et al.,

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2001; Jimenez-Moreno et al., 2009).

The immunological effect of fiber depends on its fermentation and in the result the produced short chain fatty acids can safeguard the digestive system (Liévin-Le Moal and Servin, 2006). Saki et al. (2011) came to the conclusion that mixing the fiber fractions e.g. rice hulls, etc in different feeds could not be more effective and needed further research. The addition of fiber in ration in low levels poses a good effect but if the level accedes to 30 g/kg it can be harmful for the broilers (Jimenez-Moreno et al., 2013) found reduced weight gain in the broilers of 6 days old when he added SBP up to 75 g/kg of feed. Similarly the performance and nutrient absorption was reduced when the crude fiber contents of feed were raised from 30-90 g/kg of feed of turkeys (Sklan et al., 2003).

The dietary fiber (DF) is present in feedstuff in a considerable amount while in monogastric animals it has more proportion. The DF becomes beneficial nutritionally in such a way that it directly provides energy (Varel and Yen, 1997; Jamroz et al., 2002) and indirectly by invigorating the GIT and immune system of animals (Choct et al., 1996; Jha et al., 2010; Pieper et al., 2008). But previously the DF was rendered as an anti-nutritional factor because of its bad effect on the utilization of nutrients (Jha et al., 2010; Annison, 1993). However, in recent past, due to its positive role in uplifting the gut health of monogastric animals, the DF has gained special consideration (Jha and Berrocso, 2015). The maintenance of gut health of animals is of great importance because it improves the feed efficiency, upholds the growth, and poses

a good effect on overall health of animals. In past the antibiotic growth promoters (AGP) have been consecutively used in animals for their growth promotion but due to possible residual effect of antibiotics in humans which was a serious public health concern, the use of antibiotics for growth promotion was banned in several countries. So the alternative feed resources for growth promotion were sought and the DF was considered to be a good choice. These are plant derived feedstuff composed of cereals, tubers and agro-industrial by-products (Jha and Berrocso, 2015; Tiwari and Jha, 2016; Tiwari and Jha, 2017). However there are some bad effects but, due to its good impact on digestion, the usage of DF is gradually increasing (Jha and Berrocso, 2016). Microbial fermentation of DF leads to production of short-chain fatty acids (SCFA), which improves growth of productive bacteria in gut by improving intestinal health and immune function. The studies have shown the beneficial impacts of DF on fermentation, gut health and its physic-chemical characteristics (Jha et al., 2015).

Dietary Fiber

McDonald and Whitesides (2002) have defined the term “fiber” as part of plant cell wall, a non-starch polysaccharide (NSP), is composed of lignin, cellulose and hemicelluloses. According to (Branton et al., 1997) the addition of NSP in diet is responsible for necrotic enteritis in poultry which is due to increased microbial fermentation.

According to (Bach Knudsen, 2001) chemically the DF is composed of

NSP e.g. cellulose, arabinoxylans, inulin, chitins, pectins, beta-glucans and phenolic polymer lignin which are part of plant cell wall hence poultry birds don't effectively digest DF, therefore put no nutritional value. Analytically, the DF is rendered as a part of dietary fractions which remain present after the extraction with neutral detergent solution (Soest and Wine, 1967) it is called neutral detergent fiber (NDF). The researchers have found that dietary metabolizable energy (ME) and age of the bird increases side by side (Sell, 1996; Zelenka, 1968; Batal and Parsons, 2002). Shires et al. (1987) observed low feed passage rates in old age birds, and recommended that DF digestibility may be increased if the diet is exposed for more time in ceaca for microbial fermentation. However (Siregar and Farrel, 1980) reported no influence on ME by age of the broiler.

The poultry meat and eggs play an important role in fulfilling the protein needs of human beings in the form of cheap and economical protein source and the demand is increasing as the population of this world is increasing. It is estimated from the data of Food and Agriculture Organization (FAO) of the United Nations by (Henchionet et al., 2014), from the year 1900-2009, poultry meat consumption increased by approximately 77% to 126%, respectively. Feed is the most crucial input in poultry production for its enhanced meat production and it accounts for 50-70% of production costs (Rochell, 2018).

The microbes living in GIT of animals can ferment the NSP which can lead to the production of short chain fatty

acids (SCFA), which are then absorbed and used as energy source (Dierick et al., 1989; Jorgensen et al., 1997; Just et al., 1983). However about 40% of NSP are degraded, the lower efficiency of energy utilization obtained from the process of microbial fermentation as compared to enzymatic digestion, and high energy requirements (Dierick et al., 1989) generally it establishes that the NSP contributes less amount of energy to the bird (Jorgensen et al., 1997). The DF can impede the digestion thereby reducing the nutrient absorption from diet (Choct and Annison, 1992; Annison, 1992; Montagne et al., 2003; Smits et al., 2000; Smits et al., 1998). Especially insoluble, recalcitrant, fiber fractions that resist fermentation in the gut may be important from this perspective due to their effects on gizzard function and digesta retention time in the GIT (Hetland et al., 2004). A better understanding on the relation between specific fiber fractions and factors as GIT development, digesta retention time, and microbial colonization will help to develop nutritional strategies using specific fiber fractions to steer on GIT health and function to enhance performance, especially under suboptimal environmental conditions.

Studies conducted

Two experiments were performed to find out the impact of fiber with voluntary or by choice feeding on some parameters including performance, intestinal health, immunity level, and fiber preference in broilers. In the first experiment, 240, one day-old broiler chicks (Ross 308) were randomly divided

in 4 groups, comprising 5 replicates per treatment. The dietary treatments were: basal diet (control) or 30 g/kg sugar beet pulp (SBP), 30 g/kg rice hull (RH), or 30 g/kg equal combination of them (SBP/RH) added to the basal diet. Results showed SBP and SBP/RH reduced weight gain in the growing phase compared to control. On the other hand there was decreased FCR value in the groups which was given SBP during the entire rearing period. When the comparison was made to control and SBP treatment groups, administering SBP/RH considerably lowered the antibody titer level against Newcastle Disease Virus (NDV) at 23rd of age. Moreover the, the SBP decreased the villi height of duodenum and ileal region compared to control at 21st day of age. In 2nd experiment, 240 chicks were grouped into 4 different experimental treatments: 1) control; or by choice feeding, 2) control and SBP (C-SBP); 3), control and RH (C-RH); 4) control and SBP/RH (C-SBP/RH). The results depicted that the chicks had an inclination to utilize separate sources of fiber. RH remained less consumed than C-SBP/RH and C-SBP in starter and growing periods, respectively. In the group where the chickens took feed by choice, the RH and SBP/RH showed better daily feed intake than control across 14th to 28th day of age. In the same treatment group increased antibody titer against ND was also seen. However, reduced daily weight gain was reported in all the fiber fed birds which ultimately decreased FCR in broilers of the C-SBP group. So by concluding, the addition of fiber in both of the experiments put negative effects on

the growth of birds but immunity level was improved. So the broilers had an inclination to use separate fiber sources (Sadeghi et al., 2006).

The direct emphasis has been on the nutrient intake to get optimum weight gain particularly in growing phase in laying hens. The research trial is performed to appraise digestibility of nutrients, GIT development, and development of bone of two types of layers, semi-heavy (Hy Line Brown) and light-strain (Lohman LSL), are given feed in their 7th to 12th weeks of age. For this purpose 1,296 laying hens were randomly allocated in a completely randomized design in a 2 x 3 factorial arrangement (two strains x three levels of NDF) having four replicates of 54 birds each. The hens were divided to feeding treatments containing 14.50, 16.50, and 18.50% NDF and it was observed that light-strain pullets had lower performance with 18.50% NDF. It was also found that the descending ratio of NDF in the feed decreased the digestibility coefficients of dry matter, nitrogen and gross energy, and the values of ME. On the other hand the increased proportions of NDF in the feed ascended the weight of liver and intestines and decreased gizzard weight. The light and semi heavy strains also experienced difference in quality and composition of tibia and femur bones. In growing phase the increased levels, up to 14.50%, of NDF in diets lowered the digestibility of nutrients and ME but it didn't impact the carcass quality, quality and composition of bone, feed intake and weight gain (Freitas et al., 2014).

A trial was performed on 360 male broilers, 240 were fast-growing strain

(Cobb 500) and 120 were slow-growing strain (Label Rouge), to find out the dietary effect of fiber on digesta, transit time and metabolism during 1st to 42nd days of their age. For this a completely randomized experimental design with a 3x2 factorial arrangement was framed, which was composed of 3 groups of birds (slow growing (SG); fast growing fed ad libitum (FGAL); and fast growing pair fed with SG broilers (FGPF) and two iso-protein diets containing 3100 kcal ME/kg low fiber diet (LFD) and 2800 kcal ME/kg high fiber diet (HFD) having 14% wheat bran and 4% oat hulls). The decreased ME was observed in HFD fed birds group on the other hand lower dry matter metabolizability (DMM) was found out that was probably due to the reason of short digesta transit time of these birds. The DMM was decreased with age while ME remained at same level and this might be due to ascended levels of feed intake as the birds grew old. The HFD was not better utilized in slow growing strains relative to fast growing strain (Krass et al., 2013).

Conclusion

Only a varying portion of fiber fraction is analyzed in conventional or old procedures to analyze fiber as CF and NDF so these are not better enough for the evaluation of fiber for poultry feeds. For scientific purposes, the enzymatic-chemical (Englyst or Uppsala) methods are more appropriate, whereas for routine analyses the AOAC method for total, insoluble, and soluble dietary fiber can be used. The tract of digestibility of NSP in chicken range between 0 and 0.4 and

generally reflects differences in solubility of the fiber fraction. Besides this the polysaccharides when stuck in cell wall, time available for fermentation and the lack of pertinent enzyme by the microbes residing in GIT are possible limiting factors for NSP degradation. The fiber in poultry diets sometimes provides less amount of energy which is due to the reason of its limited contribution in energy supply and less engagement with digestion; hence a moderate quantity of fiber (up to 50 g/kg) is productive for the development and health of digestive system which leads to improved nutrient digestibility and growth performance. A better understanding on the relation between specific fiber fractions and factors as GIT development, digesta retention time, and microbial colonization will help to develop nutritional strategies using specific fiber fractions to steer on GIT health and function to enhance performance, especially under suboptimal environmental conditions.

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Insects as Alternative Feed Materials for Poultry Nutrition

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ABSTRACT

Review

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As the population of this world is gradually increasing, the requirement of cheap and economic protein source rendered by poultry meat and eggs is also increasing. In near past, the insects have attained great attention as an important and alternative feed source to substitute raw materials for animal nutrition and are considered good alternate for important ingredients. The insects, with estimated 1.5 to 3 million, are regarded as the most utilized species and among these are black soldier fly, yellow mealworm and domestic fly. Maggots are larvae of domestic fly have capability to grow on large scale of substrate and can recycle the waste into biomass rich in protein and fats. These insect species provide more sulphur containing amino acids and protein components for poultry birds. This review presents contemporary research studies of using insects, mealworms, grasshoppers, locust, crickets, katyids, black soldier fly, housefly, etc as an alternative feed stuff for poultry birds. However, there have been still technical, financial, regulatory and particularly legislative constraints in the European Union are there in order to smoothly utilize these insects on large scale as a substitute of feedstuff for the nutrition of monogastric animals.

Introduction

The human population has been constantly increasing along with the need of cheap protein source in the form of poultry meat. Therefore, the feed ingredients, necessary for poultry birds, from agricultural sources can decrease as well. The poultry production is thought to be comparatively eco-friendly in respect to other livestock animals. Throughout the world the poultry production is exponentially increasing and this requires high amount of protein contents necessary for optimum production in the form of eggs and meat (Hossain and Blair, 2007). The plant-

based protein sources for poultry production e.g. various cereal by-products, legumes, rape seed, soybean meal, etc are being used extensively. However, the composition of amino acids of ingredients from plant meals has been not actually fulfilling the demand particularly in respect to the sulphur containing amino acids. The important protein source of poultry feed, fishmeal, has been still being used in poultry feeds but due to the market price hike, its usage is dwindling now-a-days diets. In this scenario, the alternative protein sources having almost same nutritive value should have replaced the existing protein sources, from vegetable origin,

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for optimum poultry production. So, the usage of insect-derived protein sources in poultry feeds in the next level of fulfilling the protein requirements of poultry birds and this phenomenon has already attracted much attention. In rural poultry production, we often see that the poultry birds when wandering outdoors they voluntarily pick and consume the insects of almost all life stages to fulfill their nutritional requirements. This, also, indicates that the insect feeding is natural for poultry (Bovera et al., 2016). Therefore, it is quiet rationale that utilising insects as an important protein will be alternative protein source in commercial feed manufacturing for poultry. In this regard, the ideal insects should be of short reproduction cycle, nutritious, provide high concentration of protein and sulphur containing amino acids and should be easy to rear for its intensive farming in order for its constant supply (Hossain and Blair, 2007).

Insects as nutritive material

Protein is present in nearly all life stages of insects (Bovera et al., 2016). So far, studies have been only focused on mealworm, maggot and pupae of the housefly, black soldier fly, and insect families of order Orthoptera which includes locusts, crickets, katyids, etc. However, insects of order Blattodea, like American, German, and Asian insects are also focused on (Helm et al., 1990). Makkar et al.(2014) and Sanches-Muros et al.(2014) mentioned the important information about the nutritive composition of various insects in their publications. The living insects may

contain average DM up to 30% which may be problematic during feed milling operations and this need to be standardized for processing to obtain standard required quality of raw materials. In this regard, the process of oxidation and microbial deterioration should effectively be considered (Awoniyi et al., 2004). Chitin is most abundantly present polysaccharide, found in the cuticle of many insects, invertebrates, nematodes, and, also, found in fungal cell wall (Kramer et al., 1995; Nation, 2018).

Up to now, the majority of research articles are published on the usage of meal of common house fly as an alternative feed source for broilers. The results depicted good effects on weight gain, feed intake and FCR when the dietary concentration of larvae of common house fly remained up to 25% DM (Pretorius, 2011). In this way it can be predicted that the larvae or maggot meal can become an alternative feed resource for the poultry. However the regarding the ME, small number of research data is present, while the values of 17.9 MJ/kg DM for turkeys, reported by (Zuidhof et al., 2003) and for broilers 14.2 MJ/Kg DM is documented by (Bovera et al., 2016). The larvae of black soldier fly as a replacement of soybean meal did not Show any considerable weight gain as well as lowering feed intake (Makkar et al., 2014).

Maggot meal in poultry feed

According to a study trial by Elizabeth and Adeniji (2007), the maggot meal could be substituted for

groundnut oilcake meal in poultry diets without posing any negative impact of DMI. In this regard, Hwangbo et al.(2009) supplemented the maggot meal in broiler chicken diets to test their production. They planned a study and added 0% (control), 5%, 10%, 15%, and 20% maggot meal to various treatment groups. Their diet was isocaloric and isonitrogenous. They found out that the differences in live weight gain and CP digestibility could be due to the presence of essential amino acids in maggot meal. The maize gluten level, in the control diet, was about 8% and this could have affected the low performance (Afshar and Moslehi, 1997). In another trial the results were not significant of supplementing maggot meal in diets to check different performance parameters of broilers (Awoniyi et al., 2004; Tegua et al., 2002). Awoniyi et al. (2004) conducted an experiment and mixed maggot meal at the concentration of 25%, 50%, 75%, and 100%, respectively, and found no significant effect on weight gain. However, impact of maggot meal was more pronounced when the birds became 3 weeks old possibly due to the fact that after three weeks of age the birds efficiently utilized the maggot meal (Awoniyi et al., 2004). Tegua et al. (2002) conducted a research trial to find the impacts of supplementing maggot meal in the feed to investigate various performance parameters in different physiological phases of broilers. The treatment diets contained maggot meal whoever there was no addition of maggot meal in the diets given to control treatment group. At the end of trial the results depicted in

respect of weight gain when 10% maggot meal was added in the starter phase of broiler chicks. This may be due to lower CP contents (22.65%), however weight gain was significantly higher when maggot meal was supplemented 5% and 15% in starter phase. In another trial, Tegua et al.(2002) added maggot meal 50% and 100% and could not found any significant results. However, live weight gain was better in 100 % maggot meal supplemented group. Okah and Onwujiariri (2012) added maggot meal at the concentration of 0%, 20%, 30% 40%, and 50% in the diets of broilers of 0-35 days old. The authors observed 50% added maggot meal was economically good and resulted in high performance as well as 25% addition gave better live weight, feed intake and weight gain in growing phase. In another trial performed on 50 weeks old layer hens, maggot meals was added at the level of 50% gave no negative effects of egg production and egg shell strength while 100% supplementation was fatal for laying hens (Agunbiade, 2007). Akodiete et al. (1998) replaced fish meal with maggot meal and found no negative effects on performance characteristics of layer hens and suggested that maggot meal could be used as an alternative feedstuff for layer hens. However, they found significant declines in respect of egg yolk cholesterol and calcium concentration with the increased level of maggot meal supplementation. Awoniyi et al.(2004) observed no significant effect on dressing status of breast and muscle weight when they added maggot meal in the diets of broilers. Their results were similar to that of Tegua et

al.(2002) and different from that of Hwangbo et al.(2009).

Legislation on insect usage in poultry

Insect meal can be used as an alternative feed resource in poultry nutrition but there are some obstacles which are prohibiting the addition of this sources in poultry as well as livestock feeds because these are defined as processed animal protein (PAP) (Council, 2009). The insects are divided into category 3 materials which designate these items although are fit but should not be meant for human consumption. Council (2009) and EC(2001) banned insect feeding to farm animals, approval is given to feeding insects to aquaculture species. Insect feeding of poultry and pigs will be allowed in near future after reconsideration. In this regard a dossier is made public recently in which all the relevant information is mentioned (EFSA, 2015). The obstacles include a constant and considerable supply of insects is not always available for this purpose, prices of insects and their meals are very high making it economically not viable to use insect for this purpose. The way out of this is the identification and industrial level massive production of most suitable insect species which not only are economically viable but also contain required amount of nutritional significance. For the industrial level production of these insects, the pre-requisites should be development of state of the art automated system for rearing, harvesting and post-harvesting procedures (Rumpold and Schluter, 2013).

Studies conducted

One trial was conducted to replace black soldier fly (BSF) larvae meal with soybean meal (SBM) and mixed in napier grass to check various performance parameters. Two different age categories of BSF larvae were added: larvae of BSF 1 were of one week old while larvae of BSF 2 were two weeks old. The dietary treatments were formulated as follows on dry matter basis: T1 included 100% napier grass; T2 was composed of 60% napier grass + 40% SBM; T3 contained 60% napier grass + 40% BSF 1; T4 was comprised of 60% napier grass + 40% BSF 2; T5 had 60% napier grass + 20% SBM + 20% BSF 1; and T6 was composed of 60% napier grass + 20% SBM + 20% BSF 2. The samples were subjected to check their chemical composition and, then, incubated *in vitro* by mixing buffer rumen fluid for 48 hours at 39°C. EE, NDF, ADF, insoluble CP contents of treatment 3 to 6 was increased when BSF 1 and BSF 2 were supplemented. However, treatment 3 and 4 significantly decreased ammonia concentration of rumen, *in vitro* digestibility of DM and OM as compared to those parameters of treatment 2. There was significantly lowered methane gas production detected as well as *in vitro* lower nutritional value was observed when diet mixed with BSF was given as compared to that supplemented with soybean meal. However, the low level of methane was detected when diet composed of BSF 1 was given as compared to that which had

BSF 2 (Jayanegara et al., 2017).

The trials conducted in near past have shown the importance of using maggots in poultry diets to increase their overall performance. The impact of maggot addition in feed was conducted to evaluate meat standards and growth of broilers. For this, 600, day old broiler chicks were randomly divided into 5 groups which were composed of 40 replicates each containing 3 birds. The broilers were given the diets mixed with 5%, 10%, 15% and 20% maggots. The overall growth of broilers was affected by amino acids; high protein (63.99%), essential amino acid content (29.46%) and high protein digestibility (98.50%) of the maggots which increased live weight gain but didn't affect FCR. The weight gain of 4-5 weeks old broilers was significantly increased when 10% and 15% maggots were added in diets, resulted in significantly increased dressing percentage, breast and thigh muscles was observed that might be due to increased levels of lysine and tryptophan. However, fats of liver and abdomen, meat color and the CP contents of breast muscle remained unaltered (Hwangbo et al., 2009).

Another experimental trial was performed to find out the effect of adding maggot meal in the diet of broilers and for this 120, day old broiler chicks were randomly divided in different treatment groups. Maggot meal was supplemented at the rate 0%, 40%, 50% and 60% to the treatment groups namely A, B, C and D respectively. In group D, body weight gain, dressing percentage, ME were significantly higher, while FI and FCR were

significantly lower as compared to group A and B. On the other hand significantly higher digestibility of DM, CP, EE and ash was observed, and CF was significantly lower in group D as compared to that of group A. the final findings showed that 60% soybean meal could safely be substituted by maggot meal during the starter phase (Khan et al., 2018).

An experiment was performed on 150 days old broilers to check the effect of replacing silkworm caterpillar meal (SCM) with fish meal (FM) on growth and digestibility of nutrients in starter phase. The broilers were divided into 5 treatment groups containing 30 birds each and each treatment group was composed of two replicates comprised of 15 birds each. There were 5 iso-caloric and iso-nitrogenous diets formulated in such a way that diet 1 (control) had 100% FM: 0% SCM whereas rest of the diets, 2, 3, 4 and 5, contained 75% FM: 25% SCM; 50% FM: 50% SCM; 25% FM: 75% SCM and 0% FM: 0% SCM, respectively. No significant difference was observed regarding FI (29.51 - 31.66 g), body weight gain (16.56 - 19.03 g), FCR (1.60 - 1.72), protein efficiency ratio (PER) (2.67 - 2.77) and nutrient digestibility of the chicks between different treatment groups. The trial was economically good as cost per kg weight gained slowly decreased with ascending dietary level of SCM. It was concluded that SCM meal could be an economic and effective alternative feedstuff in formulating diets for starter broiler chicks leading to increased economic benefits (Ijaiya and Eko, 2010).

Conclusion

The substitution of insect meal in poultry diet can boost the performance and health of broilers as well as it is economically viable by minimizing the cost of buying feeds. However, the degree of impact depends on nutrient profile of insect being used in diets. In future, more studies should be conducted to determine the level at which replacement is done and to explore other insects being viable on growth performance for poultry, on economic perspective for its mass applicability and on health perspectives for being used for human consumption.

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Role of Cationic and Anionic Feeding in Farm Animals

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ABSTRACT

In animal diets, the cations and anions are supplemented in their respective and required proportions. This cationic and anionic feeding is of great importance in maintaining the equilibrium between acids and bases of animal body and, also, the osmotic pressure of body fluids. This maintenance is defined by three important factors; required and relevant balance of ions in diet, acid production and renal function. This review article elaborates the role and significance of cations and anions in animal nutrition particularly in preventing a very important disease of milk fever in dairy cows just after parturition. The cations and anions play very significant and crucial role in equating the acid base equilibrium as well as osmotic pressure in the body. There have been a lot of researches conducted on the topic of pathogenesis of milk fever in cows. To conclude, K ion is the most important to predispose the cows for milk fever. One way to counter the effects of K ions is to increase the anionic concentration of diet but it has also some detrimental effects. This can be done by balancing dietary cationic anionic difference.

Introduction

The term cationic and anionic feeding or dietary cation-anion difference (DCAD) means two kinds of cation [potassium {K} and sodium {Na}] and two kinds of anion [chlorine {Cl} and sulfur {S}]. This phenomenon can also be defined as sum of total cations (Na and K) is subtracted from the sum of total anion (Cl and S) and divided by 100 g of DM. Milliequivalents (mEq) is the unit which determines the balance between the concentration of cation and anion of diet. Mathematically it is narrated as below (Dishington, 1975).

$$(\text{Na} + \text{K}) - (\text{Cl} + \text{S})/100 \text{ g DM}$$

For example, from the above mentioned

equation;

$$(65.25 + 281.6) - (56.4 + 124.8) = \text{mEq/kg}$$

$$(346.85) - (181.2) = +165.65 \text{ mEq/kg}$$

Guidelines

- If the answer of calculation is + 200 mEq/kg DM or more then lower the K forage in diets of dry cow. Sometimes anionic salts are added in diets to reduce feed intake but this can be problematic because it can cause milk fever, metritis, ketosis and displaced abomasums.
- In transition period of cow, the DCAD should be – 100 mEq/kg and – 200 mEq/kg of DM just to counter the risk of milk fever and low blood Ca level.

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- Consecutively examine the urine of cow while using the anionic products because urine pH is an effective indication of the affectivity of anionic products. For Holstein, the urine pH should be 6.0 – 6.5 and, for Jerseys, the urine pH should be 5.5 – 6.0.
- To make ration more palatable, the anionic products should be slowly introduced in the diets of dairy cows. (Stewart, 1983)

To understand this phenomenon first of all we need to be familiar with the chemistry of anion and cation. For dietary point of view, important cations are sodium, calcium, magnesium, potassium while important anions are sulfur, phosphorus and chloride. The cations or anions, bearing positive and negative charges respectively, are the types dietary electrolytes added in feed. These ultimately influence the acid-base balance and calcium metabolism (Stewart, 1983).

The term “electrolytes” is commonly used in animal nutrition and primarily refers to the negative (Cl⁻) and positive ions (Na⁺, K⁺). These monovalent ions play their important role in tissue protein synthesis, maintaining the balance of homeostasis, electric potential across the plasma membranes, osmotic pressure, enzymatic reactions and acid base balance. In laying hen farming the birds undergo stress particularly when they are in cages and acid base balance is affected which leads to metabolic alkalosis (when cations are increased) and acidosis (when anions are increased). Although this electrolytic requirements can be fulfilled by supplementing organic

ingredients and salts but the balanced cationic and anionic diet not only fulfills the electrolytic demand but also ensures optimum growth (Borges et al., 2003).

Dietary cation anion difference (DCAD) is a way to reckon the status of acid and base in the diets containing different levels of cations and anions. The diets given to cows before parturition containing low levels of cations and higher levels of anions sensitizes the parathyroid hormones which ultimately leads to low incidence of hypocalcaemia the mineral salts and acids are added to the diets just to tilt the acid base concentration of cows to acidosis and if the anions are added the the metabolic position can be achieved quickly (Goff, 1998).

Feeding anions more than 250 mEq/kg of feed will result in alkalosis or acidosis and other health related problems in dairy animals. The concentration of HCO₃⁻ ions and blood pH is increased if the Na ions, without (Cl⁻), are supplemented and similarly the concentration of HCO₃⁻ and pH is decreased if the Cl⁻ ions, without Na, are given to the animals with feed. The electrolyte balance is changed from 17.4 to 12.1 mEq/kg of feed if soybean is replaced with fish meal in feed (Moncin, 1981).

In a study conducted by (Whiting et al., 1991), it was reported that in the stressful condition, a different response was given by broiler and layer, because they differ in their requirement and response to electrolyte treatment. So an aqueous solution of electrolyte positively affected growth, performance and production and decreased the mortality

in broiler chickens.

The feed deficient in K ions enhances the lysine accumulation in tissues which result in impaired metabolism of lysine and methionine and which ultimately decreases the growth and production performance of poultry birds (Leeson and Summers, 2001). The required and specific concentration of cations and anions in feed can balance the electrolyte differences in the body.

A study was conducted to evaluate the impact of various DCAD levels with different dietary proportions of roughages (60-40%) and concentrates (40-60%) on metabolism of the weaned Holstein calves which were fed diets having DCAD level of -100, +200 and +400 mEq/kg of DM (Saladini et al., 2012).

Potassium being the main intracellular cation and is the 3rd most important and abundant element of living body and involved in many biochemical processes including acid base equilibrium, osmotic pressure regulation, glucose and amino acid absorption, development of membrane potential across the plasma membranes (Leeson and Summer, 2001) who also came to the conclusion that 250 mEq/kg was pertinent level of electrolyte balance for optimum growth in poultry birds.

The basic mechanism of DCAD was studied in chicken by Mogin 1980 (Moncin, 1981) came to the conclusion of description of electrolyte balance with the help of a formula {sum of positive ions (Na and K) minus sum of negative ions (Cl)} involving the important electrolytes.

In tropical countries, dairy

animals are subjected to hot and humid environment particularly during summer seasons which results in low feed intake and high water intake (Sano et al., 2010; Rhoads et al., 2009; Salama et al., 2014). To manage heat stress, the animals reduce feed intake and give gaps between two consecutive meals by increasing meal's mass. This reduction in feed intake is probably to bring down the metabolic heat production (Alam et al., 2013; Shiao et al., 2011; Kadzere et al., 2002). In this scenario, dietary cationic and anionic feeds are supplemented to small and large animals to increase water and DMI (Tucker et al., 2010) which overall improves the rumen function and fermentation (Sharif et al, 2010).

The low concentration of Ca in blood, hypocalcemia, is a critical issue of cows within first 24-48 hours after parturition and sufficient amount of calcium is required for the cow to survive and remain stable in this critical time period (Goff, 2008). The hypocalcemia predisposes the cow to other ailments e.g. RFM, metritis, dystocia, uterine prolapse (Degaris and Lean, 2008; Grohn et al., 1989). The DCAD influences the metabolism and acid base balance and in this way cow attains good health and optimum productivity (Sanches, 2003). The reduction of DCAD when the anionic salts are increased can help in preventing and treating milk fever (Chan et al., 2006). The increased concentration of anions leads to accumulation of more hydrogen ions that induce metabolic acidosis and the this anionic diet supposedly increases resorption of bone,

level of calcium in blood and the absorption of calcium from gut (Chan et al., 2006).

Studies conducted

An experiment was conducted on 12 early lactating buffaloes to observe the effects of anionic and cationic feeding, acidifying diets, on the parameters of nutrient intake, involution period, follicle growth, ovarian activity and uterus tonicity. The experimental animals were randomly divided in 4 treatment groups each containing 3 buffaloes. The isocaloric and isonitrogenous diets were made having -110, +110, +220 and +330 dietary cation anion difference mEq/kg DM and the groups were named as A, LC, MC and HC respectively. Results showed increased DMI with the increase in DCAD level whereas maximum and minimum DMI was seen in groups fed HC and A respectively. HC diet fed buffaloes showed complete uterus involution, presence of corpus luteum, higher ovarian activity and tonicity when palpated as compared to other diet fed groups. At the end of trial it was concluded that high DCAD diet (HC diet) posed good effects on buffaloes (Sharif et al., 2012).

A research trial was performed to record the impact of different dietary electrolyte balance (DEB) on the parameters of egg weight, egg shell quality, litter dry matter, bone ash and some blood parameters of 216 Lohmann-Brown laying hens. In the treatment group 1, DEB was added 80 mEq/kg with NH_4Cl , in treatment group 2, 256 mEq/kg with NaHCO_3 , in treatment

group 3, 330 mEq/kg with NaHCO_3 and KHCO_3 whereas 170 mEq/kg DEB was supplemented the control group. The results showed that dietary alkaline supplementation partially corrected the metabolic acidosis and excessive chloride ions negatively affected the egg shell. However, a moderate quantity of DEB (256 mEq/kg) improved eggshell quality and maintained acid base balance (Gezen et al., 2005).

In a research trial, two experiments were performed on 24 male weaned Holstein calves to observe the impacts of DCAD and roughages on the metabolism of calves. In the first experiment, the calves were supplemented with DCAD of -100, +200 and +400 mEq/kg of DM having 60% roughages and 40% concentrate whereas in the second experiment, the animals were fed with the same DCAD but with 40% roughages and 60% concentrate. The results showed an increase in blood urea nitrogen according to the increased DCAD in the groups where 60% roughages was fed. It was also noted that change in roughage to concentrate ratio affected the metabolism of calves (Saladini et al., 2012).

A research study was performed on 10 cross bred goats in the period of before parturition under high temperature to observe the effects of DCAD feed on eating patterns, water intake and urination patterns. The treatment diet protocol was (DCAD 22.8 mEq/100 g DM) and high DCAD (DCAD 39.1 mEq/100 g DM) and the diets were composed of 44% corn silage and 56% concentrate. The trial was carried out in hot and humid condition so

it led to increased respiration in groups but it was significantly higher in DCAD group. The high DCAD increased feed and water intakes almost 8 weeks after parturition. Significantly bigger meal size and length were recorded in DCAD group (Nguyen et al., 2019).

A trial was conducted on 24 cows which were near to parturition and impacts of DCAD were evaluated on acid base balance, health status, lactation performance, plasma and urine mineral concentration. Both of the group composed of 12 cows each was fed with treatment diet contained either -100 DCAD or +100 DCAD for 60 days before parturition. Both, cationic and anionic groups were fed + 200 DCAD and +400 DCAD respectively for 60 day after parturition. Before parturition the reduction in DCAD led to low DMI, urinary and blood pH, concentration of Na and K in urine was increased. After parturition the +400 DCAD improved the milk fat and total solid concentration, and concentration of Na, K and pH of blood and urine was also increased and the DMI was also increased in this group. Parturient abnormalities was recorded, however, time taken by placenta to be expelled was reduced (Razzaghi et al., 2012).

Hypocalcemia

Hypocalcemia or low concentration of calcium in blood, also called milk fever, is a critical and very important disease of dairy animals which are near to parturition. This can happen at the time of calving when more amount of Ca is required for colostrum production and the cows become unable

to fulfill this need. This leads to low concentration of Ca in blood that leads to hypocalcemia or milk fever. The most dangerous type is clinical milk fever while the cows which survive exhibit more chances of retained fetal membranes, mastitis and displaced abomasums (Curtis et al., 1983; Grohn et al., 1989). The first 24-48 hours after parturition are most important and crucial because the cows are more prone to milk fever in this time. Not only hypocalcemia the risk also increases for other ailments as well e.g. displaced abomasums, retained placenta, metritis, mastitis, ketosis, etc (Curtis et al., 1983). By lowering the DCAD with the help of dietary acidity or by anionic salts was proved to be helpful in preventing hypocalcemia. The anionic feeding resulted in almost no cases of milk fever compared with 47% cases of hypocalcemia when cationic feeding was fed to cows (Block, 1984; Oetzel et al., 1988; Pilbeam et al., 2000).

Conclusion

The cations and anions play very significant and crucial role in equating the acid base equilibrium as well as osmotic pressure in the body. There have been a lot of researches conducted on the topic of pathogenesis of milk fever in cows. To conclude, K ion is the most important to predispose the cows for milk fever. One way to counter the effects of K ions is to increase the anionic concentration of diet but it has also some detrimental effects. This can be done by balancing dietary cationic anionic difference.

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Looking at Some Animal Feeds with Respect to Halal Concept

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ABSTRACT

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In halal food supply chain, animal feed is considered as the initial critical control point in ensuring the halal integrity of animal chain. The uncertainties in the halalness, quality, and safety of the animal feed may consequently affect the halal and acceptable status of the halal food products. The use of pig intestines and carcasses as feed for cultivated fish by irresponsible farmers has led to frustration and anger among the Muslims community. Such practices have created uncertainties of the legality of such fish due to non-concrete solution to this subject matter. The present review utilizes qualitative approach in which data is collected through library research. The findings of this library study could be made as reference or guidelines to the authoritative bodies and policymakers in developing legal provision for the production, importation, manufacture, sale and use of halal feed, which shall be based on the Islamic principles. Muslims do not consume non-halal food. For this reason, farmers or related sector should collectively take the responsibility to ensure the quality, safety and halal integrity of animal production from farm to fork to sustain halal food supply.

Introduction

It is certainly the cattle and sheep that feed off najasaat (filth as defined by sharia). There is controversy over chickens and whether the ruling of jallalah applies to them. Ibn Hazm argued they don't because they are known for eating filth and they were not prohibited. The majority indicated that the ruling is general and applicable to all edible meat, as Ibn Hajar indicated in Fath al-Bari. There is also another matter worth noting, which is that the animal is considered jallalah only if the majority of its food is najis, as Ibn Qudamah reported from the Hanbalis in al-Mughni, and it is also the Hanafi position. According to some, it

becomes jallalah only if the animal's odor changes and that position was ascribed to the majority by Imam an-Nawawi.

The majority considered the consumption of jallalah to be makrooh, notharam. This position is held by the Hanafis, most Shafi'is, and some Hanbalis. The Malikis don't even dislike it. Some, including some shafi'is and Hanbalis consider it haram. The proof is on the side of this latter group because of a report by Ahmad and Abi Dawood, from Ibn 'Umar, that the Messenger of Allah (blessings and peace be upon him) forbade eating jallaalah and [drinking] its milk. There are other reports from other companions as well.

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The concept of jallalah

Discussion with regard to animal feed and feeding will directly relate to the concept of Jallalah. From the Islamic perspective, al-jallalah refers to the category of animals that eat on filth and impurities (Ibn Manzur, 1990), consistently, or regularly being fed with such feed, which consequently resulted in changes of the animal's smell, taste and color of the meat. Reference (Qal'ahji, 1996), in his book *Mu'jam Lughah al-Fuqaha'* has defined al-jallalah as animal that most of its diet is from filth. The term al-jallalah came from the Arabic word 'jalla' which means contaminant or impurity (Ibn Manzur, 1990) and the contaminant also included the excrements of other animals (Jamaludin, 2011).

According to Hanafi school of thought, al-jallalah refers to animals that survive on eating only filth and impurities, thus changing the smell of their meats (Thawilah, 2012). The majority of leading schools (Hanbali, Syafi'i, and Maliki) however conclude al-jallalah as an animal which most of its diets are from filth but also consume other elements as food. The strongest opinion on the matter is the opinion given by the Shafi school of thought, who had connected the consumption of the impurities with the present of unpleasant smell and other physical changes of the meat, sweat, taste, and color, which therefore indicate that the animals are categorized as al-jallalah (Nawai, 1990). This is, therefore, understandable that al-jallalah refers to animals that live with the consumption of filth and impurities which as a result produce unpleasant smell and changes to its meat.

Muslim jurists have a different opinion on animals that fall into the category of al-jallalah as whether it is only limited to halal animals with four legs (al-An'am) or generally applicable to all animals including poultry and aquatic animals. The Hanafites had restricted this category among the four-legged animal such as camel, cow, and goat. Based on the method of qiyas, all consumable animal included fish can be classified as al-jallalah due to the same reason (illah); the changes in smell, color and/or taste due to their habits of eating filth (Al-Shafi'i, 1996). Reference (Syafi'i Hadzami, 2000), sharing the same view, considered that all animal including camel, cow, goat, chicken, fish, and other edible animals can be regarded as al-jallalah if they meet the criteria specified earlier.

It is, however, necessary to note that animal can only be considered as al-jallalah when most of the nutrition they consumed are impure and there are noticeable changes in these three criteria; the smell, taste or color of the meat and/or by-products or the sweat of the animal (Al-Akiti, 2003). This is similar to the opinion of (Nawai, 1990) who states that the classification of the animal as al-jallalah is attributed not to the amount of impurities consumed, but by the changes in the smell and stench of the animal. This is due to the fact that some animals ordinarily eat certain amounts of filth or their own droppings, and that does not make any changes in their meats and smell, which is the main legal reasoning for the animal to be regarded as al-jallalah. According to Al-Akiti (2003), any cleaning or cooking methods on the

meat of al-jallalah will not remove its legal ruling of makruh, unless the animal recover to its normal state by quarantine and be fed with uncontaminated feed before slaughter.

Animal feed is one of the essential elements in the production of halal food products. In choosing animal-based halal food products, a Muslim should be concerned not only about the sources of the animals and the slaughtering process, but also the way the animals were raised and fed. This is due to the emerging issues related to animal feeding, in which animals were being fed with unsuitable, unnatural feed, mainly because of the so-called 'economic considerations'. The improper feeding practices are believed to be the reason for the spread of Mad Cow Disease (Bovine Spongiform Encephalopathy) which has infected human beings through infected meat consumption (Brown et al., 2001). Hence, Muslim concern for eating halal food must also extend to a concern for eating food from animals that are fed with halal and safe feed.

Many studies had been conducted on the aspect of management, safety and quality of animal feed. Some of these studies focus on management and assurance system applied in the production of animal feed (den Hartog 2003) while other studies identify the contaminations and hazards associated with feed (Kan and Meijer, 2007; Sapkota et al., 2007; Maciorowski et al., 2007). Latest studies on animal feed in Malaysia are concentrated more on the potential use of locally available feed ingredients (Zahari and Wong, 2009; Ng, 2003) and detection of contaminants in animal feed

(Reddy and Salleh, 2011; Khayoon et al., 2010; Afsah-Hejri et al., 2013). These studies, however, do not specify the importance of halal in animal feeding and feed production.

According to Lodhi (2010), animal feed and fodder are among the Halal Control Point (HCP) in agricultural production systems that need to be evaluated in the halal supply chain to preserve the halalantoyyiban integrity of the animal-based products from farm to fork. Omar et al. (2012) in their research had identifies five Halalan Toyyiban Critical Control Points (HTCCP) in the poultry supply chain which include feeding and feed sources as the third HTCCP. Findings of this research suggested that the animal feed sources and the livestock should be halal certified to preserve the halalan toyyiban status of the halal poultry. Bonne and Verbeke (2008), on the other hand, have identified Halal production as the first Halal Critical Control Point (HCPs) to be evaluated in the halal meat chain and underlined the importance of quarantine process for animal that feed on filth and other animal proteins and by-products.

The practice of feeding animal with animal waste and animal by-products is a common practice in agriculture and has been observed in many countries including Malaysia and the Asian countries (Zaidah et al., 2011). This agricultural practice has raised an Islamic legal issue and created uncertainties among Muslim community due to non-availability of clear answers and solution to this subject matter. This review is, therefore, attempts to scrutinize the Islamic perspective on the use of such

feed for animals produced for human consumption, particularly the Muslim communities and the importance of quarantine process for contaminated animal by non-halal feed to fulfill the Shariah requirement of halal.

Islamic rules on non-halal feed

The issue of feeding animals with non-halal, or occasionally term as najis materials is not a new phenomenon. In fact, it has long been discussed by Muslims jurists, whom have divided the discussion into two categories; feeding the edible and the non-edible animals. According to Hammad (2004), the non-edible animals are permitted to be fed with non-halal feed according to the Hanbalites and Malikites. The opinion of this group of scholars are based on the fact that animals such as hunting dogs and eagles, and other non-edible animals are not meant for consumption, thus there is no harm to feed them with non-halal feed. Nevertheless, Muslim jurists express different opinions with regard to issue of feeding non-halal feed to animals that can be eaten. According to Hanbali school of thought, animals are permitted to be fed with impurities and filth, if the meats and milk are not to be consumed in a short period of time (Hammad, 2004). This opinion is based on the typical practice in farming, in which livestock are left freely grazing forage and somehow may also eat some filths and impurities in the pastureland.

The Fatwa (Islamic verdict) from Kelantan and Selangor however differ from the above point of view in the sense that these fatwa disallowed feeding aquacultured fish with feed derived from

najis (filth) and animal waste as a step of Saddu zarai' (preventing vices), besides for the purpose of maintaining the sensitivity of Muslim community in the country. This fatwa is supported with the fatwa from Indonesia which prohibits the production and trading of animal feed that contain swine elements or other non-halal animals (Majelis Ulama Indonesia, 2012). The fatwa of Brunei, on the other hand, discourages the practice of feeding animals with filthy feeds and selling those animals without proper quarantine process (Abu, 2004). However, according to Hammad (2004), based on the accepted theory of Istihalah, it is not an offence from the perspective of Shari'ah to feed edible animals with feed which contains impurities. The animal is, therefore, permissible to be consumed by Muslim. It is, however, important to note that the permissibility of such practice only applicable, provided that the animal is not being fed only with such feed in its entire lifetime, and that, there should be a suspension time for the animal to recover its body from the impurities.

Evidences from the Qur'an and hadith

The term al-jallalah is neither mentioned nor stated directly of its prohibition in the Qur'an. However, there are many verses in the Qur'an that directly stated about the prohibition against the consumption of pork, carrion, blood and intoxicant for Muslim, such as in al-Baqarah, verse 173. He hath only forbidden you dead meat, and blood, and the flesh of swine, and that on which any other name hath been invoked besides that of Allah. But if one is forced by necessity, without willful disobedience,

nor transgressing due limits, then is he guiltless. Allah is Oft-forgiving Most Merciful.

The substances mentioned in the above Qur'anic verse are considered as najis and harmful, thus forbidden to be taken as food and drinks in normal daily condition. The use of some of these substances (swine proteins and by-products, meat leftover from slaughterhouses, carcasses, urine and manure) as raw materials in animal feed production may indirectly affect the lawful status of the animals being fed with this feed. The condition is even worse if the traces of the contaminants are still remained in the animal body even after slaughter or prior to consumption. The prohibition of eating the meat and milk of aljallalah also appears in Kitab ad-Dahaya (Sacrifices) in the hadith number 4452 and 4453. Based on the collation of these hadith, it can be understood that the Prophet (P.b.u.h) prohibited the use of al-jallalah for the purpose of sacrifices and slaughter for consumption. Besides the clear prohibition of al-jallalah in the hadiths, consideration should also be given to the possibility of harm that can be caused by feeding animal with unnatural and inappropriate feeds. In the case of fish being fed with non-halal feed, those fish may be affected in quality and may be unsafe for consumption due to contamination by the sewage and waste water of the swine. Islam completely forbids anything that lead to harm or can cause harm. This is in line with the Islamic principle 'Harm shall be removed', in which harmful must be avoided whenever possible. Therefore, it

is imperative to state that animal should be fed with suitable nourishment in accordance with the nature of their diet and should not be fed with any element that can be considered as najis from the Shari'ah perspective.

Opinions of muslim scholars

The main issue debated among Muslims scholars related to animal feed is the Islamic position and legal ruling of animals that eat on non-halal feed for a living. This issue has been discussed by classical Islamic Jurist in Chapter of 'Legal ruling on eating al-jallalah' (Nawawi, 1990). In determination of the legal ruling of eating al-jallalah, there are three main opinions of the jurists. The first opinion is mubah (permissible) while the second and third opinion is haram and makruh. Muslim jurists such as Hassan al-Basri and Imam Malik considered it as mubah (an action as neither forbidden nor recommended) to be eaten, provided that the animals undergo certain quarantine period, until the animal return to normal condition.

These Muslim jurists permitted the consumption of meat, milk and eggs of animal that being fed filth based on the argument that animal could not be regarded as najis due to the habits of eating filth. This is supported by the fact that Islam never regards an alcoholic as a person who had defiles the whole body with alcohol and that non-Muslim who consume non-halal foods is not physically najis (Hammad, 2004).

The Hanbalite majority position in respect of al-jallalah is haram (prohibited), which is also seen from an opinion from Shafi'ite scholar. The

opinion is based on the evidences from the hadith that had been discussed earlier. The proponents of this view use the literal meaning of the hadith to support their opinion on the illegality of jallalah (Al-Zuhayli, 1985). These Islamic jurists insisted that the prohibition of Jallalah as recorded in hadith narrated by al-Tirmidzi is referred not to the physical (zat) of the animal, but the reason by which made the animal become al-jallalah. Their argument stands on the rationale that even clean and halal feed consumed by the animal will become najis in the stomach and therefore should not be taken as a reason to include this as prohibited.

Some scholars from Shafi'i and Hanbali schools opine that it is makruh to eat the meat if there is noticeable unpleasant smell. According to al-Shafi'i, al-jallalah can only be eaten after the animal changes its non-halal type of feeding to clean and natural feeding habit (Al-Shafi'i, 1996). This is consistent with Nawawi who said: "Kids growing up drinking milk of a dog is legally regarded as al-jallalah" (Nawawi, 1990). Majority of scholars are agreed upon the ruling of makruh against riding the aljallalah animals based on the previously mentioned hadith. Al-Shafi'i proposed that it is abominable to ride al-jallalah without liner or blanket due to the possibility of direct contact with the animal's sweat. Hanafites also held this view with a higher level of rigidity, which is totally makruh without exception. These jurists cited the hadith under discussion as evidence for their argument. The reason for the prohibition is similar to that given by Al-Shafi'i, besides as a

measure taken for prevention of disease from the animals to human through direct physical contact.

Conclusion

From the above account, it is apparent that Muslim should not only concern on the halal aspect of food products but should also extend his consideration on halal animal feed utilization and feeding of animals used for halal food production. This is because, from the Islamic perspective, halal animal should not be fed with non-halal feed, or feed derived from porcine and najis materials as this may eventually turn the meat to become non-halal for Muslim consumption. Despite the existing fatwa from Malaysia, Indonesia and Brunei that have prohibited the consumption of al-jallalah and the non-halal feeding practices, no alternative solutions are provided by these institutions to be applied by the Muslim consumers, fish traders, wholesalers, farmers and feed millers in addressing this issue. The adoption of al-istibra' or quarantine process, based on the opinions and guidelines given by the Islamic scholars is seen as a good solution. Proper quarantine process should be conducted as purification method to remove contaminations from jallalah animal to guarantee the halalantoyyiban aspect of the animal-based products. Nevertheless, certain prerequisite conditions need to be established for this process. The inclusion of this alternative solution as reference and guidelines to those involved in the animal feed and livestock industry shall be a judicious effort in preventing

Muslims from consuming non-halal food. Besides, those involved in the animal feed industry, including farmers should collectively take the responsibility to ensure the quality, safety and halal integrity of animal feed through the implementation of Halalan Toyyiban Critical Control Points evaluation along the feed supply chain from farm to fork, good animal feeding practices at the farm level, and good manufacturing practices during the manufacturing process and distribution of animal feed and inputs.

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Omega-3 Fatty Acids and Their Health Potentials to Human Life

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ABSTRACT

Fish oil supplementations play major roles in the biological processes, essential dietary omega-3 fatty acids. The lower consumption of EPA and DHA are suggested to be in connection with improve inflammatory activities likewise as defective fetal development, overall cardiovascular health, and risk of formation of Alzheimer's Disease (AD). Fish oils from salmon, mackerel, herring and sardine species are the only source that is very rich in EPA and DHA. These can be obtained from one whole fish about 1.5 and 3.5 g. Intake of 1 g of fish oil capsule per day could supply almost 300 mg omega-3 fatty acids. Daily consumption of n-3 PUFAs is around 100 mg. Omega-3 fatty acids which are EPA and DHA are regarded as dietary fats that consists variety of benefits to health. EPA and DHA are molecular antecedents to a family of eicosanoids which possess anti-inflammatory, antithrombotic, antiarrhythmic, and vasodilatory properties. LA is transformed into AA, and it's the antecedent to a separate category of eicosanoids which have proinflammatory and prothrombotic properties. This contention is biologically essential due to the fact that eicosanoids are obtained from these two essential fatty acids that are n-6 and n-3. EPA and DHA have a directly contrary effect. The growth of fetus brain experience acceleration in the second trimester of pregnancy and this increase in growth continues throughout the first year of life until several years. The quantity of omega 3-fatty acids required of pregnant women is higher over normal women, as this will help to support fetal growth, especially of the brain and eyes.

Introduction

Fisheries products consist of protein, healthful nutrients like vitamin D, selenium, iodine, long-chain omega - 3 polyunsaturated fatty acids. The most essential and active omega-3 fatty acids are eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). It is important to get them sufficient quantity for the proper functioning of the system (Mahaffey et al., 2011). EPA and DHA are the antecedents of various metabolites which are strong lipid

intermediary, considered by many types of research to be useful in the precaution of various diseases. It is very demanding to get an adequate quantity of EPA and DHA from food alone (Serhan et al., 2008). Fish oil supplementation play major role in the biological processes, especially omega-3 fatty acids (Leaf and Hatcher, 2009; Mann et al., 2010). The lower consumption of EPA and DHA are suggested to improve inflammatory activities likewise as defective fetal development, overall cardiovascular health, and risk of formation of

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Alzheimer's Disease (AD) (Swanson et al., 2012). Fish oil from salmon, mackerel, herring and sardine species are the only source that is very rich in EPA and DHA. Intake of 1 g of fish oil capsule per day could supply almost 300 mg of omega-3 fatty acids. Consumption of n-3 PUFAs is around 100 mg/day (Meyer et al., 2003). Omega -3 fatty acids which are EPA and DHA are regarded as dietary fats that consists variety of benefits to health (Su et al., 2008). Long-chain PUFA are absorbed in several parts of the body with inclusion of cell membrane (Lazzarin et al., 2009) and contribute to anti-inflammatory activity and in the thickness of cell membrane (Smith et al., 2010). The two important omega-3 fatty acids are crucial for appropriate fetal growth and healthy aging. They are also used for the treatment of dry eyes and glaucoma (Dunstan et al., 2007). According to Das (2004), EPA and DHA have a useful outcome in glomerular disease, which attributes to the outcome on the pro-oxidant and antioxidant degree and EFA metabolism. PUFAs is, also, utilized for age-associated macular deterioration (AMD). This is a very regular condition in elderly people which result in critical sight complications (Furuhjelm et al., 2009). The intake of long-chain n-3 PUFAs, EPA, and DHA have shown physiological advantages on blood pressure, heart rate, triglycerides, possibly inflammation, endothelial function, and cardiac diastolic purpose (Burr et al., 1989; Ristić-Medić et al., 2011). The growth of newborn and little children are greatly influenced by LA and ALA. The lowest consumption

levels for important fatty acids for the prevention of deficiency manifestation have been evaluated at 2.5% ELA and 0.5% EALA (Kostecka, 2015). According to epidemiological studies and randomized controlled tests of coronary heart disease (CHD) activities, PUFAs are needed for reducing of LDL and total cholesterol concentrations, improving HDL cholesterol concentrations and reducing the risk of CHD activities (WHO, 2008).

Origin of fatty acids

The major source dietary of omega-3 fatty acids is ALA from seed oils. Linseed oil obtained from flaxseed (*Linum usitatissimum*) is available source of ALA. It is converted in the body to EPA and DHA. Several other sources encompass canola, soybean, walnut and plants sources, dark green vegetable, while n-6 fatty acid is available in vegetable oils corn, sunflower, and soybean (Martins et al., 2008). According to Kus and Mancini-Filho (2010), EPA and DHA could be derived from dietary source by several sources encompassing the following;

Marine which is the most abundant source of n-3 such as fish and fish-like products. Oily fish like tuna, salmon, and herring has approximate levels from 862 to 1840 mg of EPA and DHA for every 100g. DHA is the main n-3 PUFAs and it is essential that several popular species of fish like cod and clams, shrimp, crabs, and oysters consists of a reduce quantity of DHA.

All animals consist of n-3 as a piece of cell membrane phospholipids, with a level close to 0.40 mg for 100 g

meat, thus, this makes meat products a poor source of EPA and DHA. There has been an improvement step in the market to supplement foods products from industry with omega -3 fatty acids mostly DHA. The foods are enriched with n-3 PUFAs by enhancement of products. Also, there has been a need to use microencapsulation, increase algae and vegetable oil production (Arbex et al., 2015).

Metabolism of essential fatty acids

The LA and ALA could be enlarged and desaturate by the activity of capable enzymatic procedure into effective essential extended chain n-6 and n-3 PUFAs. ALA could be transformed into a lower quantity of EPA which consists of 20 carbons and possibly lesser one which is DHA (Burdge and Calder, 2005; Brenna et al., 2009). EPA and DHA are molecular antecedents to a family of eicosanoids which possess antiinflammatory, vasolidatory, antithrombotic, and antiarrhythmic properties.

LA is transformed into AA, and it's the antecedent to a separate category of eicosanoids which have proinflammatory and prothrombotic properties. n-3 and n-6 PUFAs included similar enzymes (delta-5 and delta-6 desaturate) for transformation into the lengthen-chain n-3 and n-6 fats; This contention is biologically essential due to the fact that eicosanoids are obtained from these two essential fatty acids that are n-6 AA and n-3. EPA and DHA have a direct contrary effects (Martins et al., 2008).

Pregnant women and fetus growth

These most essential omega-3 fatty acids have proved to have potential effects on the health of humans, which helps in promoting childhood development when consumed by pregnant women (Jensen, 2006). The growth of fetus brain experience acceleration in the second trimester of pregnancy and this increase in growth continues throughout the first year of life until several years. The quantity of omega 3-fatty acids required of pregnant women is higher over normal women, as this will help to support fetal growth, especially of the brain and eyes (Stern, 2007). Pregnant women have always be advised for the inclusion of sufficient fatty acids, especially EPA and DHA in their diets (Ramakrishnan et al., 2010). This is because the inclusion of EPA and DHA during pregnancy proved to have various benefits in the developments of the fetus. In Pregnancy these essential omega fatty acids are transferred from the mother to the child (Helland et al., 2008). The quantity of EPA and DHA transferred to the fetus by the placenta is determined by the quantity consumed by the pregnant woman, for the fetus to have adequate quantity of EPA and DHA which is of great importance for the pregnant woman to consume adequate quantity (Dunstan et al., 2007). Fish oil is, also, utilized for the treatment of problems in association with pregnant women such as high blood pressure in late pregnancy, premature delivery, abortion (Olsen et al., 2000; Dunstan et al., 2008; Kremmyda et al., 2011). DHA plays a crucial contribution to cognitive functions. Thus, its consumption is very

essential for pregnant women, young children, adult and elderly. DHA is concerned in normal growth of fetal brain and retina and it continues till the first two years of early life (Cetin and Koletzko, 2008). There are positive connections between DHA levels in healthy children blood and enhancements on tests of cognitive and visual role (Ryan et al., 2010). Another evidence has been found about pregnant women that include EPA and DHA to their diets through supplement and during lactation, it is found that these omega 3 helps in prevention of allergies in children (Furuhjelm et al., 2009). This resulting effects may be due to the potentials of fish oil used as a supplement to reduce the number of body cells which is in connection with inflammation and immune system (Krauss-Etschmann et al., 2008).

Coronary heart diseases

The consumption of fish in good quantity has the potential to decrease death as a result of coronary heart disease. DART research proved that an acute coronary syndrome was decreased by %30 in patient-reported to consume fatty fish two times per week (Saravanan et al., 2010). Studies on omega-3 fatty acids showed that supplement with fish oil helps to reduce cholesterol levels Gunnarsdottir et al. (2008) decreased the constant incidence in patients with stroke records undergoing low-dose stain therapy (Tanaka et al., 2008) and enhance cardiometabolic profiles in high-risk patients (Barbosa et al., 2017). EPA and DHA can reduce sudden death, frequency of atherosclerosis, and, also,

faintly reduce blood pressure. Thus, American Heart Association (AHA) suggested that fish should be consumed more than two times or two times per week or fish oil supplement therapeutic plan can be adopted to decrease cardiovascular diseases (Kris-Etherton et al., 2002). Omega-3 fatty acids showed to function in atherosclerosis and peripheral arterial disease (PAD). There is an opinion that EPA and DHA enhance plaque firmness, reduce endothelial stimulation, and enhance vascular permeability, thus, lowering the opportunity to encounter a cardiovascular occurrence (Dawczynski et al., 2010). PAD is an indication of atherosclerosis, which is identified by the accumulation of plaque in the arteries of the leg and can finally result in a complete blockage of arteries (Swanson et al., 2012). EPA and DHA supplement has shown to enhance endothelial performance in patients with PAD through reduction of plasma levels of soluble thrombomodulin from a median value of 33.0 mg/L to 17.0 mg/L. Also, there is an enhancement in brachial artery flow-mediated dilation from 6.7% to 10.0% (Schiano et al., 2008). Patients with PAD were placed on EPA supplementation encounter a significant reduced vital coronary event compared with patients without EPA supplementation (Ishikawa et al., 2010).

Cancer prevention

Omega-3 fatty acids have suppressive activities on the tumor development, possibly through modification of prostaglandins combination and restriction of cell

growth in colon and breast cancer (Weisburger, 1997; Brown et al., 2003). A useful effect of omega-3 supplements throughout antineoplastic therapy was established base on weight, lean body mass, and treatment results. Fish oil as supplement could block cachexia in patients with pancreatic cancer (Vučić and Ristić-Medić, 2012) The study on 35,016 postmenopausal women reported a connection between fish oil supplement and a reduced chance of breast cancer (hazard ratio [HR] =0.68; 95% confidence interval=0.50-0.92) (Brasky et al., 2010). Some studies recommended that fish oil supplement could improve the potency of chemotherapy, increase survival. It, also, helps to preserve muscle mass in a patient with non-small cell lung cancer (Murphy et al., 2011).

A supplement enhance with eicosapentaenoic was found to enhance the rate at which the chemotherapy can be tolerated in patients with an increased colorectal cancer (Trabal et al., 2010). It is effective for treating endometrial cancer and weight loss (Brasky et al., 2010).

Depression and memory loss

Omega-3 fatty acids have been found to have potential and are recommended for treating depression and loss of memory. A survey conducted in 3,204 adults revealed that the less consumption of fish was found in connection with a higher rate of depression (Tanskanen et al., 2001).

Sarcopenia

Omega-3 fatty acids could be a

possible therapeutic substitute for treating and preventing sarcopenia (Gingras et al., 2007). Moreover, omega-3 has been proved to be used as a supplement in the prevention of muscle mass loss in burned guinea pigs (Alexander et al., 1986). EPA and DHA, also, consist of anti-inflammatory properties which could function in alleviation of the muscle anabolic resistance in ageing adults (Fetterman and Zdanowicz, 2009).

Bronchial asthma

There are two major features of bronchial asthma which are airway hyperreactivity and inflammation. Eicosanoids, interleukin-4, interleukin-5, also, tumor necrosis factors are crucial receptors of bronchoconstriction and inflammation which appeared in asthma patients. Findings on animals when coax with lung inflammation showed the beneficial effects of omega-3 fatty acids (Fetterman and Zdanowicz, 2009). The application of omega-3 fatty acids decreased the formations of thromboxane B₂ which happens with acute lung injury in pigs, while reduction of the edema quantity noticed in rabbits lungs throughout the acute inflammation (Murray et al., 1995).

Alzheimer's disease

Alzheimer's disease (AD) is a traumatic disease with restricted treatment alternatives and no cure available. Loss of memory is an early sign of this disease, which is developing, and resulted in the inability of the patient to control his or her body and finally leads to death (Freund-Levi et al., 2006).

It is utilized for Alzheimer's disease, psychosis, ADHD and several other memory-related problems (Morris et al., 2003; Connor and Connor, 2007). Docosapentaenoic acids (DHA) is available in substantial quantity in neuron membrane phospholipids, in which it is concerned with the adequate function of the nervous system, and this makes it suitable to be effective in the treatment of AD (Tully et al., 2003). A research results found that a diet categorized by high intakes of foods rich in omega-3 fatty acids such as fish, nuts, tomatoes, poultry cruciferous vegetables, and fruits and a low consumption of foods low in omega-3 fatty acids such as high-fat dairy products, red meat, and organ meat was highly connected with a reduced risk of AD (Gu et al., 2010). Unplanned weight loss is an issue faced by many patients with Alzheimer's disease, a supplement that includes EPA and DHA had shown a productive effect on weight recovery in patients with the disease (Faxén Irving et al., 2009).

Renal Disease

The PUFAs on the advancement of renal disease based on its effects on inflammation on the renal fibrosis activity is proposed in the study of animal model to be possible preventive (Baggio et al., 2005). PUFAs activity intrudes directly with mesangial cell renewal, multiplication, and extra-cellular matrix protein formation, and they are concerned in the guideline of pro-inflammatory cytokine production (Graber et al., 1994; Di Marzo, 1995).

Heamatology parameters

The study on omega-3 supplementation revealed potential effects on the red blood cell deformation and assemblage (Cartwright et al., 1985; Bowden et al., 2007). The outcome of the research proposed that n-3 PUFAs have anti-progressive, antithrombotic, and antiaggregatory platelets reactions (Mori et al., 1997).

Blood pressure

Omega-3 fatty acids are generally utilized by people to reduce blood pressure. It, also, is effective in preventing heart diseases and stroke (Djoussé et al., 2012). Studies confirmed that when fish oil is consumed in recommended dosage it is very helpful in preventing heart-related disease like stroke (Hu and Manson, 2012). A study on animal model and cell culture revealed that PUFAs reduced blood pressure and proteinuria, possibly by the vasorelaxation effects of n-3 PUFAs with improved endothelium-obtained releasing factor (Das, 2004).

PUFA and oxidative stress

The n-3 and n-6 PUFAs are extremely permissible to oxidation due to their versatile double bonds. The peroxidation of lipid results to pro-inflammatory oxidized LDL and HDL which is presumed to affect the pathogenesis of atherosclerosis. Various research revealed that dietary supplement of n-6 PUFAs improved the lengthen of LDL oxidation in vitro in comparison to dietary augment in mono-unsaturated fatty acids (Abbey et al., 1993).

Conclusion

Omega-3 fatty acids displayed an important role in human health. Its utilization is focused on the precaution of a large body of critical diseases, majorly concerning lowering of cardiovascular risk, cognitive health, and eye-health complications. Eicosapentaenoic acid (EPA) and Docosapentaenoic acid (DHA) are more abundant. They can be obtained naturally from fish oil, the inclusion of these important acids in human diets its of great benefits to health. The omega-3 (EPA and DHA) are necessary for fetal growth, it reduces immune-related diseases in infants.

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Dünya ve Türkiye Süt ve Süt Ürünleri Dış Ticareti

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Dünyada demografik ve ekonomik yapıdaki değişimler ve sürdürülebilirlik süt ürünlerinin geleceğini etkilemektedir. BM'e göre dünya nüfusunun 2050'li yıllarda 10 milyara ulaşacağı, 2/3 daha fazla hayvansal protein tüketimi gerçekleşeceği, gelişen ülkelerde kişi başına hayvansal protein tüketiminde artış olacağı, gelecek 20 yılda hayvansal ürün talebinin 2 kat artacağı ve 2050'de küresel süt tüketiminde %58 artış olacağı öngörülmektedir. Türkiye süt üretimi, 2018 yılında 22 milyon ton olmuştur. Yaklaşık 850 milyon ton olan dünya süt üretiminin % 2,5'ini Türkiye karşılamaktadır. Türkiye, 206 milyar ABD doları olan dünya çiğ inek sütü üretim değerine, 5,2 milyar dolar (% 2,5) katkı sağlamaktadır. Çiğ sütün sanayiye gitme oranı ise Türkiye'de %50, Dünyada % 64, AB'de % 94, ABD'de %100'dür. Diğer yandan, Türkiye, bulunduğu coğrafya itibariyle GSYH'ları 25 milyar doları bulan 1,5 milyar müşteriye kolayca erişim imkânı sunmaktadır. Küresel büyüklüğü 75 milyon ton ve 86 milyar dolar olan dünya süt ürünleri pazarına Türkiye 195 bin ton ve 328 milyon dolar süt ve süt ürünleri ihraç etmektedir. Bu pazarda Almanya 11 milyar dolar süt ürünü ihraç ederek ilk yer alırken, Türkiye ise 38. sırada yer almaktadır. Türkiye bu pazardan 23 bin ton ve 98 milyon dolar değerinde süt ürünü ithal etmektedir. Bu çalışmada ulusal ve uluslararası veri kaynaklarından süt ve süt ürünleri ile ilgili veriler derlenmiş, Türkiye ve dünyadaki son yıllarda yaşanan gelişim, karşılaştırmalı olarak incelenmiş, bu çerçevede dış ticarete mevcut durum değerlendirilmiş ve bazı öneriler sunulmuştur.

Milk and Milk Products Foreign Trade in Turkey and in the World

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ABSTRACT

Review

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Changes in the demographic and economic structure in the world and sustainability affect the future of dairy products. According to the UN, the world population will reach 10 billion in the 2050s, 2/3 more

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animal protein consumption will be realized, animal protein consumption will be increased in developing countries, animal product demand will increase twice in the next 20 years and global milk consumption will increase by 2050. 58% increase is foreseen. Turkey milk production was 22 million tons in 2018. Approximately, 2.5% of the 850 million tons of world milk production belongs to Turkey. Turkey is contributing the world 206 billion US dollars worth of raw cow's milk production with 5.2 billion dollars (2.5%). The ratio of the raw milk contribution to industry is 50% in Turkey, 64% in the world, the EU, 94%, 100% in the US. On the other hand, Turkey will access easily to 1.5 billion customers having 25 billion \$ GDP with the advantage of her geography. Turkey is exporting 195 million dollars and 328 thousand tons of milk and dairy products to the global world market having capacity of 75 million tons and 86 billion dollars in for dairy products. Germany in the first place with 11 billion \$ of exported milk products, while Turkey ranks on 38th. Turkey imports 23 thousand tons and 98 million dollars worth of dairy products from the market. In this study, the compiled data on milk and milk products from national and international data sources were reviewed. Recent development in Turkey and in the world were comparatively analyzed, assessed the current situation in foreign trade in this framework and some suggestions were presented.

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Giriş

Dünyada nüfusun artması, şehirleşme, ekonomik gelişim ve küreselleşme süt ve ürünlerine olan talebi giderek artırmaktadır. Öte yandan kaynakların zamanla azalması ve çevrenin kirlenmesi süt ve ürünleri üretimi üzerinde baskı oluşturmaktadır.

Birleşmiş Milletlere göre, dünya nüfusunun 2050'li yıllarda 10 milyara ulaşacağı, bu güne göre de 2/3 daha fazla hayvansal protein tüketimi olacağı, gelecek 20 yılda hayvansal ürün talebinin 2 kat artacağı ve 2050'de küresel süt tüketiminin % 58 artacağı öngörülmektedir.

Günümüzde süt ürünleri uluslararası ölçekte pazarlanmakta, süt işleyen firmaların piyasa payları da giderek artmaktadır. Sektörde birleşmeler ve satın almalar artmakta ve özellikle çiftçi açısından karlılıklar

azalmaktadır. Tüketiciler, süt ürünlerini uygun fiyatla ambalajlı olmasını ve firmaların sosyal gelişim programlarını katılmalarını talep edilmektedir. Devletler, halk sağlığını ve çevreyi korumak için daha sıkı çevre, gıda ve süt ürünleri mevzuatları hazırlamaktadırlar. Süt sektöründe üreticiden tüketiciye kadar olan tüm zincirde yaşanan bu gelişmeler ve sorunlar arz/talep dengesinde değişimlere de sebep olmaktadır. Bu çalışmada dünyada ve Türkiye'de süt sektörü üretim, tüketim, ticaret boyutuyla incelenmiştir.

Türkiye'nin çiğ süt üretimi ve dünyadaki yeri

Türkiye'nin 1930 yılında 1.856.326 ton olan çiğ süt üretimi, gerek hayvan ıslahında ve gerekse bakım ve besleme şartlarında yapılan çalışmalarla 2018 yılında 22.120.716 tona yükselmiştir. Bu üretimin 20.036.877

tonu sığır, 75.742 tonu manda, 1.446.271 koyun ve 561.826 tonu keçiden elde edilmiştir (Tablo 1).

2017 yılında 849 milyon ton olan dünya süt üretiminin % 2,4'ü (20.700 bin ton) Türkiye'den gelmektedir. Türkiye, bu üretimi ile dünya süt üretiminde 9. Sırada yer almaktadır (Tablo 2).

Dünyada üretilen % 81,97'si sığır, % 14,08'i manda, % 1,26'sı koyun, % 2,22'si keçi ve % 0,47'si diğer hayvanlardan gelirken Türkiye'de % 90,6'sı sığır, % 0,3'ü manda, % 6,5'i koyun, % 2,5'i keçiden gelmektedir (Tablo 3).

Dünya sütçülük Federasyonu (IDF) verilerine göre 2017 yılında dünya inek sütü üretiminde 165,5 milyon tonla Avrupa Birliği (AB) gelmektedir. Onu 97,7 milyon tonla Amerika Birleşik Devletleri (ABD) gelmektedir. Türkiye ise 18,8 milyon tonla 9. sırada yer almaktadır (Tablo 4).

2017 Yılında Türkiye'de işletme başına düşen sağmal inek sayısı 5 adet, yılda üretilen süt miktarı 16 ton, inek başına düşen ortalama süt verimi 3148 kg iken sırasıyla AB 40 adet, 154 ton, 6,627 kg., Meksika'da 16 adet, 79 ton, 4,757 kg., Polonya'da 18 adet, 113 ton, 6,227 kg'dır (Tablo 5). Görüldüğü üzere işletmelerdeki sağmal inek sayısı ve inek

başına düşen ortalama süt verimi bakımından ve dolayısıyla da işletmede yılda üretilen süt miktarı da bakımından girmeyi düşündüğümüz AB'ne göre epeyce azdır. Aynı şekilde bu değerler, ekonomik durumları Türkiye'ye benzer olan Meksika ve Polonya'dan da azdır.

Süt, dünyada tarımsal üretim değerinin % 8'ini, hayvansal üretim değerinin % 25'ini karşılarken Türkiye'de tarımsal üretim değerinin % 9'unu, hayvansal üretim değerinin % 15,6'sını karşılamaktadır.

Dünyada ve Türkiye'de çiğ inek sütü, en yüksek üretim değerine sahiptir. Dünyada çiğ inek sütünün üretim değeri 2016 yılında 205.695 milyon dolar iken bu değer Türkiye'de 5.238 milyon dolardır (Tablo 6). Türkiye'de çiğ inek sütü son on senedir en yüksek üretim değerine sahip tarım ürünüdür. Süt ve süt ürünleri sanayi, ülke ekonomisine sağladığı katma değer ve kırsal kalkınmanın gerçekleştirilmesi açısından son derece önemli bir alt sektördür. Yani Türkiye de kırsal kalkınmanın temeli süt hayvancılığıdır.

Çiğ inek sütünün sanayiye gitme oranı Türkiye'de % 50, Dünyada % 64, AB'de % 94, ABD'de % 100'dür. Bu durum, zoonoz hastalıkların kol gezdiği ülkemizde halk sağlığı açısından çok önemli bir tehdittir.

Tablo 1. Türkiye türlere göre çiğ süt üretimi (Anonim, 2019e)

Yıl	İnek		Manda		Koyun		Keçi		Toplam Ton
	Ton	%	Ton	%	Ton	%	Ton	%	
1930	709.885	38,24	263.445	14,19	378.364	20,38	504.632	27,18	1.856.326
1940	1.160.502	40,44	380.537	13,26	713.090	24,85	615.143	21,44	2.869.272
1950	1.381.535	43,54	377.451	11,90	667.710	20,05	746.039	23,51	3.172.735
1960	2.240.960	53,45	257.900	6,15	882.000	21,04	811.460	19,39	4.192.320
1970	2.550.000	59,24	279.000	6,48	859.000	19,97	613.600	14,26	4.302.000
1980	3.421.020	62,51	273.903	5,01	1.147.395	20,97	630.026	11,51	5.472.345
1990	7.960.600	82,89	174.200	1,81	1.145.000	11,92	323.700	3,37	9.603.500
2000	8.732.000	89,19	67.300	0,69	774.400	7,91	216.300	2,21	9.790.000
2010	12.418.544	91,69	35.487	0,26	816.832	6,03	272.811	2,01	13.543.674
2014	16.867.419	91,2	54.687	0,3	1.113.130	6,0	463.394	2,5	18.498.630
2015	16.933.520	90,8	62.761	0,3	1.177.288	6,3	481.174	2,6	18.654.682
2016	16.786.263	90,8	63,085	0,3	1.160.143	6,3	479.401	2,6	18.489.161
2017	18.762.319	90,6	69.401	0,3	1.344.779	6,5	523.395	2,6	20.699.894
2018	20.036.877	90,6	75.742	0,3	1.446.271	6,5	561.826	2,6	22.120.716

Tablo 2. Dünya ve Türkiye'deki çiğ süt üretimi (Anonim, 2018, 2019e)

Yıllar	Dünya		Türkiye		Dünya üretimindeki payı %
	Milyon ton	Değişim % (Önceki yıla göre)	Milyon ton	Değişim % (Önceki yıla göre)	
2000		-	9,7	-	1,8
2005	652	12,6	11,1	14,4	1,7
2009	716	0,7	12,2	0,0	1,7
2010	732	2,4	12,5	2,5	1,7
2012	770	2,2	17,4	15,6	2,3
2013	783	1,3	18,2	4,7	2,3
2014	802	2	18,5	1,5	2,3
2015	818	2,1	18,7	1,1	2,3
2016	829	1,3	18,5	-1,1	2,2
2017	849	2,5	20,7	11,2	2,4
2018			22,1	6,8	

Tablo 3. Dünya ve Türkiye’de türlere göre çiğ süt üretimi ve türlerin payları (Anonim, 2018, 2019e)

Türler	Dünya		Türkiye	
	Milyon ton	Toplam içindeki %	Milyon ton	Toplam içindeki %
İnek	696	81,97	20	90,6
Manda	119,6	14,08	0,08	0,3
Koyun	10,7	1,26	1,4	6,5
Keçi	18,9	2,22	0,6	2,6
Diğer	4,0	0,47	-	-
Toplam	849	100	22,1	100

Tablo 4. İnek Sütü Üretiminde Lider Ülkeler (Anonim,2018)

Ülkeler	Üretim (milyon ton) 2017
AB 28	165,5
ABD	97,7
Hindistan	83,5
Brezilya	35,7
Çin	35,5
Rusya	30,9
Yeni Zellanda	21,5
Türkiye	18,8
Pakistan	16,7
Meksika	12,2
Arjantin	10,4

Tablo 5. Türkiye ve bazı ülkelerin, işletme ve sağmal inek sayısı ile işletme başına düşen sağmal inek sayısı ve süt miktarı, ort. süt verimlerinin karşılaştırması (Anonim, 2018, 2019e)

Ülke	Yıl	Sığır. İşlet. Sayısı	Sağmal İnek Sayısı (Bin adet)	Süt (Bin Ton)	İşletme Başına Düşen		Ort. Süt Ver. Kg/baş
					Sağ. İnek sayısı	Süt Mik. (ton/yıl)	
Türkiye	2013	1.250.000	5.607	16.655	4,4	13	2.970
	2017	1.160.371	5.969	18.762	5,1	16	3.148
AB	2013	643.000	23.243	154.041	36,3	240	6.627
	2017	1.077.020	23.153	165.455	40	154	7.060
Meksika	2017	154.045	2.506	12.162	16	79	4.757
Polonya	2014	145.300	2.248	12.370	15,8	90	5.502
	2017	121.830	2.153	13.721	18	113	6.227

Tablo 6. Dünya ve Türkiye’de bazı ürünlerin üretim değeri (Milyon dolar) (Anonim, 2019b)

Türkiye	2000	2005	2010	2014	2015	2016	Türkiye'nin Dünya Üretim. Payı, 2011 (%)
Çiğ İ. Sütü	2.725	3.129	3.875	5.305	5.284	5.238	2,5
Domates	2.793	3.157	3.158	4.379	4.662	4.656	7,1
Buğday	2.730	3.085	2.810	2.998	3.565	3.250	2,7
Üzüm	2.058	2.201	2.432	2.387	2.086	2.286	5,2
Tavuk Eti	904	1.344	2.064	2.505	2.505	2.505	1,8
Sığır Eti	957	867	1.581	2.026	2.026	2.026	1,2
Yumurta	645	588	558	888	867	930	14,8
Bal	153	207	204	260	270	265	0,4
Dünya							
Çiğ İ. Sütü	147.000	163000	179.193	204.931	208.070	205.695	
Domates	40.209	47.066	55.552	63.749	64.349	65.428	
Buğday	71.590	76.280	78.941	115.739	116.283	118.251	
Üzüm	37.068	38.528	38.484	42.344	43.921	44.265	
Tavuk Eti	83.565	100.076	124.481	137.161	137.161	137.161	
Sığır Eti	151.925	160.144	170.389	170.235	170.235	170.235	
Yumurta	39.780	43.971	49.598	58.154	59.671	62.283	

Tablo 7. Dünya, AB ve Türkiye’de nüfus, süt üretimi ve tüketimi (kişi başına süt eşdeğeri olarak, kg/yıl) (Anonim, 2018)

Yıl	Dünya			Avrupa Birliği			Türkiye		
	Nüfus (Milyon Kişi)	Süt Üretimi (Milyon Ton)	Kişi Başı Süt Miktarı (Kg)	Nüfus (Milyon Kişi)	Süt Üretimi (Milyon Ton)	Kişi Başı Süt Mik.(Kg)	Nüfus (Milyon Kişi)	Süt Üretimi (Milyon Ton)	Kişi Başı Süt Mik.(Kg)
2000	6.115	584	95	483	155,5	322	68	9,8	144
2005	6.512	658	101,4	491	154,1	314	71	11,1	157
2010	6.895	735	106,9	501	152,5	305	74	13,5	184
2013	7.294	782	109,6	507	157,2	310	77	18,2	237
2016	7.444	826	111,1	510	164,3	322	80	18,5	232
2017	7.530	849	113	512	165,5	323	80,8	20,7	256

Tablo 8. Türkiye, AB ve Dünyada kişi başına protein üretimi ve dağılımı (g/kişi/gün, %) (Anonim,2019b)

Protein Kaynağı	Türkiye		AB		Dünya	
	Miktarı g	Oranı %	Miktarı g	Oranı %	Miktarı g	Oranı %
Toplam protein	120	100	128	100	80	100
Bitkisel	83,7	69,75	69,4	53,2	49,3	61,3
Hayvansal	36,3	30,25	58,6	46,8	30,8	38,7
Süt, g	18,19	50	20,47	34,9	8,2	26,62
Yumurta, g	2,54	6,99	3,74	6,38	2,79	9,06
Su ürünleri, g	1,81	4,98	6,6	11,26	5,22	16,95
Et g	13,77	37,92	27,75	47,35	14,54	47,21

Dünyada süt işleyen firmaların yarısı kooperatif, diğer yarısı ise şirketlerinden oluşmaktadır. Türkiye’de ise neredeyse tamamı şirketlerden oluşmaktadır.

Dünya süt pazarında etkili olan ilk 20 firma; sanayiye giden toplam süt miktarının ise % 39’unu işlemektedir. Türkiye’de ise ilk 20 firma; sanayiye giden toplam süt miktarının ise 2/3’sini işlemektedirler.

Dünya’da 2017 yılında kişi başına düşen süt miktarı 113 kg., AB’nde 323 kg., Türkiye’de ise 256 kg’dır (Tablo 7). Kıtalar olarak baktığımızda ise Asya 75 kg., Kuzey Amerika 254 kg., Avrupa 270 kg., Güney Amerika 165 kg., Afrika 49 kg., Orta Amerika 101 kg., Okyanus 217 kg’dır.

Tüketilen protein miktarı Dünya’da 80 gr. AB’nde 128 gr, Türkiye’de ise 120 gr.dır. Dünyada tüketilen proteinin 30,8 gr.1 hayvansal kaynaklı, AB’nde 58,6 gr.1 hayvansal kaynaklı, Türkiye’de ise 36,3 gr.1 hayvansal kaynaklıdır. Dünya’da tüketilen proteinin 8,2 gr.1 yani % 26,62’si süttten, AB’nde 20,47 gr.1 yani % 34,9’u süttten, Türkiye’de ise 18,19 gr.1 yani % 50’si süttten gelmektedir (Tablo 8).

Türkiye’de süt sanayi

Devamlı artan Türkiye’nin çiğ süt üretimi, 2018 yılında 22.121 milyon ton olarak gerçekleşmiştir. 20.037 bin ton olan çiğ inek sütününün 10.028 bin tonu sanayiye gitmektedir. Çiğ inek sütününün sanayiye gitme oranı ise % 50,05’dir (Tablo 9).

Çiğ sütler, Tarım ve Orman

Bakanlığı verilerine göre, 5996 Sayılı Kanunun kabulünden yani onay işlemleri başlamadan önce 2011 yılında 2252 süt işleme tesisi bulunmaktadır. Bu sayı onay işlemlerinden sonra 2019 yılında 2001 olmuştur (Tablo 10). Bu tesislerde çiğ süt peynir, yoğurt ve ayran, içme sütü, ayran, süt tozu, tereyağı, dondurma, kefir ve sütlü tatlılara işlenerek değerlendirilmektedir.

Son üç yıldır çiğ süt üretimi sırasıyla -% 0,9, % 11,7 ve % 6,9 oranında değişim gösterirken süt ürünleri üretiminde aynı paralellliği görmemekteyiz. Sadece peynir üretimi 2016 yılında çiğ süt üretimine paralel olarak -% 0,7 oranında azalmıştır. Diğer süt ürünleri aynı % 4,5 ile % 11,2 oranında artmıştır. 2017 yılında içme sütü % 7,2, peynir % 4,4, ayran % 4,8, Tereyağı % 3,2, Süttozu % 7, dondurma % 4 oranında artmış, yoğurt üretimi ise -% 0,8 oranında azalmıştır. 2018 yılında içme sütü % 7,3, peynir % 9,6, yoğurt % 2,3, ayran % 1,9, Tereyağı % 10,8, dondurma % 4 oranında artmış, süttozu üretimi ise -% 17,7 oranında azalmıştır (Tablo 11). Bu da kayıt dışı üretimin arttığını göstermektedir. Bu durum sektörde oluşturduğu haksız rekabetin yanında hayvandan insana geçen birçok hastalığın kol gezdiği ülkemiz için tüketicinin sağlığını ciddi bir şekilde tehdit eden çok büyük bir gıda güvenliği sorunudur. Çünkü sanayici tarafından kalite yetersizliği sebebiyle kabul edilmeyen sütler, merdiven altı işletmeler tarafından kayıt dışı olarak ve gıda güvenliğinden uzak biçimde işlenmektedir.

Tablo 9. Çiğ süt üretimi ve sanayiye giden miktarı ve değişim oranları (Bin Ton,%) (Anonim,2019e)

Ürün		2010	2014	2015	2016	2017	2018
Çiğ Süt	Üretim	12.500	18.499	18.655	18.489	20.700	22.121
	Değişim	2,5	1,5	0,8	-0,9	11,7	6,9
Çiğ inek Sütü	Üretimi	12.419	16.867	16.934	16.786	18.762	20.037
	Değişim	7,2	1,3	0,4	-0,9	11,7	6,8
	Miktari	6.745	8.625	8.934	9.123	9.112	10.028
Sanayide işlenen inek sütü	Değişim		8,65	3,6	2,1	-0,13	10,05
	Sanayide işleme oranı	54,3	51,1	52,8	54,3	48,6	50,05

Tablo 10. Süt işletmeleri miktarı (Anonim, 2019c)

	17.12.2011' den önce (a)	01.01.2014 Adet (b)	a/b %	01.01.2016 Adet (c)	a/c %	01.01.2019 Adet (d)	a/d %
Süt işleme tesisi	2252	1429	63	1.896	84	2001	89
Süt top. merkezi	5943	3149	53	4.966	84	5529	93
Toplam	8195	4575	56	6.862	84	7530	92

Tablo 11. Süt ve süt ürünleri üretim ve değişim oranları (Ton, %) (Anonim, 2019ae)

Ürünler		2010	2014	2015	2016	2017	2018
İçme sütü	Üretim	1.090.605	1 310 534	1378.524	1.444.980	1.548.880	1.661.785
	Değişim	-0,6	0,96	5,19	4,8	7,2	7,3
Peynir	Üretim	473.491	629.675	665.580	660.976	689.909	756.009
	Değişim	74,3	4,89	5,5	-0,7	4,4	9,6
Yoğurt	Üretim	908.269	1 101 253	1.122.941	1.173.578	1.172.194	1.198.793
	Değişim	16,7	1,83	1,97	4,5	-0,8	2,3
Ayran	Üretim	397.935	598 877	626.774	684.526	717.334	730.705
	Değişim	40,5	6,92	4,66	9,2	4,8	1,9
Tereyağ	Üretim	32.987	45 817	51.789	57.609	59.449	65.856
	Değişim	5,9	10,36	13,0	11,2	3,2	10,8
Süttozu	Üretim	72.102	111.079	112.175	124.197	132.970	109.500
	Değişim	24,6	28,14	0,9	10,7	7,0	-17,7
Dondurma (bin litre)	Üretim	243.286	326.500	340.000	353.600	367.745	382.455
	Değişim	29	4	4	4	4	4

Dünya süt ürünleri dış ticareti

Trade Map verilerine göre 2017 yılında dünya toplam süt ürünleri ihracatının 81 milyar dolar olarak olduğu, bunun 10,1 milyar dolarını Almanya, 9,9 milyar dolarını Yeni Zelanda, 9,1 milyar dolarını Hollanda yapmaktadır. Türkiye ise 322 milyon dolarla 24. sırada yer almakta ve dünya ihracatının % 0,41'ini oluşturmaktadır. İthalata baktığımızda ise 7,9 milyar dolarla Almanya ilk sırada yer alırken, bunu sırasıyla 4,9 milyar dolarla Çin Halk Cumhuriyeti, 4,3 milyar dolarla Fransa takip etmektedir. IDF'unun verilerine göre ise aynı yıl 74,9 milyon ton süt ürünü uluslararası ticarete konu olmaktadır (Şekil 1).

2017 yılında dünya genelindeki süt ürünleri ticareti ele alındığında 2017 yılı içerisinde yağsız süttozu ticareti % 10,3 oranında ve peynir ticareti % 4,1 oranında artarken, yarım yağlı süttozu ticareti ile tereyağı ticareti sırasıyla % 3,4 ve % 13,9 oranında düşmüştür.

Dünyada temel ithalatçı konumunda yer alan ülkelerde ortaya çıkan tüketim alışkanlıklarına bağlı olarak ülkelerin ithalata konu olan ürünleri de değişiklik arz etmektedir. Çin, 2017 yılında yağlı süttozu ithalatını azaltırken, UHT süt, mozzarella ve krem peynir ithalatını artırmış ve ülkenin ana tedarikçilerinden olan Yeni Zelanda da ihracat odağını bu ürünlere çevirmiştir.

2018 yılı için değerlendirildiğinde ise, ABD'nin bazı ticari partnerleri arasında yaşanan gümrük sorunları

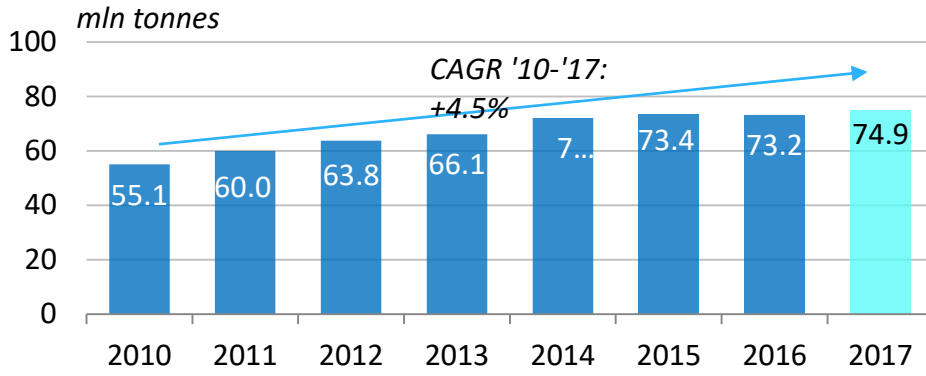
nedeniyle ticaret akışında bir takım değişiklikleri görmemiz muhtemeldir. 2018'in ihracatçıları için eski kapıların kapandığı ve yeni kapıların açıldığı bir yıl olduğu tahmin edilirken sonuç olarak süt ve süt ürünlerinde toplam ticaret hacminin küçüldüğü tahmin edilmektedir.

Petrol ihracatçısı ülkelerinde 2018 yılındaki süt ürünleri ithalatının, petrol fiyatlarındaki iyileşmeye paralel olarak bir önceki yıla göre arttığı tahmin edilirken yıl içerisindeki toplam miktarın 2015 ve 2016 yıllarından yine de az olduğu tahmin edilmektedir.

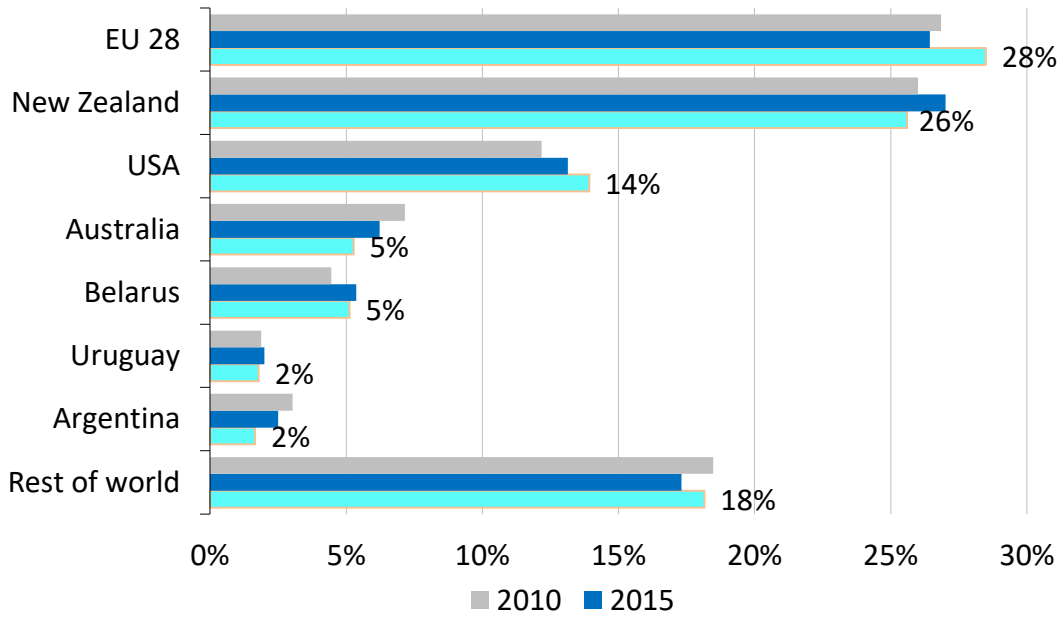
Temel ihracatçı ülkelere bakıldığında, AB ülkelerinin dünya süt ve süt ürünleri ticaretindeki paylarını bir önceki yıla göre artırarak 2017 yılında % 28 oranında pay aldıkları görülmektedir. İkinci olarak Yeni Zelanda'nın ise % 26, üçüncü olarak ise Amerika Birleşik Devletlerinin % 14 oranında pay aldığı görülmektedir (Şekil 2).

Dünyada peynir, yağlı süttozu, yağsız süttozu ve tereyağı en fazla ihracata konu olan süt ürünleridir. Peynir ve yağsız süttozu ihracatı giderek artarken yağlı süttozu ve tereyağı ihracatı düşmektedir (Şekil 3).

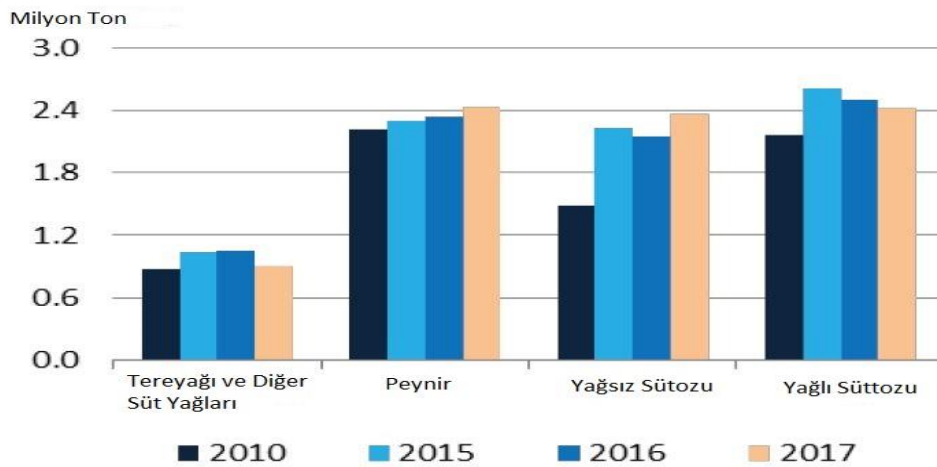
Dünyada 10 bin tonun üzerinde peynir, tereyağı, tam yağlı ve yağsız süttozu, whey protein ve ürünleri ile süt ve krema ihracatı yapan beş ana ihracatçı ülke ve ihracat yaptıkları ülkeler ile 2016 yılından 2017 yılına değişim oranları % olarak Şekil 4, 5, 6, 7, 8, 9'da verilmektedir.



Şekil 1. Süt ve süt ürünleri ticareti (Anonim,2018)



Şekil 2. Temel ihracatçı ülkelerin pazar payları (Süt eşdeğeri olarak) (Anonim,2018)



Şekil 3. En fazla ihracatı yapılan süt ürünleri (Anonim,2018)



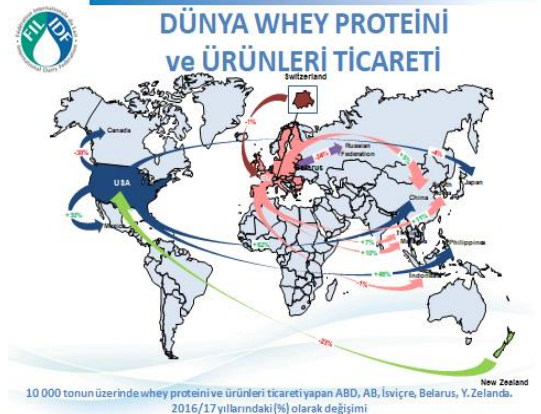
Şekil 4. 10.000 tonun üzerinde peynir ihracatı yapan beş ülke. 2016/17 yıllarındaki % olarak değişim (Anonim,2018)



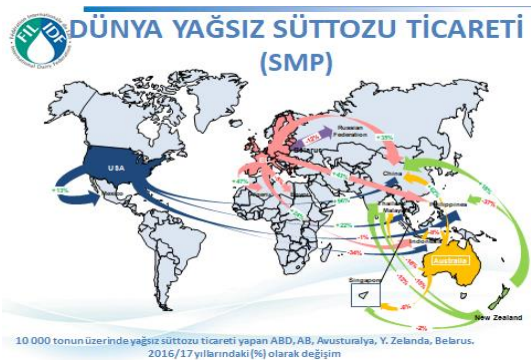
Şekil 7. 10.000 tonun üzerinde tam yağlı süttozu ihracatı yapan beş ülke. 2016/17 yıllarındaki % olarak değişim



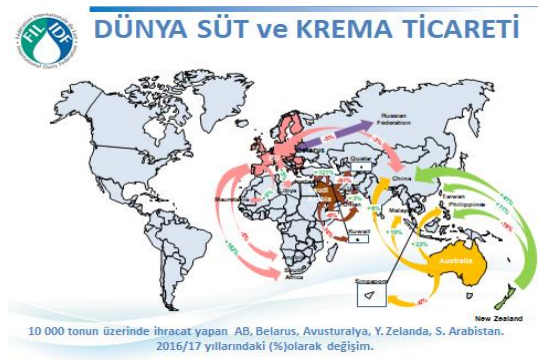
Şekil 5. 10.000 tonun üzerinde tereyağı ve diğer süt yağları ihracatı yapan beş ülke. 2016/17 yıllarındaki % olarak değişim (Anonim, 2018)



Şekil 8. 10.000 tonun üzerinde whey proteini ve ürünleri ihracatı yapan beş ülke. 2016/17 yıllarındaki % olarak değişim (Anonim, 2018)



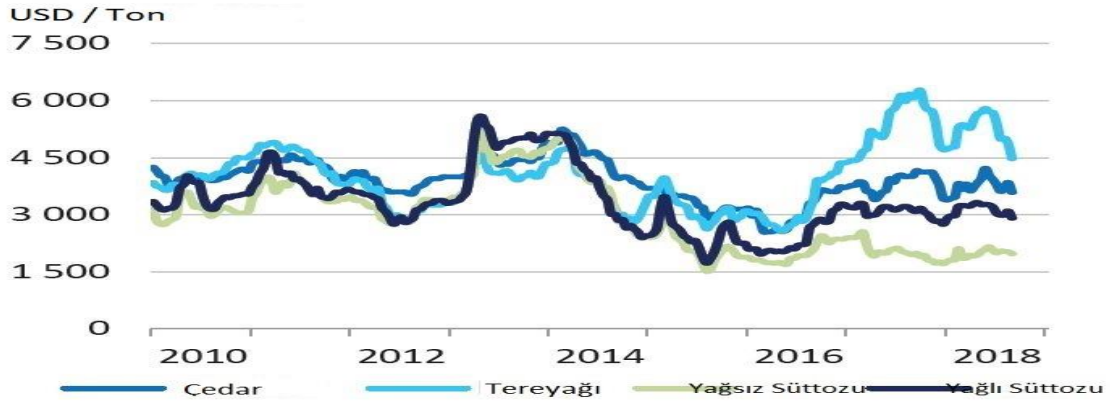
Şekil 6. 10.000 tonun üzerinde yağsız süttozu ihracatı yapan beş ülke. 2016/17 yıllarındaki % olarak değişim (Anonim, 2018)



Şekil 9. 10.000 tonun üzerinde süt ve krema ihracatı yapan beş ülke. 2016/17 yıllarındaki % olarak değişim (Anonim, 2018)

Çedar peyniri fiyatları 2010 yılının başında tonu 4.250 dolar civarında iken inişli çıkışlı bir seyir takip ederek 2018 yılının sonunda tonu 3.600 dolara inmiştir. Tereyağı fiyatları ise 2010 yılının başında tonu 3.800 dolar civarında iken inişli çıkışlı bir seyir takip ederek 2018 yılının sonunda tonu 4.500

dolar olmuştur. Yağsız süttozu fiyatları da 2010 yılının başında tonu 3.600 dolar civarında iken inişli çıkışlı bir seyir takip ederek 2018 yılının sonunda tonu 2.000 dolara inmiştir. Tamyaglı süttozunun fiyatı ise 2010 yılında 3.600 dolar iken 2018 yılının sonunda 2.900 dolar olmuştur (Şekil 10).



Şekil 10. Dünya süt ürünleri fiyatları (Anonim,2018)

Türkiye süt ürünleri dış ticareti

Türkiye, bulunduğu yer itibariyle GSYH'ları 25 milyar doları bulan 1,5 milyar müşteriye kolayca erişim imkânı sunmaktadır (Şekil 11).

Türkiye, 2018 yılında, 166.595 bin dolar peynir, 46.620 bin süttozu, 34.456 bin dolar dondurma, 32.502 bin dolar süt ve krema, 27.924 bin dolar peyniraltı suyu tozu, 8.922 dolarlık tereyağı, laktoz ve yoğurt olmak üzere toplam 328.305 milyon dolarlık süt ürünü ihracatı gerçekleştirmiştir (Tablo 12). Türkiye peynir ihracatçısı ülkeler arasında dünya dokuzuncusu, peyniraltı suyu tozu ihracatçısı ülkeler arasında dünya yedincisi, laktoz ihracatçısı ülkeler arasında dünyada 5. sıradadır.

Türkiye 2018 yılında yaptığı ihracatın 54.216 bin doları eritme peyniri, 48.062 bin doları UHT süt, 42.344 bin doları süttozu, 34.456 bin

doları dondurma, 25.843 doları ise beyaz peynirden gelmektedir (Tablo 13).

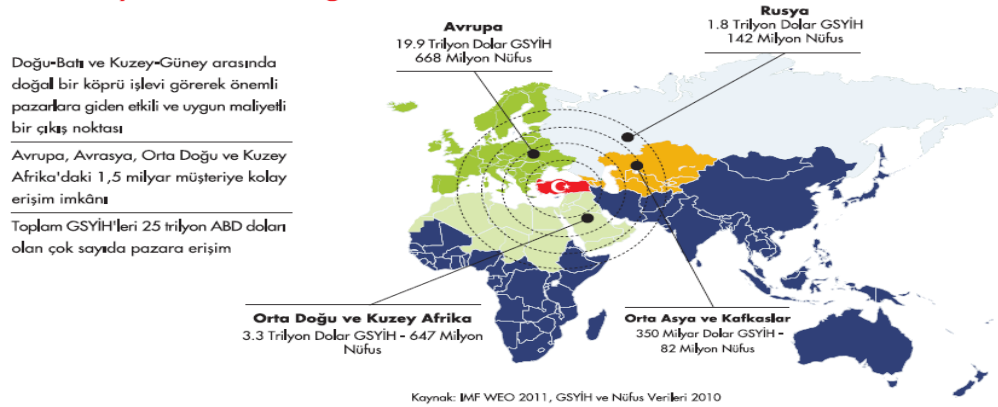
Türkiye Şekil 12'de görüldüğü üzere süt ürünleri ihracatını devamlı artırmakta olup ihracat artışı özellikle peynirden kaynaklanmaktadır.

Türkiye, 2018 yılında 105 ülkeye süt ve süt ürünleri ihracatı yapmakta olup en fazla ihracatımız 78 milyon dolarla Irak, ikinci olarak 45 milyon dolarla Suudi Arabistan ve onu 21 milyon dolarla Libya takip etmektedir (Şekil 13). Pazarlarımızı daha çok Orta Doğu ülkeleri ile Türk Cumhuriyetleri oluşturmaktadır.

Türkiye 2018 yılında 47.803 bin dolar tereyağı ve 19.077 çeşitli peynir, 10.365 bin dolar çedar peyniri, 7.223 dolar laktoz olmak üzere toplam 97.967 bin dolarlık süt ve süt ürünü ithal etmiştir (Tablo 14). Türkiye tereyağı ithalatçısı ülkeler arasında dünya onuncusudur.

Toplam 25 Trilyon Dolar GSYİH ve 1,5 milyar nüfusa doğrudan erişim

TURKİYE GIDA VE İÇİŞİLERİ BAKANLIĞI
DERNEKLERİ FEDERASYONU
FEDERATION OF FOOD & DRINK INDUSTRY ASSOCIATIONS OF T



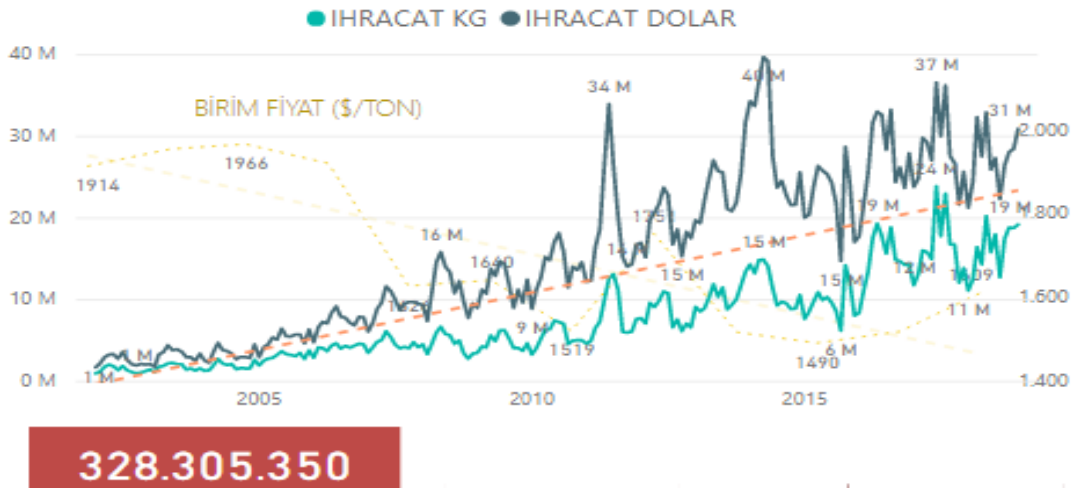
Şekil 11: Türkiye'nin pazarlara erişimi (Anonim, 2019d)

Tablo 12. Süt ve süt ürünleri ihracatı (ton, Bin dolar) (Anonim, 2019d)

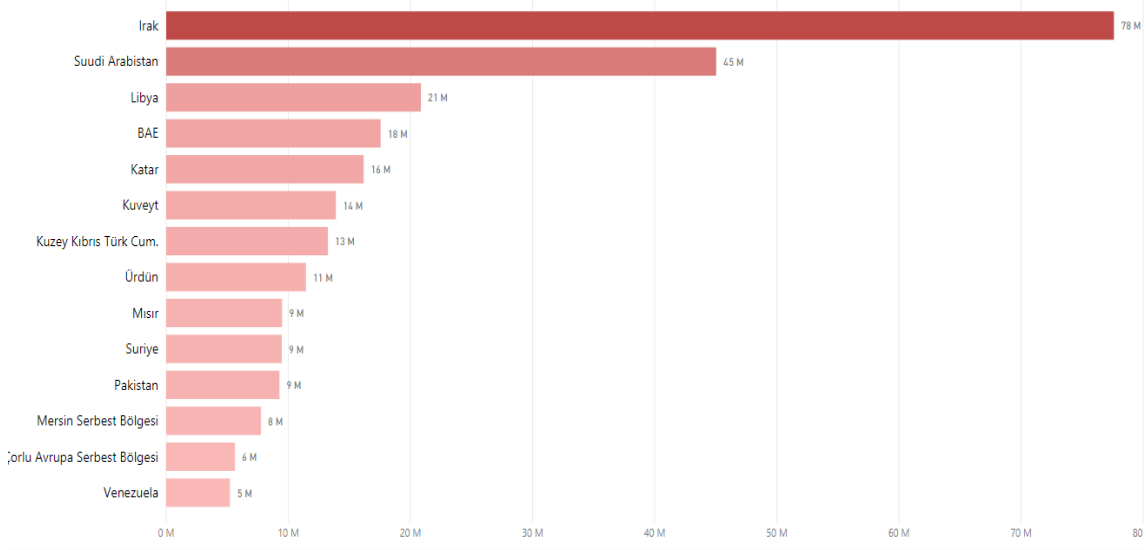
GTIP	Ürün Adı	2015		2016		2017		2018	
		Miktar	Değer	Miktar	Değer	Miktar	Değer	Miktar	Değer
0401	Süt, Krema	15.037	21.973	18.085	20.449	40.689	33.571	44.475	32.502
0402	Süttozu	8.377	14.896	56.449	84.585	32.680	62.082	30.326	46.620
040310	Yoğurt	2.682	2.664	2.534	2.054	7.267	6.905	2.832	2.420
040390	Yayık Altı süt, Pıht. Süt ve Krema, Kefir vb. Peyniraltı	4.780	11.681	3.684	9.001	4.305	9.437	5.129	11.385
0404	Suyu Tozu	24.043	19.086	33.693	19.988	42.270	29.950	43.339	27.924
0405	Tereyağı	372	2463	335	2.037	1.167	6.746	541	3.577
0406	Peynir	41.763	162.947	45.732	150.388	48.252	153.830	50.693	166.595
170211- 170219	Laktoz			4.423	3.147	4.526	4.116	3.422	2.925
2105	Dondurma	16.667	36.388	15.849	34.867	14.817	32.821	14.907	34.456
GENEL TOPLAM		116.638	274.144	181.039	326.878	196.475	340.355	195.664	328.305

Tablo 13. Süt ve süt ürünleri dış ticareti (ton, Bin dolar) (Anonim, 2019d)

Kalem	İhracat Ton	İhracat Dolar	Değişim	İthalat Ton	İthalat Dolar	Değişim
İnek sütü	54.165	48.062.136	%12.5	913	2.818.378	%55.4
Peynir altı suyu	43.335	27.915.327	-%6.7	83	157.491	-%71.4
Süt tozu	25.764	42.344.907	-%31.5	253	1.017.618	%32.8
Eritme peynir	17.504	54.216.356	%2.7	915	3.043.547	%47.1
Dondurma	14.907	34.456.118	%5.1	347	2.249.495	%19.6
Diğer peynir	12.008	49.656.765	%24.8	4.522	19.097.839	-%5.5
Beyaz peynir	11.555	25.843.964	-%6.4	0	629	-%95.6
Feta	4.394	14.178.307	%1.6	54	152.257	%18743.7
Laktoz	3.422	2.925.253	-%29.0	2.808	7.223.259	%22.2
Mozeralla	3.069	13.631.275	%30.1	94	440.201	%106.8
Kaşkaval	1.729	8.255.114	%4.8	0	0	
Ayran	1.605	877.092	-%66.2	0	0	-%100
Yoğurt	1.227	1.542.941	-%63.1	3	22.795	-%24.2
Tereyağı	541	3.577.442	-%47.0	10.160	47.803.467	%3.4
Çökelek	176	252.389	%30.0	0	0	-%100
Lor	174	189.524	-%59.8	7	8.075	-%0.5
Dil peyniri	77	318.227	-%4.0	0	0	
Çedar peyniri	6	37.782	-%58.4	2.533	10.364.90	-%24.8
Diğer süt ürünleri	4	8.391	-%99.1	347	1.956.257	%13.9
Gravyer peyniri	1	6.208	-%38.1	0	0	
Çester peynirleri	1	5.269	-%91.3	84	480.263	%226.4
Emmentaler peyniri	1	3.497		35	187.850	-%26.2
Edam peyniri	0	798	-%43.2	57	305.401	%62.3
Toplam	195.664	328.305.350	-%3.3	23.326	97.957.123	%1.5



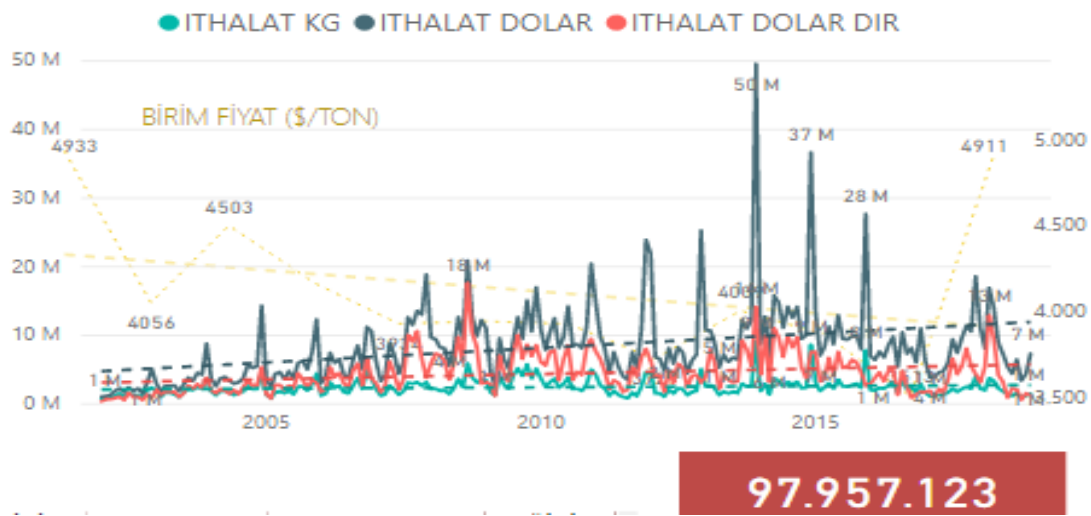
Şekil 12. Süt ve süt ürünleri ihracatının artış seyri (Anonim, 2019d)



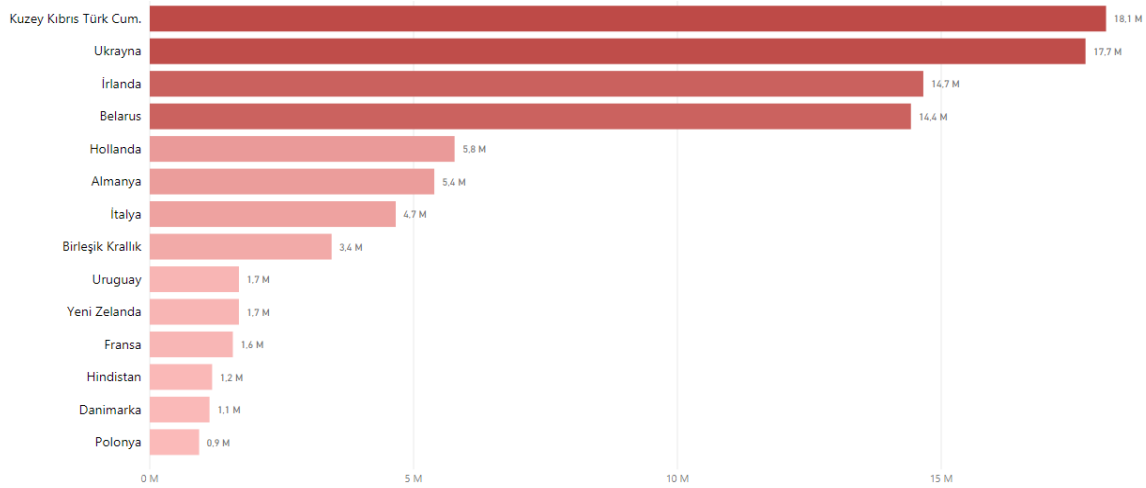
Şekil 13. Ülkeler bazında süt ve süt ürünleri ihracatı (ton, Bin dolar) (Anonim, 2019d)

Tablo 14. Süt ve süt ürünleri ithalatı (ton, Bin dolar) (Anonim, 2019d)

GTIP	Ürün Adı	2015		2016		2017		2018	
		Miktar	Değer	Miktar	Değer	Miktar	Değer	Miktar	Değer
0401	Süt, Krema	506	1.589	450	1.351	602	1.814	913	2.818
0402	Süttozu	106	494	180	639	94	513	121	644
040310	Yoğurt	515	877	49	112	-	-	3	23
040390	Yayık altı Süt, Piht. Süt ve Krema, Kefir vb.	14	108	2	11	86	253	132	374
0404	Peyniraltı suyu tozu	971	1.898	801	1.467	325	550	430	2114
0405	Tereyağı	20.060	72.469	13.517	43.916	-	-	10.160	47.803
0406	Peynir	10.923	43.342	10.590	37.148	9.342	37.578	8.285	34.025
170211 170219	Laktoz			2.129	4.709	2.388	5.912	2.808	7.233
2105	Dondurma	1.879	9.047	827	3.311	395	1.880	347	2.249
Genel Toplam		37.498	136.360	28.977	181.039	23.305	96.516	23.326	97.967



Şekil 14. Süt ve süt ürünleri ithalatın artış seyri (Anonim, 2019d)



Şekil 15. Ülkeler bazında süt ve süt ürünleri ithalatı (ton, Bin dolar) (Anonim, 2019 e)

Tablo 15. İhracatın ithalatı karşılama oranı (Anonim, 2019e)

Yıl	İhracat			İthalat			a/b, %
	Miktar	Değeri (a)	Değ %	Miktar	Değeri (b)	Değ. %	
2010	66.858	167.993	19	31.637	123.830		135
2013	120.733	286.000	25	29.163	144.000	22	199
2014	136.904	351.000	23	36.502	178.000	24	197
2015	116.638	274.144	-23	37.498	136.360	-24	199
2016	181.039	326.878	19	28.977	94.791	-30	345
2017	196.475	340.355	4	23.305	96.516	1,8	352
2018	195.664	328.305	-3,5	23.326	97.967	1,5	335

Türkiye süt ve süt ürünleri ithalatı Şekil 14’de görüleceği üzere yataya yakın bir seyir izlemektedir.

Türkiye 2018 yılında en fazla süt ve süt ürünleri ithalatını 18,1 milyon dolarla Kuzey Kıbrıs Türk Cumhuriyeti’nden yapmıştır. Bu ülkeyi 17,7 milyon dolarla Ukrayna ve 14,7 milyon dolarla İrlanda takip etmiştir (Şekil 15). Kuzey Kıbrıs Türk Cumhuriyeti’nden başta hellim peyniri olmak üzere çeşitli peynirler, Ukrayna’dan tereyağı, İrlanda’dan çedar peynir ithalatı yapılmaktadır.

Türkiye, süt ve süt ürünleri dış ticaretinde pozitif durumdadır. 2018 yılında 328 milyon dolarlık ihracata karşılık, 98 milyon dolarlık ithalat yapılmıştır. İhracatın ithalatı karşılama oranı % 335’dir (Tablo 15).

Sonuç ve Öneriler

Ulusal ve uluslararası veri kaynaklarından süt ve süt ürünleri ile ilgili veriler incelendiğinde, Türkiye ve dünyadaki son yıllarda yaşanan gelişim, karşılaştırmalı olarak incelenmiş, bu çerçevede dış ticarete mevcut durum değerlendirilmiş mevcut sorunlar ve çözüm önerileri belirlenmiştir.

- Üreticilerle ilgili sorunlar;
- Çiftliklerin küçük ölçekli olması,
- Verim düşük,
- Hayvan hastalıklarının varlığı,
- Hijyen Sorunu,
- Bilinçsiz bakım ve beslenme,
- Mevsimplere bağlı istikrarsız üretim,
- Kayıtdışılık,
- Üretici örgütlerinin zayıflığı,
- Yem hammaddelerinde dışa bağımlılık,
- Sanayi İşletmeleri ile ilgili sorunlar;

- Kalifiye eleman sıkıntısı var,
- Kayıt dışılık,
- Kaliteli ve sağlıklı hammadde de süreklilik olmayışı.
- İhracat ile ilgili sıkıntılar;
- Çin Halk Cumhuriyeti pazarının açılmamış olması,
- Pazarın istediği ürünleri üretilmemiş olması,
- Mevcut pazarların istikrarsız oluşu,
- Çözüm olarak; tüm paydaşların katılımı ile süt ve süt ürünleri eylem planı hazırlanmalı ve uygulanmalıdır.

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Ülke Toprakları ve Tarım Arazilerinin Bitkisel ve Hayvansal Üretim Faaliyeti Dışında Kullanımı

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MAKALE BİLGİSİ

ÖZET

Derleme

Geliş : 24 Aralık 2019

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Anahtar Kelimeler

Tarım

Tarım arazisi

Toprak

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Tarım, bitkisel ve hayvansal ürünler elde etmek amacıyla toprağın işlenmesi ve hayvan yetiştirmeyi içeren faaliyetlerin tümü olarak tanımlanmaktadır. Dünya nüfusu her geçen gün artarken, tarım arazileri ve verimli topraklar maalesef aynı oranda artmayıp, aksine azalmaktadır. Günümüzde, özellikle verimli tarım arazilerinin insanlar tarafından amacı dışında kullanımlarının hız kazanması ile konunun önemi daha da artmaktadır. Türkiye’de tarım arazileri tarımsal üretim dışında yoğun olarak kentleşme, sanayi, turizm, madencilik, enerji santralleri, alt yapılar, endüstriyel tesisler, karayolları, demiryolları, hava limanları, barajlar, kanallar, boru hattı gibi kamu yatırımları ve diğer alanlarda kullanılmaktadır. Tarım arazilerinin geri dönüşümü olamayacak şekilde tarım dışı kullanımı kısa vadede rant veya kazanç, uzun vadede ise fiyat ve destekleme politikasının olumsuz etkileri ile tarım topraklarının elden çıkması, telafisi olmayacak şekilde üretimde azalma ve buna bağlı olarak sosyal-ekonomik olumsuzlukları beraberinde getirecektir. Ülkemizde hayvancılıkla ilgili olumsuz gelişmeler sonucunda meralar elden çıkartılarak amaç dışı turistik tesis, sanayi tesisi veya alışveriş merkezi, kentsel dönüşüm projeleri kapsamında toplu konut alanına dönüştürülmektedir. Gelecek generasyon için, yaşanabilir bir doğa, gıda ihtiyaçlarını karşılayabilecekleri tarım arazisi ve toprak bırakılması için kaynakların planlı ve rasyonel bir şekilde kullanılması gerekmektedir.

Use of Country Soils and Agricultural Lands Except Plant and Animal Production Activities

ARTICLE INFO

ABSTRACT

Review

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Agriculture can be defined as all activities involving cultivation of land and animal husbandry in order to obtain plant and animal products. As the world population increases day by day, unfortunately,

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Keywords

Agriculture
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Soil

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agricultural lands and fertile soils do not increase at the same rate, but on the contrary, it decreases. urbanization farmland extensively outside of agricultural production in Turkey, industry, tourism, mining, power plants, sub-structures, industrial facilities, highways, railways, airports, dams, canals, is used in public investment and other areas such as pipeline. Non-agricultural use of agricultural lands which cannot be recycled will bring rent or gain in the short term, negative effects of price and support policy in the long term and the disposal of agricultural lands, decrease in irreversible production and consequently socio-economic problems. As a result of negative developments related to animal husbandry in our country, pastures are disposed of and tourism facilities, industrial facilities or shopping centers are turned into mass housing areas within the scope of urban transformation projects. For the next generation, resources should be used in a planned and rational way to leave a livable nature, agricultural land and soil where they can meet their food needs.

Giriş

Tarım, bitkisel ve hayvansal ürünler elde etmek amacıyla toprağın işlenmesi ve hayvan yetiştirmeyi içeren faaliyetlerin tümü olarak tanımlanmaktadır (Anonim, 2019a). Bitkisel ve hayvansal üretim faaliyetlerinin birlikte değerlendirildiği tarım arazileri üstünde yapılan hayvancılık, tarımsal etkinliğin içerisinde ve ayrı bir alan olarak değerlendirilmemesi gerekmektedir (Topçu, 2012). Tarım; istihdam sağlayan, nüfusun beslenmesi için ihtiyaç duyulan gıdaları üreten, sanayi için girdi sağlayan, ülke ihracatına katkıda bulunan, milli gelirin önemli bir kısmını oluşturan bir sektördür. Bu nedenle tarım alanlarının amaç dışı kullanılması konusu önemlidir (Bayar, 2018). Toprak ve tarımsal arazi kavramları birbirinden farklıdır. Tarım arazisi; toprak, topoğrafya, iklim, bitki örtüsü ve diğer ekolojik faktörler bakımından tarımsal üretim için uygun olan arazidir. Toprak ise arazinin bir

parçasıdır. Mineral ve organik maddelerin ayrışması sonucunda oluşan, yaşamın sürdürülmesini sağlayan canlı ve doğal en önemli kaynaklardan biridir (Topçu, 2012; Anonim, 2019a; Turan ve ark., 2019).

Dünya nüfusu her geçen gün artarken, tarım arazileri ve verimli topraklar maalesef aynı oranda artmayıp, aksine azalmaktadır. Günümüzde, özellikle verimli tarım arazilerinin insanlar tarafından amacı dışında kullanımlarının hız kazanması ile konunun önemi daha da artmaktadır. Tarım nüfusu ve tarımsal üretimin öne çıktığı bir ülke olarak Türkiye’de; doğal kaynaklar, tarım arazisi ve toprak varlığı gibi üretim faktörlerinin amaç dışı kullanımlara karşı korunması bir zorunluluk arz etmektedir. Ülkemizde toprak kaynaklarının tarımda kullanılması hususundaki ilk çalışmalar Cumhuriyet döneminde Tarım Bakanlığı tarafından 1932 yılında başlatılmıştır. 1960 yılında TOPRAKSU Genel Müdürlüğü’ nün kurulmasıyla arazilerin

kullanım alanlarına göre belirlenmesi amaçlanmıştır. Tarım alanlarının tarım arazisi dışında kullanımlarının en önemli nedenlerinden biri olarak artan nüfus gösterilmektedir (Dengiz ve Sarıoğlu, 2011).

Türkiye’de tarım arazileri tarımsal üretim dışında yoğun olarak kentleşme, sanayi, turizm, madencilik, enerji santralleri, alt yapılar, endüstriyel tesisler, karayolları, demiryolları, hava limanları, barajlar, kanallar, boru hattı gibi kamu yatırımları ve diğer kullanım alanlarında kullanılmaktadır. Bunun sonucunda sürdürülebilir tarım toprağı kullanımı olumsuz yönde etkilenmektedir. Tarım arazilerinin geri dönüşümü olamayacak şekilde tarım dışı

kullanımı kısa vadede rant veya kazanç, uzun vadede ise fiyat ve destekleme politikasının olumsuz etkileri ile tarım topraklarının elden çıkması, telafisi olmayacak şekilde üretimde azalma ve buna bağlı olarak sosyo-ekonomik olumsuzlukları beraberinde getirecektir (Aksoy, 1997; Yılmaz, 2001). Geri dönüşümü olmayan tarımsal üretim kaynaklarının yok olmasına paralel olarak açlık, ekolojik dengenin bozulması, biyolojik çeşitliliğin azalması, tarıma dayalı yatırımların son bulması gibi birçok olumsuz faktör de kaçınılmaz bir sonuç olacaktır (Topçu, 2012; Akseki ve Meşhur, 2013; Karakuş ve Karakuş, 2017).

Tablo 1. Yıllara göre toplam tarım arazisi kullanımı (Çolak ve Memişoğlu, 2018)

Yıllar	Türkiye'de toplam ekilen alan (ha)
2001	26 350 475
2002	26 579 218
2003	26 027 240
2004	26 593 178
2005	26 606 715
2006	25 876 271
2007	24 887 394
2008	24 505 223
2009	24 294 681
2010	24 394 205
2011	23 613 762
2012	23 781 999
2013	23 805 512
2014	20 697 903
2015	20 649 766
2016	20 433 356

Ülkemizde ekilebilir tarım alanları her geçen yıl azalmaktadır. 2001 yılında bu rakam 26.350.475 ha iken, 2016 yılında ise 20.433.356 ha olmuştur.

(Çolak ve Memişoğlu, 2018).

Türkiye tarım alanları son yıllarda giderek azalmıştır. Son 18 yılda yaklaşık %16 oranında bir azalma söz

konusudur (Anonim, 2019c; Anonim, 2019d, Anonim, 2019f).

Tablo 2. Türkiye’de tarım alanları 1990 – 2018 verileri (Anonim, 2019d)

Tarım Alanı	1990		2002		2015		2016		2017		2018	
	(Bin ha)	%	(Bin ha)	%	(Bin ha)	%	(Bin ha)	%	(Bin ha)	%	(Bin ha)	%
Tarla Bitkileri	18.868	67,7	17.935	67,5	15.723	66,0	15.575	65,7	15.532	66,4	15.436	66,5
Nadas	5.324	19,1	5.040	19,0	4.114	17,2	3.998	16,9	3.697	15,8	3.513	15,1
Sebze	635	2,3	930	3,5	808	3,4	804	3,4	798	3,4	784	3,4
Meyve, İçecek ve Baharat	3.029	10,9	2.674	10,1	3.284	13,7	3.329	14,0	3.343	14,3	3.462	14,9
Süs Bitkileri	-	-	-	-	5	0,02	5	0,02	5	0,02	5	0,02
TOPLAM	27.856	100	26.579	100	23.934	100	23.711	100	23.375	100	23.200	100

Tablo 3. Türkiye’de bölgelere göre mera alanlarının değişimi (Gökkuş, 2018)

Bölgeler	1970 Köy Hizmetleri		1991 Tarım Sayımı		2001 Tuik Sayımı		1998-2019-1	
	Alan (ha)	%	Alan (ha)	%	Alan (ha)	%	Alan (ha)	%
Ege	1.027.900	1,32	615.900	0,79	802.879	1,03	276.924	0,35
Marmara	463.600	0,59	564.100	0,72	552.662	0,71	283.743	0,36
Akdeniz	1.002.400	1,29	434.300	0,56	659.334	0,85	580.406	0,74
İç Anadolu	5.884.200	7,54	3.890.300	4,99	4.570.182	5,86	4.166.634	5,34
Karadeniz	1.993.100	2,56	1.556.000	1,99	1.533.603	5,81	1.263.469	1,61
Doğu Anadolu	9.162.100	11,75	4.573.400	5,86	5.485.449	7,03	4.337.580	5,56
Güney Doğu Anadolu	2.165.100	2,78	743.600	0,95	1.012.576	1,30	787.739	1

Dünya 3,4 milyar hektar mera alanı içerisinde Türkiye 14,6 milyon hektar ile 46. sırada yer almaktadır. Ne yazık ki mera alanlarımız hızla azalmaktadır. Ülkemizde hayvancılıkla ilgili olumsuz gelişmeler sonucunda meralar elden çıkartılarak amaç dışı turistik tesis, sanayi tesisi veya alışveriş merkezi, kentsel dönüşüm projeleri kapsamında toplu konut alanına

dönüştürülmektedir. Ayrıca terör ve ekonomik sorunlar nedeni ile kırsaldan kente göç ile hayvancılığı yapacak olan gençlerin iş tercihlerinin değişmesi, köylerin boşalması, mera ıslahının uzun yıllar geçmesine rağmen istenilen seviyede olmaması bu alanların hızla kaybolmasına neden olmaktadır. Meraların kullanım amacının dışına çıkışının önlenmesi ülke hayvansal

üretimi açısından son derece önemlidir (Sabancı ve Yavuz, 2015; Anonim, 2019e).

Çayır mera alanları 1970 yılında 2.165.100 ha iken, 2019 yılında bu rakam büyük oranda düşerek 787.739 ha olmuştur (Gökkuş, 2018). Mera alanlarının azalması ve yanlış kullanılması sonucunda yem üretimindeki olumsuz sonuçlar nedeni ile dışa bağımlılık ve ithalatın artması kaçınılmazdır. Bunun sonucunda et ve süt üretim maliyetlerinin artması ile tüketiciye ürün fiyatlarının artması olarak yansımaları olumsuz olacaktır (Sabancı ve Yavuz, 2015; Anonim, 2019d)

Türkiye’de tarım alanlarında son 15 yılda yüzde 12 düşüş olmuştur. Bununla beraber çiftçi sayısında da son 10 yılda yüzde 38 azalma olmuştur. Sosyal Güvenlik Kurumunda kayıtlı olan çiftçi sayısında yılları takiben bir azalma gözlemlenmektedir. 2008’de 1 milyon 127 bin olan çiftçi sayısı 2018’de 697 bine kadar gerileyerek yüzde 38 gibi ciddi bir oranda azalma gerçekleşmiştir. Tarım sektöründe istihdam edilen kişi sayısında ise bu azalma oranı yüzde 33 olmuştur (Anonim, 2019f). Son yıllarda mera alanlarının bitkisel üretim alanlarına dönüşümü artmıştır. Hayvansal üretim açısından öncelikli olarak yem kaynaklarından biri olan meraların yüksek maliyetler harcanarak bu dönüşümü, üretici ve tüketici açısından olumsuz sonuçlar yaratırken, ekolojik olarak dengenin bozulması ve o bölge ve yöreye özgü canlıların yok olması ile de olumsuz bir durum oluşturmuştur (Bayar, 2018).

Sonuç ve Öneriler

Gelecek generasyon için, yaşanabilir bir doğa, gıda ihtiyaçlarını karşılayabilecekleri tarım arazisi ve toprak bırakılması için kaynakların planlı ve rasyonel bir şekilde kullanılması gerekmektedir. Bunun için ülkemizdeki kaynaklarımızın amaç dışı kullanımının önlenmesi için gereken tedbirlerin alınarak, ileriye dönük yönetim politikaları ve stratejilerin geliştirilmesi sürece olumlu katkı sağlayacaktır. Bugüne kadar izlenen tarım politikaları ve ilgili mevzuat da tarım arazilerinin tarım dışı kullanılmasını etkileyen önemli faktörlerdendir. Tarım arazileri ve toprağın ekolojik, bitkisel üretim, sosyo-ekonomik ve endüstriyel olarak yasal zorunluluklar dışında amaca uygun olarak kullanılması gerekmektedir. Bunun için kullanıcıların sorumluluğunda gereken önlemlerin alınması zorunlu kılınmalıdır (Anonim, 2019b). Türkiye toprakları ve tarım arazileri için ulusal, güncel bir veri tabanının oluşturulması, yapılacak yatırım ve planlamalarda tarım arazilerinin sürdürülebilirliği ve arzu edilen hedeflere ulaşılmasında önemli bir adım olacaktır (Karaca ve ark., 2019). Tarım alanlarını korumak ve kalitesini arttırmak için çalışmalar hız kazanmalıdır (Turan ve ark, 2019). Ayrıca tarım arazi ve topraklarının özelliklerine göre sınıflandırılmaları ve üretim modelleri oluşturulmasında yararlı olacaktır.

Hayvancılık sektörü için büyük öneme sahip olan meraların amaç dışı kullanımı ile yemde dışa bağımlı olan

Türkiye'nin ithalattan vazgeçerek hızla hayvancılıkta üretimini artırması gerekmektedir. Mera alanları ıslah edilerek, yanlış kullanımının önlenmesi ile yetiştiricilerin kullanımına sunulması önemlidir. Türkiye'de daha önce çok çeşidi ve miktarı olan tarımsal ürünlerin üretiminin tekrar artırılarak dışarıdan alımları ile boşalan tarım alanlarının acilen üretime geçirilmesi önemlidir. Türkiye önemli bir tarım nüfusuna, verimli toprak ve tarım alanlarına sahiptir. Geleceğimiz için, hemen hemen hiçbir ülkenin sahip olmadığı iklim koşulları, ürün çeşidi ve potansiyele sahip ülkemizde tarım alanlarının doğru ve planlı değerlendirilmesi yararlı olacaktır. Mevcut sorunların çözümünde güncel verilerin değerlendirilerek yeni eylem planları, politikalar ve çözüm odaklı örnek model ve projelerin yapılması gerekmektedir.

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Information For Authors

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Publication types

The journal publishes original research articles, short communications, scientific reports, case reports, technical notes, letters to the editor, reviews, and, when necessary, research and conference books.

Original (full-length) manuscripts are original scientific papers based on sufficient scientific investigations, observations and experiments. Manuscript consists of the title, abstract and keywords, introduction, material and methods, results, discussion, and references. Manuscript length should not exceed 16 pages. Abstract should contain 300±50 words.

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Scientific reports are short description of original research findings. These should be prepared in the format of full-length original articles. The length of scientific reports should be no longer than 6 pages in total.

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Technical notes are notes on methods or guidance related to animal science and production. The title and summary of these articles should be written in the format of full-length original articles and the remaining sections should follow Introduction, text (with appropriate titles), conclusion, and references. The length of case reports should be no longer than 6 pages in total.

Letters to the editor are short and picture-documented presentations of subjects with scientific or practical benefits or interesting cases. The length of letters should be no longer than 2 pages in total.

Reviews are based on literature regarding a particular subject. The title and summary of this review should be prepared as described for the full-length original articles and the remaining sections should follow Introduction, text (with appropriate titles), conclusion, and references.

The length of the text should be no longer than 16 pages in total. Invited reviews have priority for publication.

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Manuscripts should be written in Turkish or English.

The manuscripts should be prepared in the format of Times New Roman style, font size 12, A4 paper size, 1.5 line spacing and 2.5 cm margins of all edges.

The appropriate positions of Figures and Tables should be indicated in the text.

Latin expression such as species names of bacterium, virus, parasite and fungus, *in vivo*, *in vitro*, *in situ*, *ad libitum*, and anatomical terms must be written in italic character as their original forms.

The necessary descriptive information (thesis, projects, financial supports etc) scripted in the format of Times New Roman Style (font size 11) should be explained below the manuscript title after placing a superscript mark at the end of title.

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References should be listed with historically name order. They should have the order of surnames and initial letters of the authors, the year of publication, title of the article, title of the journal (original abbreviated title), volume and issue numbers, page numbers and the text formatting should be performed as shown in the example below;

Coşkun, İ., Tad, M., Filik G., Altop,A., Şahin, A., Erener, G., Şamli, H.E.2017. Dietary symbiotic supplementation alters the ileal histomorphology and caecal pathogen microorganism in broiler chicks. *Journal of Livestock Science* 8: 109-114.

If the reference is a book, it should follow surnames and initial letters of the authors, year of publication, title of the book, edition number, page numbers, name and location of publisher. If a chapter in book with an editor and several authors is used, names of chapter authors, year of publication, name of chapter, name of book, editors, edition number, page numbers, name and location of publisher and the formatting should be performed as shown in the example below;

Johnson, D.E., Hill, T.M. Carmean, B.R. Lodman, D.W., Ward, G.M. 1991. New perspectives on ruminant methane emissions. In *Energy Metabolism of Farm Animals* (C. Wenk and M. Boessinger, eds) pp. 376-379. ETH, Zurich, Switzerland.

If the references can be reached online only, the web address and connection date should be added at the end of the reference information.

FAO, 2018. Nile-tilapia- Feed formulation. <http://www.fao.org/fishery/affris/species-profiles/nile-tilapia/feed-formulation/en/> (accessed 24 January 2018).

The generally accepted scientific writing instructions must be complied with the other references. Abbreviations, such as “et al” and “and friends” should not be used in the list of the references.

If applicable, DOI number should be added to the end of the reference.

Before submission

Supply a cover letter (without author/authors name)

Cover letter includes information about manuscript how it was produced, why it is original, its contribution to science, if necessary, related information about funding body, project number, project team, part of thesis, etc.

Title page must be include title, running title (no more than 5 words), the author's name, institutional affiliation, corresponding author's address, phone, fax, and e-mail information, if applicable, congress-symposium, project, thesis etc. information of the manuscript,

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Acknowledgement should be stated in the manuscript.

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Yazarlar İin Bilgi

Makale Yazım Kuralları

Hayvan Bilimi ve Ürünleri Dergisi, yılda 4 kez yayınlanmaktadır (ISSN: 2667-4580). Derginin kısa adı JASP'dır. Dergi kapsam olarak, hayvan bilimi ve üretiminin tüm aşamalarını içerir.

Hayvan Bilimi ve Ürünleri Dergisi, açık erişimli uluslararası bir dergidir. Her kullanıcı veya kurum ücretsiz olarak tüm yayınlara ulaşabilir. Yayıncı veya yazardan izin almadan kullanıcılar, makalelerin tam metinlerini okuyabilir, indirebilir, kopyalayabilir, yazdırabilir, bağlantı verebilir ve diğeryasal amaçlarla kullanabilir.

Makale türleri

Dergimizde, orijinal tam metin araştırma makaleleri, kısa araştırma makaleleri, bilimsel raporlar, vaka raporları, teknik notlar, editöre mektuplar, derlemeler ve gerektiğinde araştırma ve konferans kitapları yayınlanır.

Orijinal (tam metin) araştırma makaleleri, bilimsel çalışmalara, gözlemlere ve deneylere dayanan özgün bilimsel makalelerdir. Makale, başlık, özet ve anahtar kelimeler, giriş, materyal ve yöntem, bulgular, tartışma ve kaynaklar kısmından oluşur. Makale 16 sayfayı geçmemelidir. Özet, 300 ± 50 kelime içermelidir.

Kısa araştırma makaleleri, 6 sayfadan az olan araştırma makalelerdir. Makale, özgün olmalı, başlık, özet ve anahtar kelimeler, giriş, materyal ve yöntem, bulgular, tartışma ve kaynaklar kısımlarını içermeli, ancak özet kısmı 150 kelimeyi geçmemelidir.

Bilimsel raporlar, orijinal araştırma bulgularının kısa özetidir. Rapor, tam metin orijinal araştırma makalesi formatında hazırlanmalıdır. Bilimsel raporların uzunluğu, toplamda 6 sayfadan fazla olmamalıdır.

Vaka raporları, hayvan bilimi ve ürünleri hakkında sahada, uygulama ve laboratuvar çalışmalarında karşılaşılan güncel bulguların bildirimleridir. Vaka raporunun başlığı ve özeti tam metin araştırma makalesi formatında yazılmalı, geri kalan bölümleri, giriş, vaka tarihçesi, tartışma ve kaynaklar kısımları takip etmelidir. Vaka raporlarının uzunluğu, en fazla 6 sayfa ile sınırlandırılmıştır.

Teknik notlar, hayvan bilimi ve üretimi ile ilgili yöntemlerin ve teknik bilgilerin yer aldığı makalelerdir. Teknik notun, başlığı ve özeti, tam metin orijinal makaleler gibi yazılmalı ve geriye kalan bölümler giriş, metin (uygun başlıklar ile birlikte), sonuç ve kaynaklar kısımlarını takip etmelidir. Teknik notların uzunluğu toplamda 6 sayfadan fazla olmamalıdır.

Editöre mektuplar, bilimsel veya pratik yararı olan bir konuyu veya vakayı dikkat çeken yazılardır. Mektuplar, 2 sayfadan fazla olmamalıdır.

Derlemeler, belirli bir konu ile ilgili literatür araştırmasına dayanır. Derlemenin başlığı ve özeti, tam metin orijinal makale formatında hazırlanmalı ve kalan bölümleri giriş, metin (uygun başlıklar ile birlikte), sonuç ve kaynaklar kısımlarının takip etmesi gerekir. Derlemenin uzunluğu, toplamda 16 sayfadan fazla olmamalıdır. Davetli derlemelerin yayınlanması önceliklidir.

Makale hazırlama

Makaleler, Türkçe veya İngilizce olarak yazılmalıdır.

Makaleler, Times New Roman yazı stilinde, 12 puntoda, A4 kağıt boyutunda, 1.5 satır aralığında ve kenar boşlukları 2.5 cm formatında olacak şekilde hazırlanmalıdır.

Şekil ve Tabloların metin içinde yerleri veya konumu belirtilmelidir.

In vitro, in vitro, in situ, ad libitum gibi anatomik terimler, bakteri, virüs, parazit ve mantar gibi tür isimleri ile latince ifadeler italik karakterle yazılmalıdır.

Açıklanması gereken bilgiler (tez, projeler, finansal destekler vb.), Times New Roman stilinde 11 Punto formatında Başlığın başına bir üst simge yerleştirdikten sonra, başlığının altında açıklanmalıdır.

Kaynaklar metin içerisinde, Şahin (2017), Şahin ve Yıldırım (2017) veya Çoşkun ve ark. (2017).

Kaynaklar, tarih ve isim sırasına göre listelenmelidir. Yazarların soyadları ve ilk harfleri, yayın yılı, makale başlığı, dergi adı (orijinal kısaltılmış başlık), cilt (ve sayı numaraları) ve sayfa numaraları aşağıdaki örnekte gösterildiği gibi belirtilmelidir;

Çoşkun, İ., Tad, M., Filik G., Altop, A., Şahin, A., Erener, G., Şamli, H.E.2017. Dietary symbiotic supplementation alters the ileal histomorphology and caecal pathogen microorganism in broiler chicks. Journal of Livestock Science 8: 109-114.

Yararlanılan kaynak bir kitapsa, yazarların soyadlarını ve ilk harflerini, yayın yılını, kitabın adını, baskı numarasını, sayfa numaralarını, yayın evinin adı ve yeri sırasıyla belirtilmelidir. Bir editör ve birkaç yazarla birlikte kitapta bir bölüm kullanılıyorsa, bölüm yazarlarının isimleri, yayın yılı, bölüm adı, kitap adı, (editörlerin adlarının ilk harfi ve soyadları), edisyon sayısı, yayın numarası, sayfa numarası, yayın evinin adı ve yeri aşağıdaki örnekte olduğu gibi belirtilmelidir;

Johnson, D.E., Hill, T.M., Carmean, B.R., Lodman, D.W., Ward, G.M. 1991. New perspectives on ruminant methane emissions. In Energy Metabolism of Farm Animals (C. Wenk and M. Boessinger, eds) pp. 376-379. ETH, Zurich, Switzerland.

Yararlanılan kaynağa ancak online erişilebiliyorsa, web adresi ve erişim tarihi kaynağın sonuna eklenmelidir.

FAO, 2018. Nile-tilapia- Feed formulation. <http://www.fao.org/fishery/affris/species-profiles/nile-tilapia/feed-formulation/en/> (erişim tarihi 24 Ocak 2018).

Genel kabul görmüş kaynak bildirimleri geçerli olup kaynaklar listesinde "et al" ve " ve ark." gibi kısaltmalar kullanılmamalıdır.

Mümkünse, kaynaklar kısmında yararlanılan makale veya yayının sonuna DOI numarası eklenmelidir.

Makale Gönderiminden Önce

Başvuru mektubunu ekleyiniz.

Başvuru mektubu, makalenin nasıl üretildiğini, niçin orijinal olduğunu, proje desteği, proje numarası, proje ekibi, tez gibi bilgileri içerebilir.

Başlık sayfası, başlık ve kısa başlık (en çok 5 kelime), yazarların ad ve soyadlarını, kurum bilgilerini, kurum adresini, telefon, faks ve e-posta bilgilerini içermelidir. Gerektiğinde kongre-sempozyum, proje ve tez vb. gibi bilgiler eklenebilir.

Makale, başlık, özet, anahtar kelimeler ve ana metni içermelidir.

Makalede, sayfalar ve satırlar numaralandırılmalıdır.

Şekil ve Tablolar, metin içinde adının geçtiği uygun bir yerde ve sırayla verilmelidir, ilave dosya ile verilmesine gerek yoktur.

Gerektiğinde ilave dosyalar yüklenebilir.

Makalenin harf ve gramer denetiminin yapıldığından emin olunuz.

Gerektiğinde, yerel etik komisyon raporu vb. gibi belgeleri sağlayınız.

Makalede "Teşekkür" kısmı bulunmalıdır.

Makale Gönderimi

Makale ve ekleri (gerektiğinde) Kullanıcı sekmesindeki "Yeni gönderi" kısmını tıklamak suretiyle online olarak gönderilebilecektir.

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Deney hayvanları üzerine yapılan çalışmalar için, materyal ve yöntem kısmında yerel etik komisyon raporunun kayıt numarası belirtilmelidir. Gerektiğinde, Editörlük, etik komisyon raporunun aslını isteyebilir.

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Yayınlanması için dergi online sistemine yüklenen makaleler, yazar isimleri gözükmeyecek şekilde iki (2) hakeme gönderildiğinden yazar isimleri, kurum bilgileri, kurum adresleri, e-mail bilgileri yalnızca başlık sayfasında verilmelidir.

Dergimiz online sistemine yklenen makaleler, n deęerlendirmeye alındıktan sonra, alanında uzman iki hakemin olumlu grşleri ve blm editrnn onayından sonra yayınlanabilir. Yayın kurulu, yayınlanmak zere gnderilen makale zerinde gerekli dzeltmeleri yapabilir ve yazarlara nerilerde bulunabilir. Yazarlara dzeltme amacıyla gnderilen makaleler bir (1) ay iinde dzeltilmiř olarak Editrlk Ofisine gnderilmelidir.

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