



Husbandry and Sustainability of Water Buffaloes in Turkey[#]

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ABSTRACT

Water buffaloes in Turkey originate from Mediterranean Water Buffaloes, a subgroup of river water buffaloes and are known as Anatolian Water Buffalo. During the 1970's the number of water buffaloes in Turkey was one million, but in 2010 this figure dropped to about 85.000. Thanks to the incentives introduced for water buffalo husbandry in recent years, the water buffalo population has risen to 143.073 heads. Water buffalo husbandry in Turkey is performed in some provinces of the Black Sea, Marmara and Central Anatolian Regions. The provinces with the highest amount of water buffalo existence are listed as Samsun, Diyarbakır, İstanbul, Tokat, Bitlis, Muş, Afyon, Kayseri, Sivas and Amasya. Breeding style in Turkey is in the form small family business, with an average of 1-5 animals per enterprise. Family enterprises are keeping water buffaloes for their own consumption. Mostly breeding in modern enterprises formed for indoor barn breeding, the size of the herds is around 50 to 100 heads. Being done only at swamps or waterfronts in the past, water buffalo husbandry increasingly takes place in modern facilities nowadays. The colour of Anatolian Water Buffaloes is generally black and their horns curved backwards, are called arch horns in Turkey. The lactation milk yield and lactation length in Anatolian Water Buffaloes are between 800 and 1100 kg and about 180-280 days respectively. It is demonstrated that they varied according to effects of environmental factors, care and feeding. Adult water buffalo's live weight is about 411-518 kg. The first insemination age of water buffalo is 32 to 43 months and during a lifespan the number of lactation periods is 5 to 10. For adult water buffalo at withers the height of females is being expressed as around 135 cm. Calves are generally breastfed for 3-4 months. Generally, water buffaloes are milked twice a day in the village farms by hand.

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ÖZET

Türkiye’deki mandalar, nehir mandalarının alt grubu olan Akdeniz mandalarından köken almakta ve Anadolu mandası olarak adlandırılmaktadır. Türkiye’de 1980 yıllarda bir milyon manda varlığı varken, 2007 yılında 85.000 bine kadar düşmüştür. Son yıllarda manda yetiştiriciliğinde teşviklerin uygulanmasıyla birlikte manda varlığı 143.073 baş olmuştur. Türkiye’de manda yetiştiriciliği; Karadeniz, Marmara ve İç Anadolu bölgelerinde yoğun olarak yapılmaktadır. En çok manda sayısına sahip iller Samsun, Diyarbakır, İstanbul, Tokat, Bitlis, Muş, Afyon, Kayseri, Sivas ve Amasya olarak sıralanmaktadır. Yaygın yetiştirme biçimi küçük aile işletmeleri şeklinde, aile tüketimi için ve ortalama 1-5 başlıktır. Kapalı ahır besisi için oluşturulan sürülerde 50-100 başlık büyüklüğe ulaşılır. Geçmişte sadece bataklık veya su kenarlarında yapılan manda yetiştiriciliği günümüzde modern işletmelerde de yapılmaktadır. Türkiye’de mandalarının genel olarak rengi siyah olup, yay boynuz denilen geriye kavisli biçimde boynuzludur. Anadolu Mandalarının çevre şartları ve bakım beslemeye göre değişimle birlikte laktasyon süt miktarları 800-1100 kg, laktasyon uzunluğu da 180-280 gün arasında değişiklik göstermektedir. Yetişkin manda ağırlıkları 411-518 kg arasındadır. Mandaların ilk malaklama yaşı 32-43 ay arası olup, bir manda için toplam ömürde 5-10 laktasyon dönemi söz konusudur. Ergin dişi mandalarda cidago yüksekliği yaklaşık 135 cm olarak ifade edilmektedir. Malaklar annelerini genelde 3-4 ay emmektedirler. Köy şartlarında sağım genellikle elle ve günde iki defa yapmaktadırlar.

Introduction

Water buffalo is bred for meat and milk, its skin, horn and manure are made use of and in some countries and enterprises, it is also being used as a draught animal. Even though water buffalo was not valued as highly as other livestock until this day, it has become more regarded both in Turkey and in various other countries, due to its numerous characteristics and yield. Particularly in countries with suitable conditions, water buffalo breeding is starting to get the attention it deserves. Among the characteristics that is making water buffalo important are; durability against nature and diseases, high level of capacity to make good use of fodder, the capacity of converting low-quality roughage into meat and milk, lower breeding costs than cattle and austerity when it comes to feeding (Atasever and Erdem, 2008). Water buffalo rumen is developing earlier than that of cattle and is richer in terms of rumen bacteria, which makes it able to make use of roughage, unlike other animals (Guyton, 1991). Being also highly suitable for pasture raising makes water buffalo an economic milk and working animal for small agricultural enterprises. Contaminated with diseases, meadows are not suitable for cattle, sheep and pigs, but water buffalo makes the most use of them, without any dangers (Sarıözkan, 2011). Being particularly resistant to diseases such as *piroplasmiasis*, *distomatosis* and *anoplasmosis* is one of the advantages of water buffalo. Water buffalo is generally an animal of humid, temperate and marshy regions, thus it cannot adapt well to extremely warm or cold temperatures. In regions with suitable environmental conditions, it can be more economic than cattle (Harvey, 1963). A great ability to adapt to the environment and various conditions, water buffalo is found to wallow in mud (Fisher, 1975). Most of the domestic water buffaloes in the world (95%) are found in the Far East. As a meat, milk and draught animal, water buffalo has a particularly great economic efficiency in the tropical and subtropical regions of Asia. In addition, it is also bred in South American countries, North Africa, all Mediterranean countries excluding France, Balkans and some Central European countries Australia. Their numbers in the southern hemisphere are low.

Having over 70 different species under domestic and wild categories, domestic water buffaloes are divided into two groups, "River (Stream) Buffalo" and "Swamp Buffalo". River buffalo with Indian origin is a race with a combined efficiency, mostly bred for meat and milk. Swamp buffalo, known as "Carabao", on the other hand is not suitable for milk production and is a race found in China and South-East Asia and used for milk and meat production as well as ploughing fields (Atasever and Erdem, 2008). Water buffaloes in Turkey originate from Mediterranean Water Buffaloes, a subgroup of river water buffaloes and are known as Anatolian Water Buffalo (Soysal et al., 2005).

Water Buffalo Husbandry and Its Importance

Water buffalo is a late developer when compared to cattle, and the development continues until the age of six. Its lifespan is about 30 years. It reaches the age of sexual

maturity later than cattle. Water buffalo heifers reach sexual maturity when 13-14 months old. Therefore, water buffalo heifers can be inseminated when 22 - 24 months old. While male water buffaloes can be used as bulls after the age of 20-21 months. Male water buffaloes can be used as a bully until they reach 5-6. The breeder age of bulls is about 2-15 years (Anonymus, 2003).

Rutting in water buffalo cows is not as distinct as in cattle and its rutting period is calmer. Pregnancy periods of water buffaloes range between 299 - 346 days, depending on race, climate and country of breeding, but on average, this duration is 315 - 319 days. Birth lasts five hours on average and it takes place mostly during the quiet hours of the day, at night time or early morning, and usually no help is needed. Water buffaloes usually birth a single calf (Anonymus, 2003).

Adult skin thickness in water buffaloes is 6.0-7.6 mm, and thicker than cattle skin. However, the hair cover and subcutaneous sweat glands are 1/10 times less than those found in the cattle skin. Due to shortage of sweat glands and hair cover, it cannot self-regulate its body heat during warm summer months, becomes uncomfortable; hence feels the need to swim in the water or wallow in marsh or mud. In addition, due to low skin, hair density, resistance against cold weather is lower than that of cattle (Şahin and Küçükkebabçı, 2002).

Particularly in low-income countries, water buffaloes are important to farm animals in economic terms, and they are used for milk, meat, skin and draught. Milk yield in water buffaloes is 1850-2000 liters on average. The food substance content of water buffalo milk is higher than that of cow's milk. Water buffalo milk contains more calories than cow's milk, and as the total dry matter is higher, it increases the yield of dairy products such as cream, butter and cheese. While cow's milk yields 70 calories per 100 grams, water buffalo milk yields 100 calories. Having greater fat globules, high levels of solid fat, makes it easier to churn butter and to separate cream. Fat percentage taken from water buffalo milk is noticeably higher than that taken from cow milk (El-Salam and El-Shibiny, 2011). When compared to cow milk, water buffalo milk has lower cholesterol levels and higher tocopherol levels. Water buffalo milk, with its white color, high-fat content and taste, are milk preferred by consumers. Water buffalo milk can be stored for longer, as it has a higher peroxidase activity. When compared to cow milk, it has higher calcium content, better calcium/phosphor ratio, and lower sodium and potassium levels, which make it a better nutritional supplement for newborns. Comparing water buffalo milk with a cow, sheep and goat milk reveals that it is superior in many terms (Küçükkebabçı and Şahin, 2002; Wanapat and SungChhang, 2013; Aköz et al., 2017). Due to their adapting capacities, ability to make use of low-quality fodder, and having fats with lower cholesterol and higher unsaturated fat acids in their meat and milk, water buffaloes are irreplaceable in terms of genetic biodiversity (Borghese, 2010).

Comparison of water buffalo milk's composition with milk taken from other farm animals has been given in Table 1.

Table 1 Comparing the composition of water buffalo milk with milk content of some other farm animals (%)*

Kind of Milk	Water	Dry matter	Protein	Fat	Lactose	Mineral matter
Water buffalo	82.0	17.7	4.2	7.85	4.80	0.77
Cattle	87.5	12.4	3.4	3.65	4.65	0.75
Sheep	82.9	17.2	5.4	6.25	4.55	0.88
Goat	87.1	13.0	3.7	4.10	4.45	0.80

*(Oysun, 1987; Demirci et al., 1991; Atasever and Erdem, 2008)

Table 2 Comparing beef and water buffalo meat (100 gr)*

Components	Beef	Water buffalo meat
Calorie (kcal)	289	131
Protein (gr)	24	26.8
Fat (gr)	21	1.8
Cholesterol (gr)	90	61
Mineral (mg)	584	641.8
Vitamin (mg)	18.5	21

*(Soysal, 2009)

Table 3 Water buffalo numbers in some countries of the world (head)*

Countries	1961	1970	1980	1990	2000	2010	2014
India	51.207.900	56.118.000	66.070.000	80.570.000	93.831.000	111.300.000	110.000.000
Pakistan	6.700.000	9.345.000	11.547.000	17.373.000	22.669.000	30.800.000	34.553.000
Nepal	795.000	1.020.000	2.500.000	3.012.570	3.525.950	4.836.980	5.178.612
Bangladesh	500.000	835.000	475.000	772.000	890.000	1.349.000	1.457.000
China	8.369.516	15.713.063	18.439.744	21.421.967	22.595.017	23.602.144	23.345.000
Philippines	3.452.000	4.431.500	2.870.270	2.764.950	3.024.400	3.270.400	2.844.149
Vietnam	2.252.000	2.270.700	2.313.000	2.854.100	2.897.200	2.913.390	2.511.900
Myanmar	1.048.520	1.540.720	1.901.000	2.061.000	2.441.240	3.000.000	3.422.374
Thailand	4.963.580	5.734.500	5.650.790	5.094.270	1.711.570	1.622.650	1.020.088
Indonesia	2.893.280	2.885.000	2.457.000	3.335.080	2.405.280	2.005.000	1.335.200
Laos DHC	420.000	770.000	862.300	1.071.760	1.028.000	1.200.000	1.153.000
Egypt	1.501.000	2.009.000	2.346.580	2.897.470	3.379.410	4.000.000	3.949.262
Italy	18.000	48.600	88.900	112.400	182.000	344.000	369.352
Turkey	1.140.000	1.178.000	1.040.000	429.000	165.000	87.207	121.826
Brazil	63.000	118.000	495.000	1.397.100	1.102.550	1.184.510	1.319.478
World	83.529.592	102.247.255	117.137.305	143.854.580	160.611.854	191.084.505	192.580.241

*(FAO, 2017)

As seen in Table 1, the composition of water buffalo milk is superior to the milks of some other farm animals in many terms.

In terms of meat properties, water buffalo meat is one of the healthiest red meats that can be consumed by the human. It has low calorie and cholesterol. It has a dark red color because it has less intramuscular fat layer because of more pigmentation. Ingredients of beef and water buffalo meat are given in Table 2.

Water Buffalo Husbandry in the World

Water buffalo husbandry in the world is generally most dense in the continent of Asia, which is followed by Mediterranean countries. The country with the densest breeding in American continent is Brazil. According to statistics, world's water buffalo population in the world approached 193 million head in 2014, which was 84 million head in 1961. The country with the greatest water buffalo population figure, these figures in India went from 51 million head to 111 million head during the same period. In Mediterranean countries, Italy is leading and the population had a significant increase in this period,

rising from 18 thousand head to 370 thousand head. It is believed that the contributing factor behind this increase was the brand value of mozzarella cheese, made from water buffalo milk. Turkey, Thailand and Indonesia witnessed a decrease in the 50 year period (Table 3). As swamp buffaloes used for their draught and bearing capacities are common in Thailand and Indonesia, mechanization in wetlands (used for paddy production) and other agricultural lands led to a decrease in the number of water buffaloes used for draught (Chantalakhana, 1996).

The worldwater buffalo population has rapidly increased after 1990, particularly in India, Pakistan and Nepal, the reasons for this can be listed as; sustainable breeding improvement studies on water buffaloes, particularly for milk production, small and medium-sized enterprises rapidly developing in suburban areas in India, decrease towards water buffalo due to the religious values attach to cattle (Borghese, 2010). Due to inflated milk prices in India and Bombay, breeders are selling water buffalo milk in street markets and this leads to an increased ratio of calf deaths. In India, 18 basic water buffalo races are being bred for milk production, while

males are being bred for drought power and meat production (Soysal, 2006). 30-40% of milk produced in South Asian countries is consumed as fresh milk, while the rest is consumed as dairy product (Atasever and Erdem, 2008).

Reviewing Table 3 indicates significant falls in Thailand and Brazil after the 1990's. During the last 14 years, an increase of 33 million heads has been observed in the world's water buffalo population. Looking at the distribution of water buffalo population by continents and countries, we see that Asia, the homeland of water buffalo, has the majority of the water buffalo population. Asian continent owns majority of the world water buffalo population, the figures of which are as follows; 97.7% in 1990, in 97.1% 2000, and 96.9% in 2014. Looking from this perspective, we would be on the safe side to say water buffalo breeding is a unique traditional agricultural activity in Asia. Buffaloes in Europe and Near East are classified as river type buffaloes with a focus on milk yield and their mature live weights vary between 600 and 1000 kg in different countries (Borghese and Mazzi, 2005).

It has been reported that artificial insemination is common practice in Italy, and the 50.000 water buffaloes measures, produced 8.4% fat and 4.6% protein with a milk yield average of 2200 kg in 270 days of lactation (Borghese, 2013). Dairy cattle breeding became continuously popular in Turkey until the year 2010, which led to a rapid desertion of water buffalo breeding. However, through the incentive policies of the state, a great increase in the number of water buffaloes has been observed since 2010.

Physiological, Morphological and Yield Characteristics of Water Buffaloes of Turkey

The local race bred in Turkey and named Anatolian Water Buffalo is a farm animal with Mediterranean water buffalo origins, a sub-group of river buffaloes, and it has gained a characteristic structure unique to the conditions of Turkey. During a period lasting centuries (approximately 1500 years), Anatolian water buffalo has

well-adapted to the conditions of Anatolia and Thrace and developed characteristics unique to this area (Soysal et al., 2005).

The color of water buffaloes in Turkey is generally black, and they have a backwards curved, arc-like horns. As they have fewer sweat glands than cattle, it is an absolute must-have for them to have a pond or other similar water accumulation in their home range.

Milking is generally done manually and takes place twice a day in rural areas. The milk and meat yield per water buffalo in Turkey are far behind than in the countries with developed water buffalo husbandry. In Turkey, their lactation period is 180-280 days; milk yield is 800-1100 kg, while the mature female water buffalo is around 500 kg (Soysal et al., 2005; Soysal, 2006; Atasever and Erdem, 2008). The initial reproduction age of water buffaloes is 32 to 43 months, and there are 5-10 lactation periods for a water buffalo during its total lifetime (Soysal, 2006; Yilmaz, 2013).

Anatolian water buffaloes are generally small, skinny and slight, and their figure is thick and stumpy when compared to other developed races in the world. With black udders, hooves and horns. The color of Anatolian water buffaloes ranges from dark to black. The skin is covered with long hair and they do not bear any distinguishing marks. During the breastfeeding period, young calves have black and bright hairs, which turns into a reddish color afterwards, and this goes on until they reach the age of 1-1,5. Generally there is a beard underneath the chin (Şekerden, 2001). For adult water buffaloes the height at whether of females is being expressed as 135 cm. Young calves are breastfed generally for 3-4 months. Milking usually takes place twice a day. Carcass traits of Anatolian water buffaloes are given in Table 4. Yilmaz et al., (2017) observed the milk yield and lactation length as 763.99±18.66 kg and 262.63±8.37 days in their study which on milk composition of water buffaloes in the province of Bitlis. According to the authors, if the improvement works on Anatolian water buffaloes are concentrated particularly on milk yield, there will be a noticeable increase in the yields (Soysal et al., 2007).

Table 4 Means and standard errors (SE) for certain carcass quality characteristics of male and female Anatolian Water Buffaloes*

Characteristics/Units	Male		Female		Sig.
	Mean	SE	Mean	SE	
Hot carcass weight, kg	325.40	2.65	288.20	5.99	***
Carcass length, cm	127.07	1.00	132.16	1.93	*
Chest depth, cm	45.37	0.43	46.26	0.60	NS
Leg length, cm	72.62	1.30	67.87	0.84	**
Leg width, cm	29.96	0.65	28.99	0.61	NS
Conformation score	5.20	0.42	5.50	0.40	NS
Fatness score	7.70	0.47	7.30	0.68	NS
Backfat thickness, cm	19.84	1.69	19.77	2.06	NS
Fat colour parameters					
Lightness (L*)	64.00	1.04	60.03	0.96	*
Redness (a*)	6.14	0.49	7.01	0.89	NS
Yellowness (b*)	7.03	0.63	7.08	0.59	NS
pHu	5.49	0.01	5.44	0.01	***

*(Soysal, 2013), NS= not significant (P>0.05) *P<0.05; **P<0.01; ***P<0.001

Table 5 Several characteristics of Anatolian Water Buffalo raised in Turkey*

Parameters	Maximum	Minimum	Sources
Lactation Yield (kg)	1070.5±279.9	709.6±23.0	Şekerden et al., (2000b) Uslu, (1970b)
Lactation Length (day)	269.2±70.0	222.0±44.2	Şekerden and Tapkı, (2000a) Şekerden et al., (2000b)
Fat (%)	8.1±0.205	6.6±0.68	Kök, (1996) Şekerden and Tapkı, (2000a)
Adult Body Weight	518.6±17.2	411.0±9.07	İlarslan et al., (1983) Uslu, (1970a)
Calving Interval	434.3±57.1	365.2±17.5	Şekerden et al., (2000a) İlarslan et al., (1983)
Age at first insemination (day)	679.7±210.9		Şekerden and Tapkı, (2000a)
Age at first calving (day)	1313.2±234.8	964.1±3.94	Şekerden et al., (2000b) İlarslan et al., (1983)
Birth Weight (Male)	34.3±1.20	26.7±0.52	Uslu, (1970b)
Birth Weight (Female)	31.6±0.90	22.1±0.48	Alaçam et al., (1983) Uslu, (1970b)
Service Period	112.45	70.8	İlarslan et al., (1983) Şekerden et al., (2000b)
Gestation Length (day)	326.5±5.8 (artificial insemination)	317.0±51.5 (natural insemination)	İzgi and Asker, (1989) İzgi and Asker, (1989)
Daily Live Weight Gain (gr) (0-3 Month)	(Male) 0.483	(Female) 0.456	Şekerden et al., (2000c)
Daily Live Weight Gain (gr) (3-6 Month)	(Male) 0.305	(Female) 0.294	Şekerden et al., (2000c)
Daily Live Weight Gain (gr) (6-9 Month)	(Male) 0.314	(Female) 0.357	Şekerden et al., (2000c)
Daily Live Weight Gain (gr) (9-12 Month)	(Male) 0.504	(Female) 0.360	Şekerden et al., (2000c)
Fat Content of Milk	8.1	6.1	Kök, (1996) Soysal and Kök, (1997)
Total Solid Matter of Milk	17.7 (3. Lactation)	15.3 (1. Lactation)	Şekerden et al., (2000b)
Ash % of Milk	0.830	0.743	Şekerden and Tapkı, (2000a) Şekerden et al., (2000b)
Water of Milk	82.3		Kök, (1996) Şekerden and Tapkı, (2000a)
Protein % of Milk	4.6	4.2	Soysal and Kök, (1997) Kök, (1996)
Casein % of Milk	3.4 (3. Lactation)	3.0 (1. Lactation)	Şekerden et al., (2000b)

*(Soysal, 2013)

Findings of studies conducted by different authors on the physiologic and morphologic traits of Anatolian water buffaloes are given in Table 5.

Water Buffalo Husbandry in Turkey

When we review the regional distribution of water buffalo population, following the numerical change in Turkey (Figure 1), The Black Sea Region, with many traditional water buffalo breeding provinces, tops the list with a share of 37.2 % (43.846 heads). Black Sea region is followed by another traditional water buffalo breeder region, Marmara, with a share of 17%. The third place is occupied by one of our central regions, Eastern Anatolian Region, with 15,5% and it is followed by Central

Anatolian Region with a share of 12%. The shares of the remaining regions are below 10% and the water buffalo population in The Mediterranean Region in particular is highly insignificant (Şahin, 2015).

Increased demand of investing on intensive milk cattle breeding in recent years and inclination towards Holstein and Simmental cattle races, creates a disadvantage for low milk yielding water buffalo, and low precipitation levels and global climate change, in particular are among the reasons of decreasing water buffalo population levels (Aköz et al., 2017). As seen in Figure 1, water buffalo husbandry is mostly carried out in regions with high levels of precipitation and in the Black Sea, Marmara and Eastern Anatolian regions where water resources such as ponds and streams are available.

Table 6 Top 20 provinces of Turkey for water buffalo population with milk yields (TUIK, 2017)

Provinces	Adult water buffaloes (head)	Young water buffaloes (head)	Total water buffaloes (head)	Water buffaloes milked (head)	Milk (Ton)
Samsun	13904	4040	17944	8871	8782
Diyarbakır	10805	2360	13165	6967	6619
İstanbul	8935	2165	11100	5422	5823
Tokat	6714	2380	9094	3224	3060
Bitlis	7211	1127	8338	4535	4172
Muş	5435	2000	7435	3138	3035
Afyonkarahisar	4290	1308	5598	2370	2607
Kayseri	4222	1241	5463	2255	2232
Sivas	4008	917	4925	1754	2478
Amasya	3115	1121	4236	1550	1614
Balıkesir	3234	460	3694	2206	2235
Giresun	2543	784	3327	1382	1355
Kütahya	2453	726	3179	1237	1206
Düzce	2306	793	3099	1013	945
Bartın	2000	898	2898	1184	1078
Çorum	2138	635	2773	1124	1093
Yozgat	2092	511	2603	1255	1255
Kocaeli	1629	455	2084	849	764
Iğdır	1458	440	1898	676	676
Erzincan	1196	599	1795	622	603
70 provinces total	110700	31373	142073	59804	63085



The number of water buffaloes



Figure 1 Distribution of the 20 provinces over 1500 heads water buffaloes in Turkey map (2017)

Water buffalo husbandry takes place in 70 out of 81 provinces in Turkey and distribution of the 20 provinces on the Turkish map with the highest water buffalo population has been given in Figure 1 and the ranking has been given in Table 6. Looking at Table 6, we can see that the province with the highest water buffalo population is Samsun (17.944 heads). Water buffalo is mostly done for milk production in this province and 8.782 tons of milk is being produced. Kızılırmak delta and a high level of precipitation in the region are factors for Samsun being the center of water buffalo husbandry. The increasing

water buffalo husbandry in Istanbul in recent years, contributing to milk production and is meeting the water buffalo milk need of the population living in the metropolitan area.

Water buffalo milk produced in the Afyonkarahisar province is being consumed in the form Afyon cream (kaymak), which has become a traditional brand. In Kayseri, meat production comes into prominence and water buffalo is meat is particularly used when producing the famous Kayseri pastrami (pastrırma). A significant achievement has been made in line with the advances in

process meat products industry. And in Eastern and South-eastern Anatolian regions Diyarbakır, Muş and Bitlis serve as local center. In line with the recent incentives provided by the Ministry of Food, Agriculture and Livestock for water buffalo husbandry and the increased number of Water Buffalo Breeders Associations, it has been observed that the previously local-level water buffalo husbandry is now organized in many provinces and turned into commercial production.

In Diagram 1 and 2 presents the changes that occurred in Turkey in the past regarding the numbers of cattle and water buffalo. Since 1940 cattle races changed from domestic races to culture races, keeping and feeding conditions have improved and support policies have been introduced, and as a result of all these an increased yield

has been achieved. Water buffalo population was over 1 million during 1970's, but following a sharp decrease until 2010, this figure fell to 85.000 water buffaloes. Thanks to the water buffalo supports since that same year the number of water buffaloes has increased to 142.000 head in 2016.

Diagram 3 presents the distribution of cow and water buffalo milk in Turkey during the past 16 years. Looking at the diagram, the increase in cattle population as well as in milk quantity can be observed, however, it can also be seen that after the year 2000 a decrease in water buffalo population was followed by a decrease in milk quantity, and following the supports introduced since year the 2010, a significant increase in milk production took place in line with the increased water buffalo population.

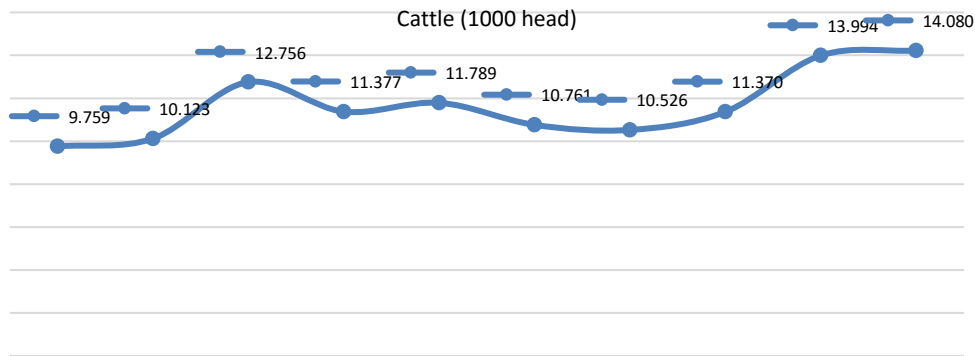


Diagram 1 Demonstration of cattle wealth of Turkey within years (1000 head) (TUIK, 2017)

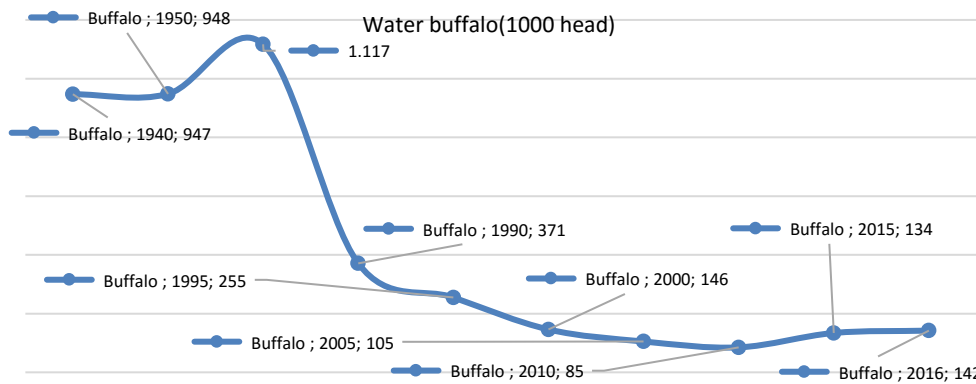


Diagram 2 The demonstration of water buffalo wealth of Turkey within years (1000 head) (TUIK, 2017)

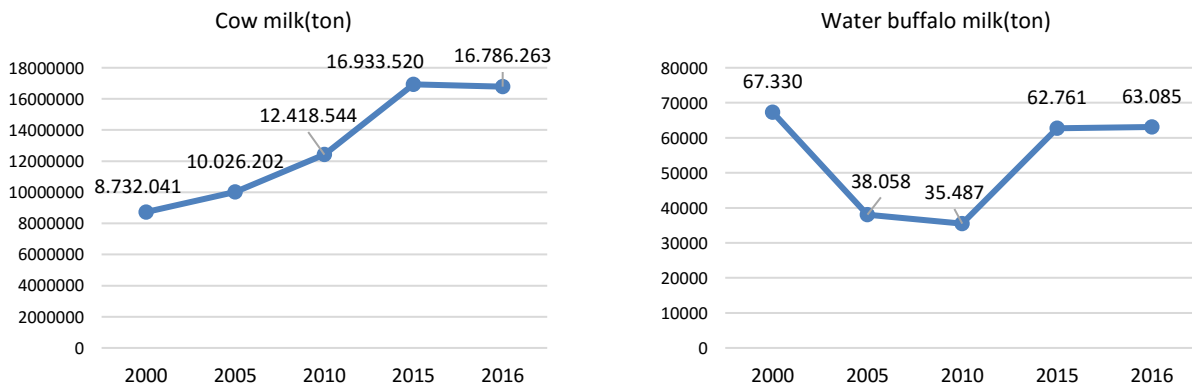


Diagram 3 Milk production from cattle and water buffalo in Turkey since 2000's (tons) (TUIK, 2017)

As of 2017, the Central Association of Breeding Water Buffalo Breeders of Turkey has 25 provincial associations' members, and the number of enterprises affiliated to these provincial associations and the number of water buffaloes in these enterprises is presented in Table 7 (Anonymus, 2017). Table 7 indicates Diyarbakır as the province with the highest number of enterprises, and in 1225 enterprises it has 18.570 head of water buffaloes. The number water buffaloes per enterprise is 15,2. The province with the lowest number of enterprises is Bursa, and the 28 enterprises in the province have a water buffalo population of 489 heads. Whether a member or not to the Central Association of Breeding Water Buffalo Breeders of Turkey, the average capacity of all small family enterprises is 1-5 heads, but despite this, the average figure per enterprise in Istanbul province, where water buffalo breeding generally takes place as intensive, is approximately 154 heads. The reason for this is the existence of large-scaled water buffalo husbandry enterprises, even if low in numbers, which are close to great consumption centers such as Istanbul, have no problems in marketing water buffalo milk and dairy products.

Being conducted as family husbandry with an average of 1-5 heads, generally fed with pasture based roughage in rural areas, husbandry in areas close to metropolitans is in the form of large herds with 50-100 heads, and feeding is made by hay, corn silage, clover, sugar beet pulp, barley, wheat and concentrated fodders. Artificial insemination is not a common practice in water buffaloes of Turkey, it is only applied at research institutions (Soysal, 2013).

Işık and Gül (2016), in their study conducted in Muş province to examine the economic and social structures of water buffalo breeders, have reported that most producers are doing water buffalo husbandry together with other animals, are working as a family labor force, 31 % of them are marketing their dairy products by themselves, generally feed their water buffaloes in pastures and achieve an average of 954 kg milk during a 230 days lactation period. The keeping of the water buffaloes is generally the duty of females, breeders with low-income levels and the small amount of land are usually breeding do meet their own needs.

Conclusion and Recommendations

At the same rate of the global increase in population, the demand for food and especially for healthy food is also increasing. With the purpose of meeting the increasing demand, there is a need for low-cost, eco-friendly farming systems, along with the efforts to increase production. Water buffalo husbandry milk, dairy products and meat production must be taken into consideration as an alternative solution for food problem. Water buffaloes are animals able to make the most and convert even low-quality roughage into the meat and milk yield, has a high capacity of fodder benefiting, resistant against diseases, and when compared to culture race cattle, it does not require much care in terms of feeding. When the benefits are taken into account, there is a need to revive water buffalo husbandry, define the problems of the sector and develop new strategies.

Table 7 The number of enterprises affiliated to provincial associations of Water Buffalo Breeders' Associations of Turkey and the water buffalo populations in these enterprises*

Turkish Water Buffalo Associations	Number of Enterprises	Heads Number of Water Buffalo	Heads Number per Enterprise
Diyarbakır	1225	18570	15.2
Giresun	519	1217	2.3
Kütahya	384	918	2.4
Bitlis	312	3875	12.4
Sivas	241	915	3.8
Tokat	196	2980	15.2
Afyonkarahisar	193	2894	15.0
Muş	190	959	5.0
Samsun	188	22154	117.8
Bartın	182	985	5.4
Çorum	156	1385	8.9
Amasya	140	1148	8.2
Yozgat	138	1284	9.3
Balıkesir	130	1458	11.2
Düzce	127	1397	11.0
Kayseri	124	1370	11.0
İstanbul	85	13050	153.5
Kırklareli	63	850	13.5
Kocaeli	57	1210	21.2
Tekirdağ	57	687	12.1
Çankırı	37	483	13.1
Sinop	35	384	11.0
Bolu	32	984	30.8
Zonguldak	32	532	16.6
Bursa	28	489	17.5
Total	4871	82178	16.9

*(Anonymus, 2017)

Income levels in rural areas must be increased by providing water buffalo breeders in rural areas by ensuring sustainability through national supports as well as incentives and induced activities provided by local authorities. By improving animal husbandry, migration from towns to provinces will be prevented, producers will be getting the opportunity to continue their traditional water buffalo breeding methods with more modern and technical conditions. Distribution of breeder material in places suitable for water buffalo husbandry must be taken under the scope of incentive competitions, festivals and other similar activities to increase awareness.

It is necessary to protect, improve and rectify the conditions for the breeding of Anatolian water buffalo race, which has adapted to Turkey and is being bred in rural areas for many centuries. Production made under traditional conditions needs to be improved through farmer training, and planning must be made to continue with research, training and supports to make the best use of water buffalo meat-milk products. In areas suitable for water buffalo husbandry, protection must be encouraged by special incentives to increase the number of enterprises, productive applications for producer development need to be defined and in particular the young population needs to be directed towards this field. In areas with intense levels of water buffalo husbandry, new projects must be prepared to improve low productivity through raising pure races and crossbreeding, successful National Breeding Projects must be continued with improvement. Efforts must be made to help water buffalo milk and meat products, which are highly suitable for organic production, to be produced, used and marketed organically. Producers need to eliminate production and marketing related problems by becoming organized. On the other hand, water buffalo meat and milk and the superiorities, in terms of taste and health, of products made from them should be explained to consumers through media and public service ads to create demand. As incentives by Ministry of Food, Agriculture and Livestock, activities Association of breeding and studies at universities and research institutes on water buffalo husbandry and improvement increases, the number of water buffaloes has risen in recent years and it must be ensured that this becomes sustainable. Sustainability in water buffalo husbandry is also seen as an important potential for being an improving enterprise for water buffalo husbandry areas and to meet the increasing demand for animal food products.

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