

## RESEARCH ARTICLE

# Fisheries and Aquaculture in Veterinary Medical Education in Turkey: History and Recent Developments

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## Abstract

This study aims to depict the historical background and recent developments of education on fisheries, aquaculture, and aquatic animal diseases in veterinary faculties in Turkey. Data collected by verbal communication with the deanships of veterinary faculties in Turkey and the exploration of their web sites, as well as original documents obtained first-hand from the archives of the Ankara, Ondokuz Mayıs, Bursa Uludağ, Erciyes, Harran, and Aksaray Veterinary Faculties, constituted the main material of this study. Data were assessed by means of the content analysis. In Turkey, while fisheries and aquaculture were first included in the veterinary curriculum in the 1940s as a joint lecture, under the name of "Honeybee and Fish Diseases", the first department was established in 1967 within the Ankara University Veterinary Faculty. In the following years, counterpart departments were established within the veterinary faculties in Elazığ and İstanbul. However, after the reorganisation of higher education in 1981, it was decided to close down those departments. The significant advances of the aquaculture sector by the end of the 20<sup>th</sup> century, requiring the employment of veterinarians in this sector, and the inclusion of this field in the acquis of the European Union led to relevant lectures being reincluded in the curricula of veterinary faculties in Turkey and relevant departments being established within these faculties. It has been determined that, today, while 5 veterinary faculties continue with related education and training activities and academic research under the tutelage of departments of fisheries, aquaculture, and aquatic animal diseases, 21 veterinary faculties with no counterpart departments have included lectures on fisheries, aquaculture, and aquatic animal diseases in their curricula. It is considered that in order to improve the aquatic animal health status and to meet the increasing demand for veterinary human resources of the sector in Turkey, education and research opportunities offered by veterinary educational institutions need to be increased, and the authorities and responsibilities of the different occupational stakeholder groups involved in fisheries and aquaculture should be clearly demarcated in the legislation.

**Keywords:** Aquaculture, aquatic animal health, Turkey, Veterinary education, Veterinary history

## Türkiye’de Veteriner Hekimliği Eğitiminde Su Ürünleri ve Balıkçılık: Tarihsel Süreç ve Son Gelişmeler

### Öz

Bu çalışma, Türkiye’de veteriner fakültelerinde balıkçılık, su ürünleri ve sucul hayvan hastalıklarına ilişkin eğitim-öğretim faaliyetlerinin tarihsel gelişimini ortaya koymak ve bugünkü durumunu değerlendirmek amacıyla gerçekleştirilmiştir. Çalışmanın ana materyalini, Türkiye’deki veteriner fakültelerinin dekanlıklarıyla yapılan sözlü görüşmeler ve kurumsal web sitelerinin taranması yoluyla toplanan veriler ile Ankara, Ondokuz Mayıs, Bursa Uludağ, Erciyes, Harran ve Aksaray Üniversiteleri Veteriner Fakültelerinin Arşivlerinden sağlanan ilk elden kaynaklar oluşturmuştur. Ulaşılan veriler, içerik analizine tabi tutulmuştur. Türkiye’de veteriner hekimliği eğitim-öğretiminde su ürünleri ve balıkçılıkla ilgili ilk dersin "Arı ve Balık Hastalıkları" adıyla 1940’lı yıllarda müfredat programına alındığı belirlenmiş, 1967 yılında ilk kürsü Ankara Üniversitesi Veteriner Fakültesinde kurulmuştur. İzleyen yıllarda Elazığ ve İstanbul’da bulunan veteriner fakültelerinde de ilgili kürsüler açılmış ancak 1981 yılında yükseköğretimde gerçekleştirilen reorganizasyonun ardından, bu kürsülerin kapatılmasına karar verilmiştir. Yirminci yüzyılın sonunda önemli bir gelişim gösteren su ürünleri yetiştiriciliğinde, veteriner hekimlerin istihdamına duyulan gereksinim ve Avrupa Birliği müktesebatında konuya gösterilen hassasiyet, Türkiye’de veteriner fakültelerinde bu alana ilişkin derslerin tekrar müfredata konulmasını ve ilgili anabilim dallarının açılmasını sağlamıştır. Bugün beş veteriner fakültesinde bulunan Su Ürünleri ve Hastalıkları Anabilim Dallarında eğitim-öğretim ve akademik çalışmalar devam etmekte olup, anabilim dalı olmayan 21 veteriner fakültesinde su ürünleri ve hastalıklarına ilişkin derslerin verildiği belirlenmiştir. Türkiye’de sucul hayvan sağlığının iyileştirilmesi ve sektörde gün geçtikçe artan veteriner hekim talebinin karşılanması için, veteriner hekimliği eğitim kurumlarında bu disipline ilişkin eğitim ve araştırma olanaklarının artırılması ve bu alana ilgili farklı meslek gruplarının yetki ve sorumluluklarının mevzuatta açıkça belirtilmesi gerektiği düşünülmüştür.

**Anahtar sözcükler:** Su ürünleri yetiştiriciliği, Sucul hayvan sağlığı, Türkiye, Veteriner hekimliği eğitim-öğretimi, Veteriner hekimliği tarihi

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## INTRODUCTION

The increased use of aquatic animals as pets, experimental animals, and/or food products has increased the need to improve their health, living conditions, and welfare <sup>[1,2]</sup>. Veterinary education and training on aquatic animal health are observed to be limited on a global scale, and veterinary practitioners are found to be dissatisfied with their level of competence in this area. In many countries, veterinarians are not the only occupational group entitled to maintain aquatic animal health and treat aquatic animals. This bestows the right for practitioners of non-veterinary professions to practice on aquatic animals <sup>[3]</sup>. Nevertheless, as a result of being perceived as an occupational group responsible for the health of all animals, veterinarians are expected to be equipped with the knowledge and skills to maintain the health of aquatic animals. In order to meet this expectation, lectures on aquatic animals should be included in the undergraduate and postgraduate curricula of veterinary faculties <sup>[1]</sup>.

In Turkey, education in the field of fisheries and aquaculture was first introduced within the scope of the discipline of zoology, and as of the mid-20<sup>th</sup> century <sup>[4,5]</sup>, two hydrobiology research institutes, subordinated to the science faculties of İstanbul University-Cerrahpaşa and Ege University, were established <sup>[6,7]</sup>. These institutes pioneered the training of reputable scientists in the fields of hydrobiology and fish biology and served as research centres for the first academic studies on biological oceanography, ichthyology, and limnology in Turkey <sup>[4]</sup>. In the meantime, fisheries and aquaculture lectures were included in the curricula of veterinary faculties, which over the course of time led to the establishment of departments specific to this field.

This study aims to depict the historical background and recent progression of training activities in the field of fisheries, aquaculture, and aquatic animal diseases in veterinary medical education in Turkey.

## MATERIAL AND METHODS

Relevant information was obtained from the web pages of veterinary faculties and by verbal communications with their dean ships. In addition, the historical data of the study were mainly derived from original documents belonging to the archives of the Ankara University Veterinary Faculty and five other veterinary faculties (the universities of Ondokuz Mayıs, Bursa Uludağ, Erciyes, Harran, and Aksaray), each of which have a separate Department of Aquaculture and Aquatic Animal Diseases. Data were analysed with the aim of providing a retrospective overview. Additional explanatory information and the identification tags of the original documents are detailed in the footnotes of the manuscript.

## RESULTS

Based on the data accessible to the authors, the first step taken in the field of aquaculture and fisheries within the

scope of veterinary medical education was the delivery of a course of lectures entitled “Honeybee and Fish Diseases” at the Yüksek Ziraat Enstitüsü (YZE) in Ankara. This course of lectures was delivered by the Department of Parasitology and Helminthology to fifth-year students during the 1947-1948 academic year.<sup>1</sup> This course continued to be delivered after the subordination and transfer of the Veterinary Faculty of the Higher Agricultural Institute (YZE) to Ankara University in 1948.<sup>2</sup> The first department specific to fisheries and aquaculture was established on 16 May 1967 under the name of “Aquaculture, Fisheries, and Game Animals Department” within the Ankara University Veterinary Faculty (AUVF), which was the only veterinary school in Turkey until the 1970s. In the same year that the department was established, the first Turkish veterinarians specialising in the field of aquaculture and fisheries started to be trained <sup>[8]</sup>.<sup>3</sup> During the same period, the skeleton crew of the department was also formed. This team organised several study visits for educational, investigational, and research purposes. It was ascertained that, by virtue of these visits and observations, the academic staff of the department gave priority to aquaculture research in both the seas and some lakes and state farms of Turkey.<sup>4</sup> These efforts were aimed at increasing access to protein sources and creating a new business area in Turkey, and they were complemented by the decision to print brochures, categorised as “community publications”, to raise public awareness <sup>[9,10]</sup>.<sup>5</sup>

In the 1970s, efforts were also made for the delivery of lectures and the establishment of departments specific to fisheries and aquaculture at veterinary faculties other than the AUVF. Hence, the Veterinary Faculty established in Elazığ in 1970, under the subordination of Ankara University<sup>6</sup>, had a Department of Aquaculture, Fisheries, and Game Animals among its 16 departments <sup>[11]</sup>. In 1977, a Fisheries and Aquaculture Department was established within the İstanbul University-Cerrahpaşa Veterinary Faculty, which was founded in 1972 <sup>[12]</sup>. Furthermore, Bursa University, which instituted education and training activities in 1978, established an Aquaculture and Fisheries Unit within the Animal Production and Improvement Department of its Veterinary Faculty <sup>[13]</sup>. The academic staff of the Department of Aquaculture, Fisheries, and Game Animals of the AUVF also delivered lectures at some of

<sup>1</sup> The Exam Protocol dated June 23, 1948 of the Veterinary Faculty of YZE

<sup>2</sup> The Personal File of Professor Hasan Şükrü Oytun, Archive of the AUVF Deanship; Law No. 5234, Official Gazette, No. 6951, 1948

<sup>3</sup> The Personal File of Professor Zihni Erençin, Archive of the AUVF Deanship

<sup>4</sup> The Personal Files of Gülten Köksal, Orhan Erdem, Selçuk Seçer, Metin Timur and Fikri Aydın, Archive of the AUVF Deanship

<sup>5</sup> The official letter numbered 3365 and dated June 28, 1972 of the Aquaculture, Fisheries, and Game Animals Department addressed to the AUVF Deanship; The official letter numbered 27-74 and dated September 9, 1974 of the Editorial Board of Journal of AUVF addressed to the AUVF Deanship

<sup>6</sup> In 1975, it was agreed on the separation of Elazığ Veterinary Faculty from Ankara University, and the subordination of the Faculty to Fırat University. For further information see the Law on the Establishment of Four Universities published in the Official Gazette dated April 11, 1975 and numbered 15205

## Research Article

the veterinary faculties of other Turkish universities on a periodic basis.<sup>7</sup>

The enactment of the Higher Education Law<sup>8</sup> in 1981 brought about fundamental changes in the Turkish university system, such that the academic organisation and curricula of these higher education institutions, including veterinary faculties, were restructured. The Aquaculture, Fisheries, and Game Animals Departments were closed down the same year, and the lectures delivered by these departments were designated as elective courses.<sup>9</sup> The academic staff of the departments were appointed to various other faculties and departments<sup>[14],10</sup> and some served as the basic education staff of the newly established Fisheries and Aquaculture Collegiate Schools<sup>[15]</sup>, which were converted to faculties in 1992.<sup>11</sup>

Education and training activities related to fisheries and aquaculture were relaunched within veterinary faculties in the 1990s. First, lectures on fish diseases, fish parasitology, fish immunology, sperm storage and artificial insemination, vaccination of aquatic animals, processing of aquaculture and fisheries products, and hygiene rules were introduced into the postgraduate education curricula. Subsequently, the course of lectures on aquatic animals and their diseases was reintroduced into the undergraduate education curricula. Despite the extended implementation of these actions, the lack of individual specific departments within veterinary faculties and the inefficient education of veterinarians on fish diseases raised the issue of re-establishing relevant departments within veterinary faculties.<sup>12,13</sup> The first institution to agree upon the establishment of a Department of Aquatic Animal Diseases in 2003 was the Faculty of Veterinary Medicine of Ondokuz Mayıs University (OMU), and the department became operational in 2005.<sup>14</sup>

<sup>7</sup> The decision numbered 118/2497 and dated November 30, 1976 of the AUSENATE; The official letter numbered 1065 and dated March 3, 1978 of the AUVF Deanship addressed to the AU Rectorate; The decision numbered 3900 and dated November 7, 1978 of the AUSENATE; the official letter numbered 897 and dated April 13, 1978 of Bursa University Veterinary Faculty Deanship addressed to the AUVF Deanship; The official letter numbered 7081 and dated December 22, 1979 of the AUVF Deanship addressed to the Aquaculture, Fisheries, and Game Animals Department; the decision numbered 79-9/2b and dated March 29, 1979 of the Administrative Board of the Bursa University Veterinary Faculty; the decision numbered 588 and dated November 4, 1982 of the Administrative Board of AUVF

<sup>8</sup> Law No. 2547, Official Gazette, No. 17506, 1981

<sup>9</sup> The official letter numbered 226/2960 and dated August 18, 1982 of the Higher Education Council addressed to AUVF Deanship

<sup>10</sup> The official letter numbered 9687 and dated November 29, 1982 of AUVF Deanship addressed to the AU Rectorate; The official letter numbered 9436 and dated November 17, 1982 of AUVF Deanship; The decision numbered 35 and dated September 6, 1983 of AUVF Board

<sup>11</sup> Law No. 2809, Official Gazette, No. 21281, 1992

<sup>12</sup> The Justification of the Establishment of the Department of Aquatic Animal Diseases under Ondokuz Mayıs University, Veterinary Faculty, 2003

<sup>13</sup> The Justification of the Establishment of the Department of Aquaculture, Fisheries and Aquatic Animal Diseases under Aksaray University, Veterinary Faculty, 2014

<sup>14</sup> The official letter numbered 026938 and dated December 12, 2003 of the Higher Education Council addressed to OMU Rectorate; The official letter numbered 076-516 and dated March 12, 2009 of OMU Deanship addressed to the OMU Rectorate

The main factors that led to the establishment of the department included the highest levels of fishery captures and aquaculture production belonging to the Black Sea region; Turkey being a member of the Black Sea Economic Cooperation Programme; the high numbers of streams, rich flora and fauna, and endemic fish and other aquatic animal populations of the region; fisheries and aquaculture having an important place in the European Union (EU) acquis; and the existing institutions falling behind in the diagnosis and treatment of aquatic animal diseases.<sup>12</sup>

In the ensuing years, similar attempts were made in other veterinary faculties, such that counterpart departments were established within veterinary faculties subordinated to the universities of Bursa Uludağ (2010), Erciyes (2012), Harran (2012), and Aksaray (2014).<sup>13,15,16</sup> Today, a total of 14 academic staff, including 5 professors, 4 associate professors, 3 assistant professors, and 2 research assistants, are appointed to these departments. These departments have been determined to deliver 5 compulsory courses and 12 elective courses, which are presented in *Table 1*, to undergraduate students.<sup>16</sup>

The curricula of the 21 veterinary faculties with no counterpart departments have been ascertained to include 21 compulsory and 21 elective courses (*Table 2*). Some departments have made efforts to launch not only undergraduate but also postgraduate education and training programmes. The first step towards this purpose was taken by the FVM of Bursa Uludağ University in 2011, followed by the initiation of postgraduate education in the FVM of Ondokuz Mayıs University in 2014.<sup>17</sup> To date, 5 masters and 3 doctorate students have graduated from this programme.

## DISCUSSION

Following the establishment of the Department of Aquaculture, Fisheries, and Game Animals in 1967 within the AUVF, activities in this field mainly focussed on aquaculture studies.<sup>3,4</sup> Aquaculture studies conducted as part of the scientific research of the department<sup>3,4,5</sup> were performed not only for academic purposes but also with an aim to extend aquaculture and fisheries throughout Turkey and to contribute to the national economy. Besides this, the launch of an aquaculture and fisheries specialisation programme and, thereby, the education and training of the

<sup>15</sup> At the Erciyes, Aksaray and Harran Veterinary Faculties, this department was named as "the Department of Aquaculture, Fisheries and Aquatic Animal Diseases". Official letter of Harran University, Veterinary Faculty dated 17.03.2011 and numbered 2011-01; official letter of Aksaray University, Veterinary Faculty dated 10.06.2014 and numbered 04-011

<sup>16</sup> Relevant information was obtained from the web pages of the previously mentioned veterinary faculties and by verbal communication with the administrative and academic staff of these faculties

<sup>17</sup> The official letter numbered 2418 and dated April 12, 2011 of the Higher Education Council addressed to Bursa Uludağ University Rectorate; The official letter numbered 65475 and dated November 7, 2014 of the Higher Education Council addressed to OMU Rectorate

**Table 1.** Undergraduate courses offered by the Departments of Aquaculture and Aquatic Animal Diseases in Turkish faculties of veterinary medicine

| Veterinary School        | Undergraduate Courses                    | Compulsory/Elective | Midterm (Theoretical/Practical) |
|--------------------------|--|---------------------|---------------------------------|
| Ondokuz Mayıs University | Aquaculture and Aquatic Animal Diseases  | C                   | 5 (1/2)                         |
|                          | Aquarium Fish Breeding and Diseases      | E                   | 5 (1/0)                         |
| Bursa Uludağ University  | Aquatic Animal Diseases                  | C                   | 5 (2/2)                         |
|                          | Ichthyology                              | E                   | 4 (2/0)                         |
|                          | Aquaculture Production and Biotechnology | E                   | 6 (2/0)                         |
| Erciyes University       | Aquatic Animal Diseases                  | C                   | 9 (1/2)                         |
|                          | Aquaculture                              | E                   | 4 (1/2)                         |
|                          | Ecology                                  | E                   | 5 (1/0)                         |
| Harran University        | Aquatic Animal Diseases                  | C                   | 7 (2/0)                         |
|                          | Aquarium Fish Diseases                   | E                   | 7 (1/0)                         |
| Aksaray University       | Aquatic Animal Diseases                  | C                   | 6 (2/1)                         |
|                          | Seafood Processing Technology            | E                   | 7 (1/0)                         |
|                          | Aquaculture                              | E                   | 4 (1/0)                         |
|                          | Fish Farming                             | E                   | 8 (1/0)                         |
|                          | Fish Reproduction                        | E                   | 8 (1/0)                         |
|                          | Aquarium Fish Diseases                   | E                   | 4 (1/0)                         |

first specialist veterinarians on fisheries and aquaculture<sup>3,4</sup> can be considered as pioneering steps in this field in Turkey.

Despite the rapid development of fisheries and aquaculture throughout the world in the following years [16,17], the termination of specialisation training and the closing down of the Aquaculture, Fisheries, and Game Animals Departments pursuant to the higher education regulation<sup>8,9</sup> enacted in 1981 are still considered controversial. Both the need to employ veterinarians in the aquaculture sector, which had displayed major advances by the end of the 20<sup>th</sup> century, and the ongoing EU accession process of Turkey, requiring legislative and administrative actions, rekindled the attempt to institutionalise education, training, and academic organisation in this field within several veterinary faculties. Urdes et al.<sup>[17]</sup> pointed out significant economic losses being caused and further development being prevented by emerging diseases and pathogens in the aquaculture sector, and they highlighted the need to employ veterinarians so as to ensure both public health and the health of aquatic animals. The need for veterinary services in the aquaculture sector has also been underlined by several international organisations, including the OIE and FAO, and the employment of veterinarians in this sector has been clearly detailed in EU legislation<sup>18</sup> [16,17]. In this context, in view of

<sup>18</sup> Council Directive 91/67/EEC of 28 January 1991 concerning the animal health conditions governing the placing on the market of aquaculture animals and products (OJ No: L 46/1, 19.02.1991); Council Directive 2006/88/EC of 24 October 2006 on animal health requirements for aquaculture animals and products there of, and on the prevention and control of certain diseases in aquatic animals. (OJ No: L 328/14, 24.11.2006); Commission Decision 2008/946/EC of 12 December 2008 implementing Council Directive 2006/88/EC as regards requirements for quarantine of aquaculture animals. (OJ No: L 337/94, 16.12.2008); Regulation (EU) 2016/429 of The European Parliament and of the Council of 9 March 2016 on transmissible animal diseases and amending and repealing certain acts in the area of animal health ('Animal Health Law'). (OJ No: L 84/1, 31.03.2016)

several factors, including, among others, the geographical location, natural water resources, and physical conditions of Turkey, Aquatic Animal Diseases Departments having been established in only five (Table 1) out of 28 veterinary faculties is considered unsatisfactory given the ongoing EU alignment process. Mean while, the fact that the curricula of the remaining 21 veterinary faculties without counterpart departments include lectures related to aquaculture and fisheries (Table 2), although delayed, could be considered as a positive development at first glance. Indeed, Iatridou et al.<sup>[2]</sup> reported the delivery of aquatic animal disease lectures at 74 out of 77 veterinary education institutions belonging to the European Association of Establishments of Veterinary Education (EAEVE), which is the official accreditation authority of veterinary schools in Europe, showing the importance attached to this field in veterinary medical education.

It can be said that the number and the status quo of aquaculture and fisheries lectures included in the curricula of Turkish veterinary faculties are much better than the number of specific departments established. In fact, while Turkish veterinary faculties with Aquaculture and Aquatic Animal Diseases Departments have been determined to offer 5 compulsory and 12 elective courses (Table 1), the remaining 21 veterinary faculties with no counterpart departments include 21 compulsory and 21 elective courses in their curricula (Table 2). On the other hand, it has been reported that 36 out of the 74 veterinary education institutions belonging to the EAEVE in 2018 offered a lecture solely devoted to this subject, while the remaining 38 faculties provided related information within other lectures. Courses on aquaculture and aquatic animal diseases have been reported to be compulsory in 42 of those institutions, elective in 9 institutions, and semi-compulsory/semi-elective in the remaining 23 faculties<sup>[2]</sup>.

**Table 2.** Courses given by veterinary faculties with no counterpart departments

| Veterinary School                   | Undergraduate Courses  | Compulsory/Elective | Midterm (Theoretical/Practical) |
|-------------------------------------|--|---------------------|---------------------------------|
| Ankara University*                  | Aquatic Animal Diseases  | C                   | 8 (2/2)                         |
|                                     | Aquarium Fish Diseases   | E                   | 7 (1/0)                         |
|                                     | Fish Diseases and Pathology  | E                   | 7 (1/0)                         |
|                                     | Biotechnology Applications in Fish Reproduction  | E                   | 8 (1/0)                         |
| Firat University                    | Aquatic Animal Diseases  | C                   | 8 (3/0)                         |
|                                     | Ornamental Animal Diseases   | E                   | 9 (1/0)                         |
| İstanbul University-Cerrahpaşa      | Fish Diseases  | C                   | 6 (1/0)                         |
|                                     | Drug Use in Honeybees, Fish, and Exotic Animals  | E                   | 8 (1/0)                         |
|                                     | Aquatic Animal Nutrition   | E                   | 6 (1/0)                         |
|                                     | Fish Pathology   | E                   | 6 (2/0)                         |
|                                     | Hygiene and Technology in Seafood Processing   | E                   | 8 (1/0)                         |
| Selçuk University                   | Aquatic Animals  | C                   | 6 (1/0)                         |
| Van Yüzüncü Yıl University          | Aquatic Animal Diseases  | C                   | 10 (1/2)                        |
| Kafkas University                   | Aquatic Animal Diseases  | C                   | 6 (1/0)                         |
| Aydın Adnan Menderes University     | Bacterial Fish Pathogens and Identification  | C                   | 5 (1/1)                         |
|                                     | Aquatic Animal Medications   | C                   | 8 (1/0)                         |
|                                     | Aquatic Animal Diseases  | C                   | 8 (1/1)                         |
| Dicle University                    | Aquatic Animal Diseases  | C                   | 5 (1/1)                         |
|                                     | Fish Farming   | E                   | 7 (1/1)                         |
|                                     | Fish Nutrition   | E                   | 2 (1/0)                         |
|                                     | Reproduction and Artificial Insemination in Bees, Fish, Laboratory Animals, and Wild Animals | E                   | 4 (1/0)                         |
| Burdur Mehmet Akif Ersoy University | Aquatic Animal Diseases  | C                   | 8 (1/1)                         |
| Kırıkkale University                | Fish Diseases  | E                   | 5 (1/0)                         |
| Mustafa Kemal University            | Aquatic Animal Diseases  | C                   | 9 (1/0)                         |
| Afyon Kocatepe University           | Aquatic Animal Diseases  | C                   | 6 (1/0)                         |
|                                     | Hygiene and Examination of Water   | E                   | 4 (1/0)                         |
|                                     | Aquaculture  | E                   | 5 (1/0)                         |
|                                     | Diseases and Pathology of Aquatic Animals  | E                   | 6 (1/0)                         |
|                                     | Hygiene and Technology in Seafood Processing   | E                   | 8 (1/0)                         |
| Atatürk University                  | Aquatic Animal Diseases  | C                   | 6 (1/0)                         |
| Balıkesir University                | Fish Diseases and Aquaculture  | E                   | 4 (3/0)                         |
| Cumhuriyet University               | Aquatic Animal Diseases and Treatment  | C                   | 7 (2/0)                         |
| Bingöl University                   | Aquatic Animal Diseases  | C                   | 9 (1/2)                         |
|                                     | Fish Diseases and Pathology  | E                   | 6 (2/0)                         |
| Tekirdağ Namık Kemal University     | Aquatic Animal Diseases  | C                   | 8 (1/2)                         |
| Siirt University                    | Aquatic Animal Diseases  | C                   | 6 (1/0)                         |
|                                     | Aquaculture  | E                   | 6 (1/0)                         |
| Çukurova University                 | Aquaculture and Aquatic Animal Diseases  | C                   | 7 (3/1)                         |
| Kastamonu University                | Aquaculture and Aquatic Animal Diseases  | C                   | 5 (1/0)                         |
|                                     | Industrial Aquaculture   | E                   | 6 (1/0)                         |
| Dokuz Eylül University              | Aquatic Animal Diseases  | C                   | 6 (1/2)                         |
|                                     | Aquaculture Production and Biotechnology   | E                   | 6 (1/0)                         |

\* The same courses are included in both the Turkish and English curricula of this faculty

These numbers for undergraduate education differ for postgraduate education. Today, while two veterinary faculties subordinated to Bursa Uludağ University and Ondokuz Mayıs University are known to deliver postgraduate training

in this field<sup>17</sup>, only 30 out of the 69 veterinary education institutions belonging to the EAEVE have been reported to offer postgraduate education on aquatic veterinary medicine <sup>[2]</sup>. The fact that the postgraduate education and

training programmes implemented by Turkish veterinary faculties are few in number has been attributed to the limitations of the criteria set by the Higher Education Council for the implementation of doctorate and master's degree programmes. Despite the organisational efforts initiated for the implementation of undergraduate and postgraduate aquaculture and aquatic animal diseases programmes at veterinary faculties in the last few years, the questionable infrastructure, human resources, and education quality of the increasing number of veterinary faculties [18,19] have rendered the topic more controversial than ever.

On the other hand, despite these steps recently taken in the field of veterinary education, the number of veterinarians employed in the public and private sectors for the maintenance of the health of aquatic animals remains low. This is attributed to the diversity of occupational groups working in this area; the fact that the tasks, authorities, and responsibilities of these occupational groups have not been clearly demarcated; and the existence of very few diagnostic laboratories offering services in this area [19,20]. Altun et al. [15] drew attention to a similar situation is observed in the existing academic veterinary institutions in Turkey, such that while no veterinarian is employed by 3 out of the 5 Departments of Aquatic Animals and Aquatic Animal Diseases, some veterinary faculties with no counterpart departments have appointed non-veterinary occupational groups for the delivery of the relevant lectures. Although the fisheries and aquaculture legislation in force stipulates veterinarians as the only occupational group responsible for the health of all animals, including aquatic animals, the sufficiency of the education, training, and research infrastructure of the existing veterinary educational institutions remains another issue of concern.

In conclusion, it has been determined that, despite aquaculture and fisheries-related lectures having started to be given in Turkish veterinary faculties in 1948 and a Department of Aquaculture, Fisheries, and Game Animals having been established in 1967, today only 5 veterinary faculties accommodate departments specific to this field, and 26 veterinary faculties deliver relevant lectures with no counterpart departments. In the past decade, not only has the need for the employment of veterinarians to ensure both public health and aquatic animal health increased with the growth of the fisheries and aquaculture sector, but this area has also gained a strong position in the EU acquis. In order to meet the demands for veterinary human resources within the sector in Turkey, as an EU candidate country, the aquaculture and fisheries-related efforts within veterinary educational institutions should be further strengthened via the improvement of the education, training, and research opportunities and infrastructure, and the authorities and responsibilities of the different occupational groups involved in fisheries and aquaculture should be clearly demarcated in the legislation.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## STATEMENT OF AUTHOR CONTRIBUTIONS

B. Melikoğlu Gölcü and A. Uyguntürk conceived the ideas of the study. B. Melikoğlu Gölcü wrote the manuscript. A. Uyguntürk and A. Ünsal Adaca made substantial contributions to the collection of the historical and current information. All authors revised and read the final manuscript.

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