Animal Health Prod and Hyg (2022) 11 (2) : 1 - 8

Animal Health, Production and Hygiene

www.dergipark.or.tr/tr/pub/aduveterinary

Research Article

The Use of Demountable Dog Skeleton Model in Osteology Education

Naif Onur CEYLAN[1], Bünyamin YILDIRIM[1], Erkut TURAN[2]*, Firuze TÜRKER[2]

[1] *Aydin Adnan Menderes University , Faculty of Veterinary Medicine, 5th year undergraduate student, Efeler, Aydın, TÜRKİYE*
[2] *Aydin Adnan Menderes University , Faculty of Veterinary Medicine, Department of Anatomy, Efeler, Aydın, TÜRKİYE*

ABSTRACT

The aim of the study is by making the osteology information given in the theoretical part of the anatomy course more understandable in the practical courses; to increase the effectiveness of osteology education. Three dog cadavers were used as animal material. The bones of the cadavers were cleaned with the maceration method. Holes were drilled on the articular surface of the bones and powerful magnets were embedded in such a way that they were facing each other. Magnets were placed between the head and mandible, C1-C6 vertebrae in the anterior and posterior limb joints. Thus, the demountable skeleton was obtained. The possible contributions of these skeletons to the learning of osteology were evaluated by considering the questionnaire, quiz, midterm exam, end-of-year exam, and course success rate made to the 1st year students (n:38) that took the Anatomy I course in Aydın Adnan Menderes University Veterinary Faculty. The students participating in the study were randomly divided into 3 groups. In practice lessons, Group 1 studied with the demountable skeleton model and bones; group 2 studied with the traditional (fixed at the joints) skeleton and bones, group 3 studied only with bones. In the quiz exam, 16 questions were asked to the groups about the bones of the forelimb; It was seen that the highest average of correct answers given to the questions belonged to group 1. According to the midterm exam results, it was seen that the highest-grade point average belonged to Group 1, and similarly, the success rate of the Anatomy 1-semester exam was found to be high in Group 1. In the results of the questionnaire evaluating the effectiveness of the educational materials given in the study, it was determined that the students in all groups mostly preferred to work with the demountable skeletons. According to the results of the study, it can be said that the success and motivation of the students working with the demountable skeleton are positively affected.

Keywords: *Anatomy, student, veterinarian, osteology, demountable skeleton*

Osteoloji Eğitiminde Demonte Olabilen Köpek İskelet Modelinin Kullanımı

ÖZET

Anatomi dersinin teorik kısmında verilen osteoloji bilgilerinin uygulama derslerinde daha anlaşılabilir olmasını sağlayarak; osteoloji eğitiminin etkinliğini arttırmaktır. Hayvan materyali olarak 3 adet köpek kadavrası kullanıldı. Maserasyon yöntemiyle kadavraların kemikleri temizlendi. Kemiklerin eklem yüzeyine matkapla delikler açılarak güçlü neodyum mıknatısları karşılıklı gelecek şekilde gömüldü. Mıknatıslar; kafa, mandibula, C1-C6 omurları, ön ve arka bacak eklemlerine yerleştirildi; böylece iskeletin demonte edilebilmesi sağlandı. Bu iskeletlerin osteoloji öğrenimine olası katkıları Aydın Adnan Menderes Üniversitesi Veteriner Fakültesi 2021-2022 eğitim-öğretim yılında Anatomi I dersi alan 1. sınıf öğrencilerine (n:38) yapılan anket, quiz, ara sınav, yılsonu sınavı ve ders başarı oranları göz önüne alınarak değerlendirildi. Çalışmaya katılan öğrenciler rastgele seçimle 3 gruba ayrıldılar. Uygulama derslerinde, 1. grup demonte iskelet modeli ve kemikler; 2. grup geleneksel (eklemlerinden sabitlenmiş) iskelet modeli ve kemikler 3. grup ise sadece kemiklerle çalıştılar. Yapılan quiz sınavında gruplara ön bacak kemikleriyle ilgili 16 adet soru yöneltildi; sorulara verilen doğru cevap ortalaması en yüksek grup 1'e ait olduğu görüldü. Ara sınav sonuçlarına göre en yüksek not ortalamasının Grup 1'e ait olduğu benzer şekilde Anatomi 1 dersi yarıyıl sınavı başarı oranının da Grup 1'de yüksek olduğu görüldü. Çalışmada verilen eğitim materyallerinin etkinliğini değerlendiren anket sonuçlarında tüm gruplardaki öğrencilerin çoğunlukla demonte olabilen mıknatıslı iskeletlerle çalışmayı tercih ettikleri yönünde görüş bildirdikleri tespit edildi. Çalışma sonuçlarına göre demonte olabilen mıknatıslı iskeletlerle çalışan öğrencilerin ders başarı ve motivasyonlarının olumlu yönde etkilendiğini söylenebilir.

Anahtar kelimeler: *Anatomi, öğrenci, veteriner hekim, osteoloji, demonte iskelet*

Corresponding Author: Erkut TURAN, Aydin Adnan Menderes University , Faculty of Veterinary Medicine, Department of Anatomy, Efeler, Aydın, TÜRKİYE, eturan@adu.edu.tr
Received Date: 29.06.2022 – Accepted Date: 14.09.2022
DOI: 10.53913/aduveterinary.1137573

Introduction

The science of anatomy has been one of the cornerstones of both veterinary medicine and human medicine education throughout history (Gültiken, 2011; Atay et al., 2016). Detailed knowledge of anatomical systems is vital for clinical veterinary practice. However, it has been reported that students have difficulties in transferring the skills they learned theoretically from textbooks to real-life applications (Canrigh et al., 2022). For this reason, the necessity of practical courses is emphasized as a basic element in the education programs of the Faculty of Veterinary Medicine. Difficulty and abstractness of the subjects that students see in theoretical lessons; also increase their need for practical lessons during their education (Altuğ et al., 2018).

Traditional anatomy education is carried out with theoretical lecture notes and practical lessons on cadavers. Today, the variety of course materials is greater. Didactic lessons, books, and atlases, dissection and cadaver applications, digital atlases, and 3D models can be counted among these (Altuğ et al., 2018). In anatomy; since the skeletal system (osteology) is the basis for other systems of the body, it is an important subject. For example; Many anatomical structures belonging to the muscle, vessel, and nervous system are named according to the bone sections where they are located, adjacent to, and passed through. Materials used in osteology education; natural bones of animal species, skeletons obtained by joining these bones with adhesives (traditional skeleton), and models made of plastic materials. It is not possible to show the relations and contacts of the bones at the joint level in traditional skeletons, which were reported to be instructive by the students. In addition, joint surfaces and anatomical structures on these faces cannot be seen in the traditional skeletons. In the case of examining the bones separately without creating a skeleton; students may have difficulty in learning about the placement order and position of the bones and have difficulty in visualizing a whole skeleton in their minds. The first aim of the study is to create skeletons that can be demountable (made of bones that can be separated from the skeleton and reassembled to the skeleton when desired) by processing the bones obtained from dog cadavers. The second aim is to investigate the effect of demountable dog skeleton and dog skeleton prepared by the traditional method (glued fixed) and bones that are not assembled as skeletons in osteology training. The hypothesis of the study; the demounted skeleton model can facilitate the comprehension of the order of placement of the bones on the skeleton (from cranial to caudal from proximal to distal), posture positions on the skeleton, directions, and articular surfaces. Thus, it can increase students' interest in the lesson and their learning success.

Materials and Medhods

The method in the study was carried out in two stages. The first stage is the preparation of the skeletons; The second stage is the use of skeletons in practice lessons, the evaluation of quizzes, surveys, midterm, and end-of-year exam results.

Preparation of skeletons

The animal material of the study was obtained from dog cadavers used for training purposes in the dissection laboratory of ADU Faculty of Veterinary Medicine, Department of Anatomy. The processes of removing the skin, muscles, and organs of the cadavers, cleaning the bones, and making them ready for the skeleton were carried out in the laboratories of the Department of Anatomy. In the study, 2 demountable (consisting of bones/joints that can be separated from the skeleton and reassembled to the skeleton when desired) and 1 traditional (all bones are fixed by gluing from the joints) dog skeleton were prepared. The skin, muscles, and organs of the dog cadavers were removed with surgical instruments such as scalpels, forceps, and curettes. The cleaning of fat, fascia, and tendon tissues on the bones was carried out by boiling. Tap water containing sodium hydroxide was used as the boiling solution. Boiling was done intermittently for 24-36 hours. The bones, which were free of tissues, were left to cool. For the complete removal of fat and tissue residues on the bones, whitening, and disinfection of the bones 50% hydrogen peroxide was used. Bones were kept in hydrogen peroxide for 20-30 minutes for this procedure. The bones were then kept in tap water for 1 day, washed, and allowed to dry. After drying, holes of 3-8 mm in diameter and 3-6 mm in depth were drilled in the joint areas of the bones with the help of a drill. Strong neodymium magnets were attached to the drilled holes with the help of the fast adhesive. The magnets were placed at the joints of the head, mandible, C1, C2, C3, C4, C5, C6 vertebrae, scapula, humerus, antebrachium, coxae, femur, tibia, patella, fabella, carpal, and tarsal bones as well as some of the roots of the canine and molar teeth (Figures 1-2-3). Thus, the bones were ensured that they could be separated from the joints between the mentioned bones when desired. The vertebrae were kept in their natural position using a supporting iron but they could be demountable if desired, with the aid of magnets. The scapula was attached to the body with the help of magnets. The whole skeleton was obtained in the natural standing position with the bones that could be demountable from the joint areas by means of magnets and support materials. The skeletons were made ready by placing them on the platforms (Figure 4). For the traditional skeleton construction, all operations except the placement of magnets were carried out sequentially. The bones were fixed with instant glue so that they would not be separated from the articular surfaces.

Use of skeletons in practice lesson

Aydın Adnan Menderes University Faculty of Veterinary Medicine Anatomy I course is given to the first-year students with a systematic method in the first semester. Students take general anatomical terminology and general osteology in the first week. Then they complete the forelimb osteology course in two weeks. The success and satisfaction of the students participating in the study in the forelimb osteology course were evaluated. In order

Figure 1. Placement of magnets (black arrow) on the cervical vetrebrae

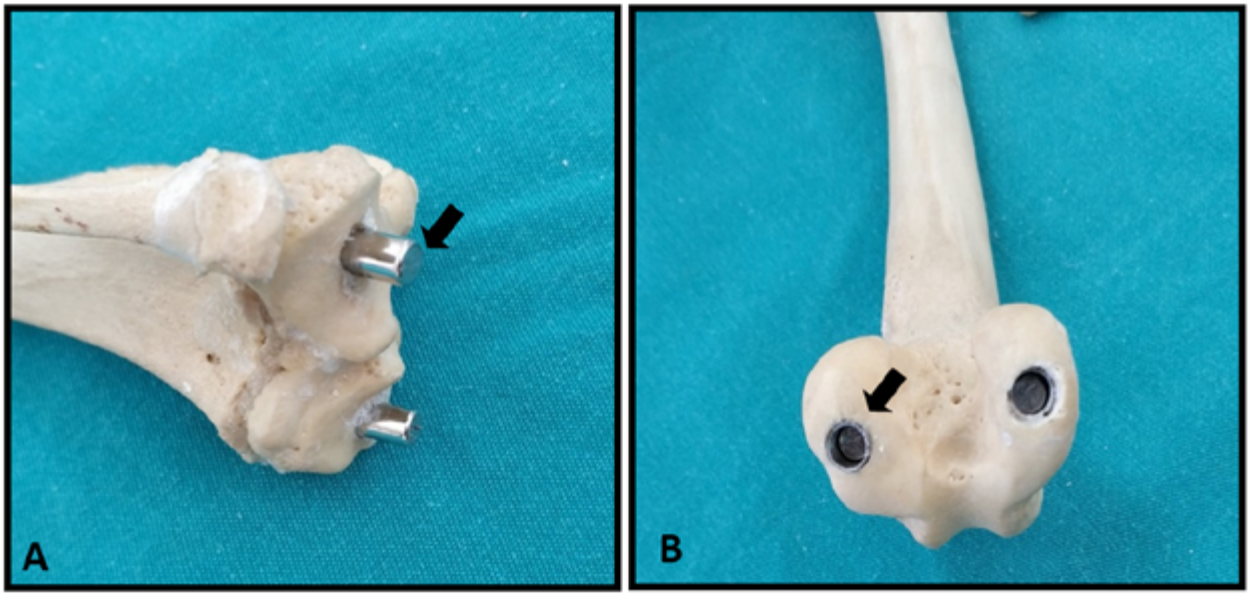

Figure 2. Placement of magnets (black arrow) on the articular surfaces of the tibia (A) and femur (B)

to evaluate the possible contributions of demountable skeletons to the osteology course, the students who took the anatomy I course were provided to use the skeletons in the practice courses (Figure 5). For this purpose, students (n:38) were randomly divided into 3 groups. The students were informed about the study and the groups; It was announced that any personal (age, gender, name, surname) data of the students participating in the groups would not be used in the study and their consent was obtained. In the osteology course, students work with the bones of the related topics. However, the students participating in the study were given a demountable skeleton or a traditional skeleton beside the bones for the practical lesson. Thus, 3 groups were formed (Table 1).

The subjects of forelimb osteology were taught to the students in all groups by the same lecturer from the Department of Anatomy in the practice course. After the forelimb osteology course was completed, a quiz exam consisting of 16 questions was given to the groups.

Students took the exam one by one; questions were directed to the students orally; each correct answer is marked as +1. The quiz was administered by the faculty member of the anatomy department, who explained the forelimb osteology to the student groups. Afterward, it was ensured that the demountable skeleton and traditional skeleton were used alternately between all groups during 2 lesson hours. A questionnaire (Appendix: 2) was conducted to the students participating in the study on whether demountable skeleton, traditional skeleton, and bones could be preferred as course materials. The success grades of the groups in the midterm exam and the correct answer rates given to the forelimb osteology subjects in the midterm exam were evaluated. At the end of the semester, the students' end-of-year exam success was also evaluated.

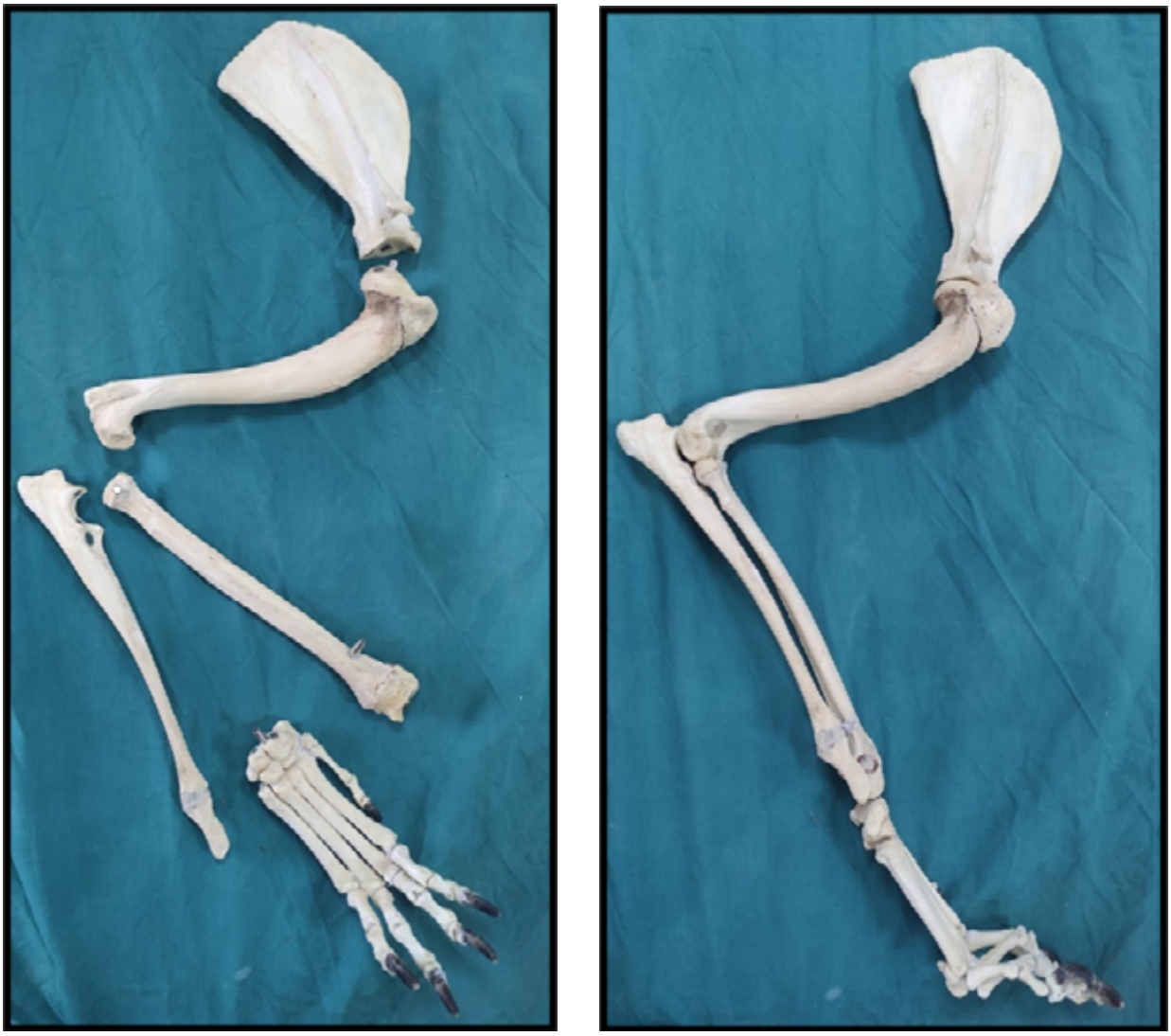

Figure 3. Demounted front leg bones (A), bringing the forelimb bones together with the help of magnets (B)

Figure 4. General view of demountable fore and hind limb bones, separated

Figure 5. Students studying with demountable skeleton

Ethics committee approval

Live animals were not used in our study. According to Article 8/19-k of the regulation on the working procedures and principles of animal experiments ethics committees, studies on "dead animal or its tissue, slaughterhouse materials" are not subject to permission. In addition, ethics committee approval was not obtained because the questionnaire and quiz exam applied to the students consisted of questions that did not contain personal information and only received opinions and answers for the evaluation of the educational materials.

Statistical analysis

The SPSS© 22.0 (Statistical Package for the Social Sciences 22) program was used for statistical analysis. The conformity of the students' grade point averages to the normal distribution was examined using the Shapiro-Wilk test. In terms of midterm, final, and make-up grades, a one-way analysis of variance (ANOVA) was used to determine whether there was a statistical difference between the groups. Scheffe post hoc test was used to determine the group or groups with a significant difference as a result of the analysis. For statistical significance, the type-I error level was determined as P<0.05 (Özdamar, 2015). The answers given by the student groups for each question in the quiz exam are correct and incorrect; At the end of the semester, the success of the anatomy course was categorized as passing and failing, and whether there was a statistical difference between the expected and observed levels of these categorical variables within the groups was determined using the "Pearson chi-square" method. Cases with a P-value below 0.05 were considered statistically significant (Hayran and Hayran, 2011). The reliability of the answers given to the questionnaire (Table 2) items was determined by the Cronbach's alpha coefficient (α). Cronbach's alpha coefficient 0-0.49 unreliable, 0.50-0.59 bad, 0.60-0.69 suspicious, 0.70-0.79 acceptable, 0.80-0.89 good, 0.90 values between -1.00 were considered as perfectly reliable (Alpar, 2016).

Results

In the study, the quiz, questionnaire, and midterm exam results of group 1 (demountable skeleton and bones), group 2 (traditional skeleton and bones), and group 3 (bones only) and the correct answer given to the questions about the forelimb bones in the midterm exam results were evaluated. rates, final exam, make-up exam results, and anatomy I course success (pass-fail) results were evaluated.

Evaluation of quiz results

The quiz consisting of 16 questions was evaluated over a total of 16 points, each correct answer being +1 point. A statistically significant difference was found between the total correct answer mean of group 1 and group 2, but no statistical difference was found between the other groups (Table 3).

In the statistical evaluation of the correct and incorrect answers given to each quiz question between the groups, a significant difference was found in the answers given to the 12th, 13th, and 14th questions. These questions are about the antebrachium bones; The frequency of correct answers to these questions higher than the expected level belongs to group I.

Evaluation of the survey results

A 6-item Likert-type questionnaire and 1 open-ended question were administered to the groups. The Cronbach's alpha coefficient (α) was 0.664. Survey work; A total of 34 people, including 12 students from group 1, 12 students from group 2, and 10 students from group 3 (Figure 6).

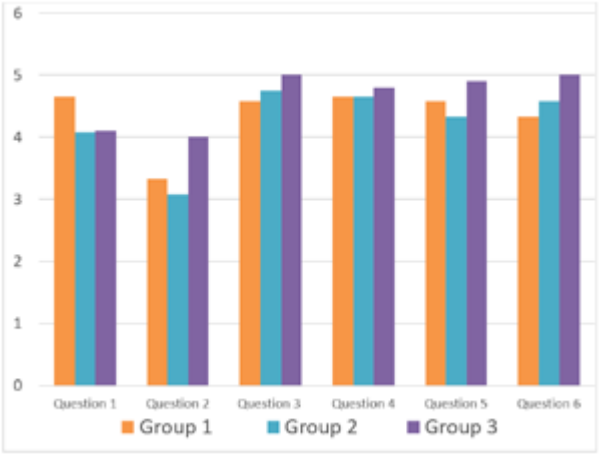

Figure 6. Questionnaire result

Anatomy lesson; Statistical evaluation of midterm, final, and make-up exams:

After the evaluation of the quiz and survey results of the groups, the exam success of the students was also exam ined in order to evaluate the general course success status of the students.

As a result of the statistical evaluations, based on midterm, final, and make-up grades, among group 1, group 2, and group 3; no difference was found for midterm and make-up exams; A statistically significant result was found between group 1, group 2 and group 3 for the end-of-year exam (Table 4).

Table 1. Students groups

Group	The course material used
1 (n:14):	Students working with demountable skeletons and bones
2 (n:12):	Students working with traditional skeletons and bones
3 (n:12):	Students working only with bones

Table 2. Questionnaire

1.	It is instructive to work with bones (not skeletally combined) in the skeletal anatomy course.
2.	It is instructive to work with skeletons with all bones joined in the skeletal system anatomy course.
3.	In the skeletal system anatomy course, it is instructive to work with skeletons whose bones can be demountable.
4.	Demountable skeletons allow easier grasping of the stance positions of the bones on the skeleton.
5.	Demountable skeletons provide a better understanding of the anatomical structures of the area where the bones articulate.
6.	The demountable skeleton model has advantages over other materials used in osteology education, such as increasing the interest in the lesson and making the lesson more productive and enjoyable.

The numbers from 1 to 5 correspond to the following expressions.
1: No, 2: partially, 3: could be, 4: correct, 5: absolutely right

Table 3. Quiz result, SD: standard deviation

	Group 1 (n=14) mean ± SD	Group 2 (n=14) mean ± SD	Group 3 (n=14) mean ± SD	P
Total correct answer average	11.78±0.80[a]	8.08±0.97[b]	9.16±0.91[ab]	0.015

[a, b]: The difference between the groups with different letters in the same line is statistically significant (P= 0.05)

Table 4. Anatomy lesson; Evaluation of midterm, end-of-year and make-up exam results, SD: standard deviation

	n	Group1 mean ± SD	n	Group2 mean ± SD	n	Group 3 mean ± SD	P
Mid-term exam	14	67.29±3.90	12	54.25±5.40	12	58.25±4.87	0.138
End of year exam	14	64.64±4.69[a]	12	45.58±5.34[b]	12	36.66±4.86[b]	0.001
Makeup exam	4	54.00±3.71	6	38.83±8.32	4	40.75±11.79	0.456

[a, b]: The difference between the groups with different letters in the same line is statistically significant (P= 0.05)

Table 5. Evaluation of Anatomy I course pass-fail rate

		Exam result		Total
		Pass	Fail	
Group 1	n	10	4	14
	%	71.4%	28.6%	100.0%
Group 2	n	7	5	12
	%	58.3%	41.7%	100.0%
Group 3	n	4	8	12
	%	33.3%	66.7%	100.0%

Statistical evaluation of Anatomy I course pass-fail rate

As a result of the chi-square analysis, it was determined that there was no statistically significant difference at the expected level in terms of the number of passing failures for each group of students (X^2: 3.860 P=0.145). In the study, the rate of the passing of the group working with the demounted model (1st group) was higher than the other groups, but no statistically significant difference was found (Table 5).

Discussion

Anatomy is a branch of science in which visual materials, which have an important place in the education programs in medicine, are frequently used. It is stated that visual education materials and methods are more effective in teaching and learning processes than auditory methods and other methods. This situation reveals the importance of practice lessons and course materials in anatomy learning (Özdemir, 2003). Within the scope of the current study, a demountable dog skeleton, which is an application course material, was created. With the use of this material, it is aimed to make the forelimb osteology subjects given in the theoretical anatomy lesson more understandable in the practical lessons and to increase the efficiency of the osteology education.

When scientific studies in the field of anatomy were evaluated in our country, it was reported that the most studies were on the locomotor system with a rate of 20.1%, and the animal species used in these studies were dogs with 12.35% (Dilek et al., 2019). Today, it is seen that the animal species brought to veterinary clinics with the highest rate is the dog (İşler et al., 2015; Şimşek and Akçay, 2021). For this reason, especially dogs were preferred as animal material in the study. In addition, the placement of the magnets used in the study of the dog skeleton and the convenience of keeping the skeleton in disassembled-assembled form was also effective in the selection of animal material.

It was predicted that the practice course with demountable dog skeleton, which was carried out within the scope of this research, could be more instructive than the traditional skeleton and bones. No other study investigating the results of the practical training given with the demountable skeleton was found in the literature. Therefore, we could not reach the articles where we can discuss the results of our study. After the forelimb osteology topics were given to the student groups in the study (1.2.3. groups), a quiz exam consisting of 16 questions was applied. Quiz exam questions are prepared to determine the cranial-caudal, proximal-distal placement orders of bones on the skeleton, their posture positions, and directions (cranial-caudal, lateral-medial) on the skeleton. In the quiz results, a statistically significant difference was found between the total correct answer mean of group 1 and group 2; no statistically significant difference was found between the other groups. The highest correct answer average given to the quiz questions consisting of a total of 16 questions belonged to the 1st group (11.78). Antebrachium, which is one of the forelimb bones, consists of two bones, the radius, and the ulna. These bones join the synovial joint at two proximal and distal points in the dog (Öcal et al., 1998). The orientation and placement of these two bones in dogs may be more difficult for students to comprehend than other forelimb bones. The 12th and 13th questions of the quiz are about the aspects of the antebrachium bones and their placement on the skeleton. The 14th question indicates the *incisura radialis ulnae*, which is the synovial articular surface located proximal to the ulna. When the answers given to the 12th, 13th, and 14th questions between the groups were evaluated, it was seen that the group 1 students had a higher correct answer frequency than the expected level. In the quiz results, it was determined that the students working with the demountable skeleton model (1st group) were more successful than the other groups; It has been observed that the bones have a better grasp of their position and orientation on the skeleton. There are studies investigating the success and satisfaction levels of anatomy courses in both human medicine (Arı et al., 2003; Sindel et al., 2008; Atay et al., 2016; Yavuz et al., 2017) and veterinary medicine (Gültiken, 2011; Özen et al., 2012; Altuğ et al., 2018). In the current study, the demountable skeleton and the traditional skeleton were used alternately between all groups, and which educational material the students preferred in terms of osteology education was investigated with a questionnaire. The reliability of the answers given to the questionnaire statements was determined by Cronbach's alpha coefficient (α). In the study, it was observed that this coefficient was 0.664, so the questionnaire was found suspicious.

The main reason for calculating the reliability coefficient as suspicious is thought to be the low number of students participating in the survey. The number of students included in the study is one of the limitations of the current study, and it can be suggested that similar studies be carried out with larger student groups. When the results of the 6-item Likert-type are evaluated, it is seen that the 3rd, 4th, 5th, and 6th propositions regarding the use of the demountable skeleton model were approved with the highest score. The students in the 2nd and 3rd groups who did not use the demountable skeleton model during their studies were the students who gave the highest scores to these propositions. The common opinion of all groups in the answers given to the open-ended question of the questionnaire; "Because the bones are removable in the demountable skeleton model, it is more preferable in terms of understanding their postures and directions". According to the results of the current study, it can be said that the demountable skeleton model is preferable to other materials as an osteology course training material. When the course-exam success of the groups is evaluated; between Group 1, Group 2, and Group 3; there was no statistical difference for midterm and make-up exams; a statistically significant result was found between Group 1, Group 2, and Group 3 for the end-of-year exam. The highest-grade point average obtained in these exams belongs to the

1st group. When only the correct answers to the forelimb osteology questions were evaluated in the midterm exam, it was seen that the highest correct answer rate belonged to the 1st group. When Anatomy I course pass-fail rates are evaluated, there is no statistically significant difference between the groups; It is seen that group 1 has the highest passing rate with 71.4%. It is thought that there is not enough data to say that the results of both the end-of-year and make-up exams, and therefore the passing rates, are completely dependent on this study. However, when the quiz, survey, and exam success results of this study are evaluated, it can be said that the learning of the 1st group, who uses the demountable skeleton model, has a positive effect on their learning. The main reasons that led to this success; as stated in the survey results, the demountable model may increase the interest in the lesson and maybe the motivation for the student to succeed in the Anatomy I lesson after the high midterm exam grade (1st group). It can be thought that many anatomical structures in the muscle, vascular and nervous systems, which are taught following the skeletal system anatomy course, are named after the bone sections where they are located, adjacent to, and pass through, leading to ease of learning and increasing motivation in students.

Conclusion

When the results of the current study are evaluated collectively; the demountable skeleton model facilitates the comprehension of the placement of bones on the skeleton, posture positions, directions, and joint surfaces; It is seen that the hypothesis that it can positively affect students' interest in the course and thus learning success has been largely confirmed. However, it will contribute to obtaining clearer results if the study is carried out with a demountable skeletal model in a large-participation student group to cover all osteology topics.

Acknowledgements

This study was supported by TÜBİTAK 2209-A program. Application number:1919B012003669. The authors thank TÜBİTAK for their support.

Conflict of Interest

The authors declare that they have no conflict of interest in this study.

References

Alpar, R. (2016). *Spor sağlık ve eğitim bilimlerinden örneklerle gualala istatistik ve geçerlik-güvenirlik* (4. Baskı), Detay Yayıncılık, Ankara, 553-584.

Altuğ, N., Özdemir, N., Muz, D., Seyidoğlu, N., Ferit, Can, M., Erdoğan, S., Muz, M. N., & Özbezek, M.F. (2018). Veteriner fakültesi öğrencilerinin bazı uygulama dersleri ile ilgili görüşleri: anket çalışması. *Balıkesir Sağlık Bilimleri Dergisi*, 7 (2), 83-90. https://doi.org/ 10.5505/bsbd.2018.26023

Arı, İ., İrgil, E., Kafa, İ. M., & Şendemir, E. (2003). Bir anket çalışması: Anatomi eğitimi ve öğrencilerin düşünceleri. *Uludağ Üniversitesi Tıp Fakültesi Dergisi*, 29(2): 15-18.

Atay, E., Çınar, Ş., Özçelik, Bozkurt, Ö., Tokpınar, A., Soysal, H., & Doğan, U. (2016). Anket çalışması: Tıp fakültesi dönem 1 öğrencilerinin sosyo demografik özellikleri ve anatomi eğitimi hakkındaki düşünceleri. *Erciyes Üniversitesi Sağlık Bilimleri Dergisi*, 25:24-28.

Canrigh, A., Bescoby, S., & Dickson, J. (2022). Evaluation of a 3D computer model of the equine paranasal sinuses as a tool for veterinary anatomy education. *Journal of Veterinary Medical Education*. https://doi.org/10.3138/jvme-2021-0134

Çevik Demirkan, A., Akalan, M.A., Özdemir, V., Akosman, M.S., & Türkmenoğlu, İ. (2016). Gerçek iskelet modellerinin anatomi teorik ve pratik derslerinde kullanımının veteriner fakültesi öğrencilerin öğrenimi üzerine etkilerinin araştırılması. *Kocatepe Veterinary Journal.* 9 (4), 266-272. https://doi.org/10.5578/kvj.28084

Dilek, Ö.G., Demiraslan, Y., & Gürbüz, İ. (2019). Türkiye'de ulusal veteriner anatomi kongrelerinde sunulan bildiriler: Bir eğilim analizi. *Veterinary Journal of Mehmet Akif Ersoy University*, 4 (2), 84-89. https://doi.org/10.24880/MAEUVFD.624361

Gültiken, M.E., Osmanağaoğlu, Ş., Kalkan, M., Onuk, B., Demirci, B., & Atalar, K. (2011). Veteriner anatomi eğitiminde anatomik model kullanımının didaktik etkinliği. VII. Ulusal Veteriner Anatomi Kongresi, 11-12.

Hayran, M., & Hayran, M. (2011). *Sağlık Araştırmaları İçin Temel İstatistik*, Omega Araştırma, Ankara.

İşler, C.T., Altuğ, M.E., Deveci, M.Z.Y., Gönenci, R., & Yurtal, Z. (2015). Mustafa Kemal Üniversitesi Veteriner Fakültesi Cerrahi Kliniği'ne getirilen olguların değerlendirilmesi, 1293 Olgu (2009-2013). *Fırat Üniversitesi Sağlık Bilimleri Veteriner Dergisi*, 29(2). 97-102. https://doi.org/10.31196/huvfd.390169

Öcal, M.K., Erden, H., Öğüt, İ., & Kara, M.E. (1998). Evcil memeli hayvanlarda Anatomi (Genel-Deri-Ön Bacak). Adnan Menderes Üniversitesi Yayınları No: 5

Özdamar, K. (2015). *SPSS ile Biyoistatistik* (10. Baskı), Sözkesen Matbaacılık, Ankara; 379-381.

Özdemir, S. (2003). Tıp eğitimi ve yetişkin öğrenmesi. *Uludağ Üniversitesi Tıp Fakültesi Dergisi*, 29, 25-28.

Özen, A., Doğan, Ö., Başağaç, R.T.G, Özkul, T., & Yüksel E. (2012). Türkiye'de veteriner hekimliği üzerine araştırmalar: I. Veteriner Hekimliği Eğitim-Öğretimi, *Kafkas Üniversitesi Veteriner Fakültesi Dergisi.* 18 (4): 605-611. https://doi.org/10.9775/kvfd.2011.6016

Sindel, M., Şenol, Y., & Gürpınar, E. (2008). Akdeniz Üniversitesi Tıp Fakültesinde anatomi eğitiminin öğrenciler tarafından değerlendirilmesi. *Tıp Eğitimi Dünyası*, 28(28): 31-36.

Şimşek, A. & Akçay, A. (2021). Erciyes Üniversitesi Veteriner Fakültesi Eğitim, Araştırma ve Uygulama Hastanesi'ne getirilen hayvanların uyum analizi ile değerlendirilmesi. *Erciyes Üniversitesi Veteriner Fakültesi Dergisi,* 18(3): 182-189.

Yavuz, F., Ertekin, T., Elmalı, F., & Ülger, H. (2017) klinik öncesi ve klinik dönemde tıp öğrencilerinin anatomi eğitiminde kadavra kullanımı ile ilgili değerlendirmeleri. *Sağlık Bilimleri Dergisi*. 26(3): 227-232.