HARRAN ÜNİVERSİTESİ VETERİNER FAKÜLTESİ DERGİSİ

Comparative anatomy of the pelvic cavity of rat strains in a translational aspect

Yasemin ÜSTÜNDAĞ[1,a,*], Osman YILMAZ[2,b]

[1]Dokuz Eylül University, Veterinary Faculty, Department of Anatomy, İzmir, Türkiye.

[2]Dokuz Eylül University, Medical Faculty, Department of Laboratory Animal Science, İzmir, Türkiye.

[a]ORCID: 0000-0002-8836-0371

[b]ORCID: 0000-0001-7817-7576

Received: 16.01.2025

Accepted: 06.03.2025

How to cite this article: Üstündağ Y, Yilmaz O. (2025). Comparative anatomy of the pelvic cavity of rat strains in a translational aspect. Harran Üniversitesi Veteriner Fakültesi Dergisi, 14(1): 31-38. DOI:10.31196/huvfd.1621777.

***Correspondence:** Yasemin ÜSTÜNDAĞ

Dokuz Eylül University, Veterinary Faculty, Department of Anatomy, İzmir, Türkiye.

e-mail: yasemin.ustundag@deu.edu.tr

Available on-line at: https://dergipark.org.tr/tr/pub/huvfd

Abstract: The anatomy of the pelvic cavity has significant importance in daily clinical applications and surgical interventions such as determining dystocia, surgery of rectal cancers and mesorectal excision, treatment of twisted pouch syndrome and percutaneous sacroiliac screw fixation, and pelvic floor disorders. This study aims to determine the diameters and area calculations of the pelvic cavity in mostly preferred rat strains (Wistar Albino, Brown Norway, Sprague Dawley, and Lewis) and investigate the suitability of rats in translational studies in which anatomical conditions are not a cause of dystocia. In this study, pelvis bones were used. Each group consisted of six rats. They were examined morphologically and morphometrically. According to the Kruskal-Wallis analysis to determine whether there is any difference between strains, significant differences were observed between the strains for the length of the symphysis, oblique diameter, true conjugate, anatomical conjugate, and diagonal conjugate parameters ($p<0.05$). In conclusion, anatomically, Lewis is the most suitable laboratory rat strain that does not predispose to labor dystocia, followed by the Wistar Albino strain. These two strains may be a choice for studies on physiological dystocia. On the other hand, Sprague Dawley is less suitable for experimental studies involving the pelvic inlet, particularly those related to labor dystocia caused by anatomical factors.

Keywords: *Diameter, Dystocia, Pelvic inlet, Rat, Translational anatomy.*

Ratlarda pelvik boşluğun karşılaştırmalı anatomisi

Özet: Pelvik boşluğun anatomisi, klinik uygulamalar ve rektal kanserlerin cerrahisi, mezorektal eksizyon, torsiyonlu kese sendromu tedavisi, perkütan sakroiliak vida tespiti ve pelvik taban bozuklukları gibi cerrahi müdahalelerde önemli bir yere sahiptir. Bu çalışma, en çok tercih edilen sıçan türlerinde (Wistar Albino, Brown Norway, Sprague Dawley ve Lewis) pelvik boşluğunun çaplarını ve alan hesaplamalarını belirlemeyi ve anatomik koşulların güç doğuma neden olmadığı translasyonel çalışmalarda sıçanların uygunluğunu araştırmayı amaçlamaktadır. Çalışmada pelvis kemikleri kullanılmıştır. Her grup altı sıçandan oluşmuştur. Kemikler morfolojik ve morfometrik olarak incelenmiştir. Türler arasında fark olup olmadığını belirlemek için yapılan Kruskal-Wallis analizi sonuçlarına göre LS, DO, CV, CA ve CD parametrelerinde türler arasında anlamlı farklar gözlenmiştir ($p<0.05$). Sonuç olarak, anatomik açıdan Lewis, güç doğuma eğilim göstermeyen en uygun laboratuvar sıçan türü olup, bunu Wistar Albino türü izlemektedir. Bu iki tür, fizyolojik güç doğum ile ilgili çalışmalarda tercih edilebilir. Öte yandan, Sprague Dawley, özellikle anatomik faktörlere bağlı güç doğum ile ilgili pelvik giriş çalışmalarında daha az uygun bir türdür.

Anahtar Kelimeler: *Çap, güç doğum, pelvik boşluk, sıçan, translasyonel anatomi.*

Introduction

The pelvic cavity in rats is structured cranio-ventrally by the hip bone, dorsally by the sacrum, and the caudal vertebrae. The hip bone consists of the ilium in the cranial region, the pubis in the cranio-ventral region, and the ischium in the caudo-ventral region. The ilium represents the most cranial component of the os coxa. Its cranial end expands laterally into the ventral iliac spine and joins the sacroiliac joint. The two pubic bones are joined at the midline through the symphysis pelvina. On the ventral edge of the pubis, just cranial to the pubic symphysis and near the anterior margin of the obturator foramen, lies a distinct iliopectineal eminence, which serves as the attachment site for the pectineus muscle. The dorsal margin of the ischium is elevated, forming the ischiatic spine. The obturator foramen, a large opening, separates the ischium from the pubis. The triangular-shaped sacrum forms the first part of the pelvic roof and consists of four sacral vertebrae. The ventral surface of the sacrum is flat, in contrast to humans. The first few caudal vertebrae form the second part of the pelvic roof (Chiasson, 1994).

Anatomy of the pelvic cavity has significant importance in daily clinical applications and surgical interventions such as determining dystocia (Narumoto et al., 2015), surgery of rectal cancers and mesorectal excision (Baltus et al., 2025; Bolshinsky et al., 2024; Faisal Bin Abdur Raheem et al., 2024; Hong et al., 2020), treatment of twisted pouch syndrome (Holubar, 2024) and percutaneous sacroiliac screw fixation (Link et al., 2024) and pelvic floor disorders (Handa et al., 2003; Maccioni, 2012). Mainly, dystocia refers to difficult or obstructed labor, which is a significant cause of maternal and fetal morbidity and mortality globally. The dimensions of the pelvic cavity are a determinant of the occurrence of vaginal labor in humans. One of them is the narrowest diameter of the pelvis, the true conjugate, which is the shortest distance from the sacral promontory to the pubic symphysis (Oğuz and Desticioğlu, 2021). Early identification and management are crucial to minimize adverse outcomes. Various experimental studies have been carried out for decades for this purpose. This study aims to determine the diameters and area calculations of the pelvic cavity in mostly preferred rat strains (Wistar Albino, Brown Norway, Sprague Dawley, and Lewis) and investigate the suitability of rats in translational studies in which anatomical conditions are not a cause of dystocia.

Materials and Methods

In this study, pelvis bones belonging to four different male rat strains (Wistar Albino, Brown Norway, Sprague Dawley, and Lewis) aged 12 months old and weighing between 850 and 900 grams were used. The bones included in the study were obtained from rat cadavers used in various projects conducted at the Dokuz Eylül University Faculty of Medicine Multidisciplinary Experimental Animal Laboratory. It was taken into ensuring that the skeletal integrity of these cadavers remained intact. Therefore, each group consisted of six rats. Twenty-four pelvis were examined morphologically and morphometrically. Dokuz Eylül University Local Ethics Committee for Animal Experiments granted the ethics committee approval (22/2022) for the study. The skeletons were macerated by boiling for 30 minutes. After the maceration process, the soft tissues on the skeletons were carefully cleaned. Then, the bones were soaked in 3% hydrogen peroxide for 5 minutes and dried at room temperature (Üstündağ et al., 2024a).

Osteometric Measurements: Morphometric measurements of the pelvis of each animal were taken in millimeters using a calibrated electronic digital caliper with a sensitivity of 0.01 mm, an accuracy of ±0.01 mm (<100 mm), and a repeatability of 0.01 mm. Among the morphometric measurements, the length of the pelvic symphysis (LS), oblique diameter (DO), true conjugate (CV), anatomical conjugate (CA), diagonal conjugate (CD), vertical diameter (DV), dorsal transversal diameter (DTD), medial transversal diameter (DTM), ventral transversal diameter (DTV), anterior diameter (AD), medial diameter (MD), external bi-ischial length (EBB), posterior diameter (PD), pelvic girdle area (PGA) and pelvic inlet area (IPA) was measured. Diameters are shown in Figure 1. Moreover, the formulas based on Silva et al. (2019) study calculated pelvic girdle and pelvic inlet areas. The formulas are given below:

$$PGA = \frac{DTM}{2} x \frac{CA}{2} x\, \pi$$

$$IPA = \left(\frac{(DTD + DTM)}{2} x \frac{CA}{2}\right) + \left(\frac{(DTM + DTV)}{2} x \frac{CA}{2}\right)$$

Statistical analysis: All linear morphometric data were subjected to a homogeneity test of variances. Data were presented as the mean ± standard deviation, and the p<0.05 value was considered significant. Length of the pelvic symphysis, all the diameters, external bi-ischial breadth, pelvic girdle area, and pelvic inlet area were analyzed by the Kruskal-Wallis test following the Mann-Whitney U test to define the diversity between the groups (Üstündağ et al., 2024b). In addition, Pearson correlation analysis was applied to pelvic areas to identify the correlation between pelvic areas and the length of the pelvic symphysis, all the diameters, and external bi-ischial breadth (Silva et al., 2019).

Results

According to the Kruskal-Wallis analysis to determine whether there is any difference between strains, significant differences were observed between the strains for LS, DO, CV, CA, and CD parameters (p<0.05). The differences between the strains are shown in Table 1.

The Pearson correlation test aimed at assessing the relationship between PGA and IPA with the examined parameters yielded the following findings. In the Wistar Albino strain, a positive correlation was noted between PGA and DTD (p<0.05), while no correlation was detected

Table 1. Results of Kruskal-Wallis test.

Parameters	Wistar Mean±SD	Brown Norway Mean±SD	Sprague Dawley Mean±SD	Lewis Mean±SD	p
LS	6,04 ± 0,53[ab]	5,94 ± 0,34[ab]	5,4 ± 0,63[a]	6,8 ± 0,58[b]	0,027*
DO	29,62 ± 1,11[ab]	28,5 ± 0,62[b]	29,48 ± 0,68[ab]	30,7 ± 099[a]	0,027*
CV	38,6 ± 1,78[abc]	37,84 ± 1,49[ab]	36,48 ± 1,71[ab]	40,4 ± 1,05[c]	0,018*
CA	35,3 ± 2,02[abc]	35,14 ± 0,89[ab]	33,9 ± 1,18[ab]	36,94 ± 0,75[c]	0.032*
CD	42,2 ± 1,62[abc]	41,74 ± 0,97[ab]	39,86 ± 2,15[ab]	43,56 ± 0,51[c]	0.026*
DV	10,06 ± 1,42	10,22 ± 0,9	9,18 ± 1,23	11,1 ± 1,75	NS
DTD	14,56 ± 1,12	14,0 ± 0,95	15,28 ± 0,5	15,3 ± 1,04	NS
DTM	14,2 ± 0,68	13,8 ± 0,7	13,96 ± 1,24	14,04 ± 1,09	NS
DTV	11,18 ± 0,76	9,74 ± 0,74	10,84 ± 0,58	11,7 ± 2,69	NS
AD	15,2 ± 0,46	14,96 ± 0,71	15,34 ± 1,76	14,1 ± 2,24	NS
MD	16,44 ± 0,77	18,22 ± 1,2	16,56 ± 1,95	17,44 ± 1,31	NS
PD	20,1 ± 2,7	19,3 ± 1,85	18,7 ± 2,3	22,06 ± 3,62	NS
EBB	24,02 ± 2,17	23,76 ± 1,34	22,4 ± 2,04	25,4 ± 2,56	NS
PGA	393,30 ± 26,75	380,9 ± 26,45	370,72 ± 24,32	406,65 ± 24,02	NS
IPA	1655,69 ± 165,58	1428,91 ± 167,68	1530,06 ± 150,03	1786,66 ± 353,81	NS

***:** Significant at p<0.05 level, **NS:** Non-Significant, **LS:** the length of the pelvic symphysis, **DO:** oblique diameter, **CV:** true conjugate, **CA:** anatomical conjugate, **CD:** diagonal conjugate, **DV:** vertical diameter, **DTD:** dorsal transversal diameter, **DTM:** medial transversal diameter, **DTV:** ventral transversal diameter, **AD:** anterior diameter, **MD:** medial diameter, **PD:** posterior diameter, **EBB:** external bi-ischial length, **PGA:** pelvic girdle area and **IPA:** pelvic inlet area

Table 2. Results of pearson correlation analysis of pelvic areas.

		LS	DO	CV	CA	CD	DV	DTD	DTM	DTV	AD	MD	PD	EBB
Wistar Albino	**PGA**	0,326	0,540	0,839	0,700	0,671	-0,831	0,896*	0,548	0,256	0,659	0,274	0,529	0,214
	IPA	0,552	0,723	0,707	0,409	0,459	-0,538	0,674	0,704	0,720	0,486	-0,237	0,128	-0,263
Brown Norway	**PGA**	-0,105	0,576	0,781	0,808	0,687	-0,750	0,519	0,952*	0,609	0,875	0,570	-0,097	0,771
	IPA	-0,003	0,696	0,716	0,819	0,605	-0,509	0,658	0,799	0,904*	0,824	0,528	-0,377	0,590
Sprague Dawley	**PGA**	-0,536	0,128	-0,216	-0,653	-0,269	-0,792	0,657	0,964**	0,777	0,676	-0,900	0,124	0,470
	IPA	-0,426	0,266	-0,142	-0,723	-0,168	-0,837	0,725	0,959*	0,927*	0,470	-0,235	0,360	-0,950
Lewis	**PGA**	0,383	-0,587	-0,682	-0,855	-0,798	0,488	0,225	0,990**	0,400	0,158	-0,342	-0,750	-0,797
	IPA	0,892*	-0,287	0,397	0,189	0,109	0,857	-0,363	0,172	0,967**	-0,886*	0,635	0,126	-0,410

*****Correlation is significant at the 0.05 level (2-tailed), p< 0.05, ****** Correlation is significant at the 0.01 level (2-tailed), p< 0.01, **PGA:** Pelvic girdle area and **IPA:** Pelvic inlet area

Table 3. Results of Pearson correlation analysis of pelvic diameters.

WistarAlbino	**LS**	**DO**	**CV**	**CA**	**CD**	**DV**	**DTD**	**DTM**	**DTV**	**AD**	**MD**	**PD**	**EBB**
CD	0.640	0.308	.949*	0.844	1								
DTD	-0.117	0.390	0.539	0.541	0.353	-.932*	1						
AD	-0.241	0.700	0.428	0.683	0.249	-.917*	0.774	0.087	-0.014	1			
EBB	-0.739	-0.341	-0.055	0.278	0.003	-0.602	0.533	-0.069	-0.788	0.431	0.851	.903*	1
BrownNorway	**LS**	**DO**	**CV**	**CA**	**CD**	**DV**	**DTD**	**DTM**	**DTV**	**AD**	**MD**	**PD**	**EBB**
CA	0.323	0.616	.936*	1									
CD	0.306	0.702	0.777	.904*	1								
DTM	.903*	0.479	0.580	0.588	0.471	0.098	0.444	1					
AD	0.844	0.366	0.509	0.490	0.257	-0.060	0.555	.948*	0.609	1			
MD	-0.033	-0.070	.912*	0.730	0.470	-0.212	-0.230	0.397	0.396	0.419	1		
EBB	0.074	0.726	-0.158	0.168	0.209	-0.756	0.710	-0.146	0.580	-0.112	-0.377	-.966**	1
SpragueDawley	**LS**	**DO**	**CV**	**CA**	**CD**	**DV**	**DTD**	**DTM**	**DTV**	**AD**	**MD**	**PD**	**EBB**
DV	0.390	-0.572	0.624	.954*	0.525	1							
DTD	0.000	0.822	-0.652	-.988**	-0.265	-.916*	1						
DTM	-0.431	0.372	-0.398	-0.831	-0.332	-.918*	0.830	1					
PD	-0.144	-0.763	0.815	0.635	0.511	0.496	-0.577	-0.132	-0.120	0.644	.947*	1	
EBB	-0.253	-0.877	0.718	0.720	0.345	0.559	-0.682	-0.220	-0.299	0.661	.981**	.968**	1
Lewis	**LS**	**DO**	**CV**	**CA**	**CD**	**DV**	**DTD**	**DTM**	**DTV**	**AD**	**MD**	**PD**	**EBB**
CA	-0.011	0.639	.927*	1									
DV	.950*	-0.691	-0.014	-0.179	-0.099	1							
DTM	0.298	-0.617	-0.771	-.919*	-0.837	0.421	0.249	1					
AD	-0.758	0.154	-0.688	-0.542	-0.440	-0.713	0.583	0.266	-.971**	1			
MD	0.312	0.487	.886*	0.770	0.523	0.162	-0.257	-0.468	0.744	-0.728	1		
PD	-0.017	0.822	0.778	.927*	.901*	-0.270	0.109	-0.816	0.314	-0.383	0.743	1	
EBB	-0.281	.890*	0.809	.912*	0.764	-0.484	0.032	-0.852	0.155	-0.232	0.721	.947*	1

*Correlation is significant at the 0.05 level (2-tailed), $p < 0.05$, ** Correlation is significant at the 0.01 level (2-tailed), $p < 0.01$, **CA:** Anatomical conjugate, **CD:** Diagonal conjugate, **DV:** Vertical diameter, **DTD:** Dorsal transversal diameter, **DTM:** Medial transversal diameter, **AD:** Anterior diameter, **MD:** Medial diameter, **PD:** Posterior diameter, **EBB:** External bi-ischial length

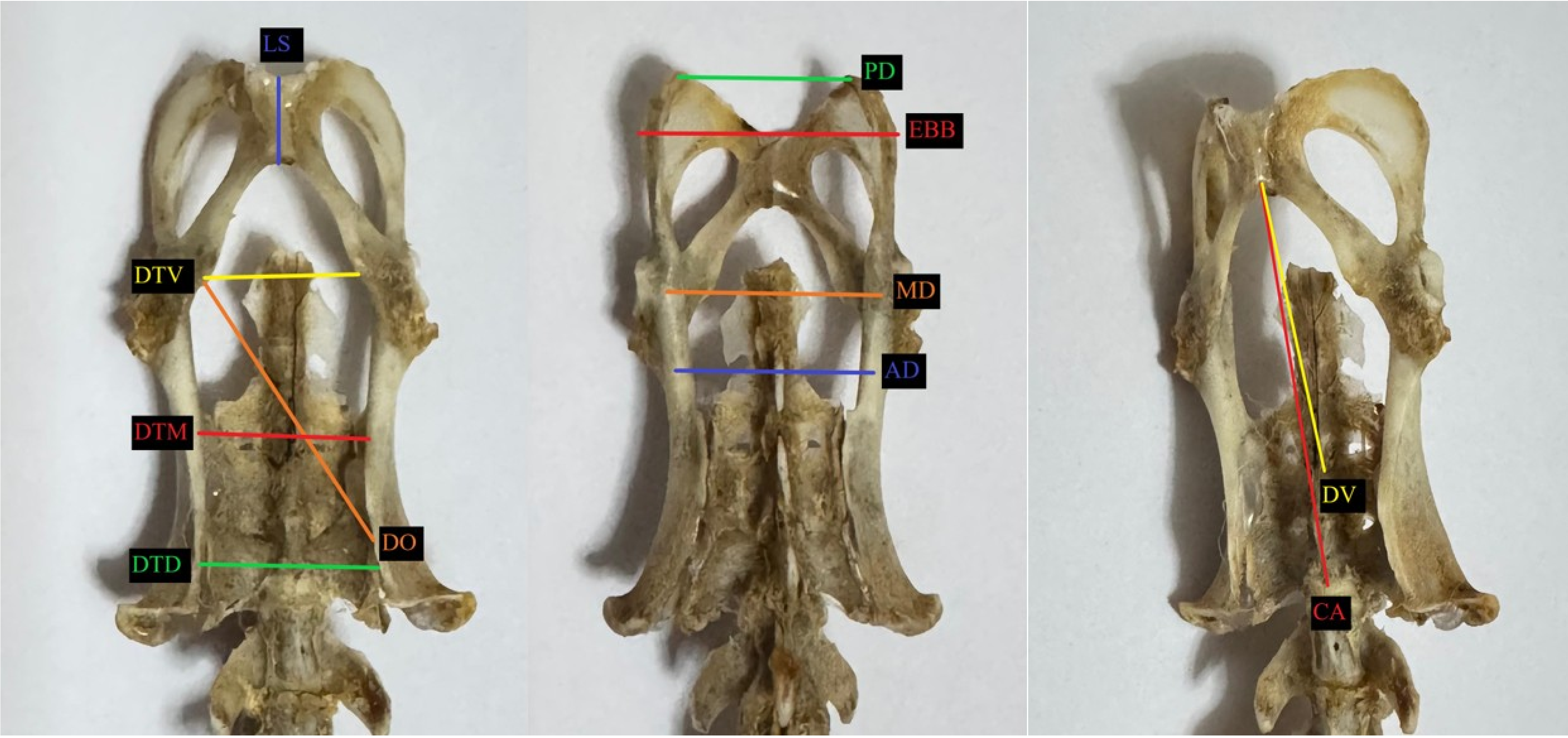

Figure 1. Measured diameters of the pelvis.

LS: The length of the pelvic symphysis, **CA:** Anatomical conjugate, **DV:** Vertical diameter, **DO:** Oblique diameter, **DTD:** Dorsal transversal diameter, **DTM:** Medial transversal diameter, **DTV:** Ventral transversal diameter, **AD:** Anterior diameter, **MD:** Medial diameter, **PD:** Posterior diameter, **EBB:** External bi-ischial length between IPA and any parameter. In the Brown Norway strain, positive correlations were found between PGA and DTM ($p<0.05$) and between IPA and DTV ($p<0.05$). For the Sprague Dawley strain, a significant positive correlation emerged between PGA and DTM ($p<0.01$) as well as between IPA and both DTM and DTV ($p<0.05$). In the Lewis strain, positive correlations were identified between PGA and DTM ($p<0.01$), along with IPA and DTV ($p<0.01$), LS, and AD ($p<0.05$). The correlations are summarised in Table 2.

The results of the Pearson correlation test conducted to evaluate the relationships among diameters revealed several significant findings. In the Wistar strain, a positive correlation was observed between CD and CV and between EEB and PD. Conversely, a negative correlation was identified between DV and DTD, as well as between DV and AD ($p < 0.05$). Positive correlations were noted for the Brown Norway strain between LS and DTM, CV and CA, and MD with both CD and AD ($p < 0.05$). In contrast, a negative correlation was found between PD and EBB ($p < 0.01$). In the Sprague Dawley strain, positive correlations were observed between CA and DV, and MD and PD ($p < 0.05$), along with stronger correlations between EBB and both MD and PD ($p < 0.01$). However, negative correlations were identified between DV and both DTD and DTM, as well as between CA and DTD ($p < 0.01$).In the Lewis strain, positive correlations were established between LS and DV, CV with both CA and MD, DO with EBB, CA with DTM, PD with EBB, and CD with PD, and another correlation between PD and EBB ($p < 0.05$). A negative correlation was found between DTV and AD ($p < 0.01$). The correlations are summarised in Table 3.

Discussion and Conclusion

Rats are not thought to be anatomically predisposed to labor dystocia. There are many anatomical reasons supporting this idea. One reason for this is the shape of the cranial aperture of the pelvis. According to the morphological findings of this study, the cranial aperture of the pelvis resembles the anthropoid pelvis in humans, which serves the most suitable labor (Handa et al., 2003; Salk et al., 2016). Additionally, taking into consideration the diameters originating from the promontory, when compared to humans, the long and inclined diameters in rats, as well as their flat pelvic floor, do not contribute to obstructed labor. Furthermore, unlike humans, the flat sacrum extends to the middle of the dorsal part of the pelvis, and the caudal vertebrae's upward orientation during birth is a facilitating factor for delivery. As known in humans, the dorsal part of the pelvis consists of a ventrally concave sacrum and coccyx (Gruss and Schmitt, 2015).

However, it should be noted that the present study exclusively analysed male rats, as the specimens were obtained from previously conducted research. While this limitation may initially suggest a lack of comparative evaluation, it is essential to acknowledge the well-documented presence of sexual dimorphism. In general, male rats tend to be larger than females. Previous studies have demonstrated that male Sprague Dawley rats exhibit greater body size and wider pelvic structure than their female counterparts (Berdnikovs et al., 2007; Routzong et al., 2024). Consequently, it can be inferred that female rats likely possess a narrower pelvic cavity.

The dimensions of the pelvic cavity are a determinant of the occurrence of vaginal labor in humans. One of them is the narrowest diameter of the pelvis, the true conjugate, which is the shortest distance from the sacral promontory to the pubic symphysis (Oğuz and Desticioğlu, 2021). According to the results of our study, Lewis has the most extended dimensions and a larger pelvic inlet area; in contrast, Sprague Dawley has the shortest dimensions and narrower pelvic inlet area compared to other strains.

In Tresch et al. (2024) study, CA is between 8.5 cm and 10.5 cm and is considered subnormal in humans. As the distance decreases, the pelvic inlet narrows, and the horizontal angle required for vaginal delivery becomes more vertical, which is undesirable. DTM should be greater than 12 cm, which refers to a gynaecoid pelvis, the most suitable shape for cephalopelvic proportion (Pavličev et al., 2020). According to our results, in rats, CA's natural incline serves standard vaginal delivery. Also, the anthropoid-shaped cranial aperture does not cause any obstruction due to the rats' narrow, elongated cranium structure due to their suitable cephalopelvic proportion.

Considering the study by Handa et al. (2003), a wide transverse diameter combined with a short anatomical conjugate of the pelvic inlet increased susceptibility to pelvic floor disorders. Based on this information, our study observed that in rats, the transverse diameters were narrow and similar across strains, while the longest anatomical conjugate was identified in the Lewis strain. The shortest diameter, however, was observed in the Sprague Dawley strain. Therefore, it can be suggested that the Lewis strain, followed by the Wistar Albino strain, is the most suitable for studies on pelvic floor disorders. Conversely, the Sprague Dawley strain should not be preferred.

Rectal cancer is one of the most commonly observed pathologies in the pelvic region, and its primary treatment is total mesorectal excision. In this process, understanding pelvic dimensions significantly impacts the surgical procedure's success rate, as the pelvis's bony structure is a critical factor that directly limits surgical access to the rectum. Pelvic types described as narrow and deep negatively affect surgical interventions (Baltus et al., 2025; Bolshinsky et al., 2024; Faisal Bin Abdur Raheem et al., 2024; Hong et al., 2020). Based on our findings, it is anticipated that rats, the most commonly used in laboratory studies, could be preferred for developing new surgical approaches for rectal cancer treatment. Also, the posterior pelvic region is crucial in addressing twisted pouch syndrome, a condition observed in humans (Holubar, 2024). Recent studies indicate that this syndrome has not yet been experimentally investigated. However, it has been noted that rats are suitable subjects for developing new surgical techniques similar to those employed in rectal cancer treatments.

Another field of experimental studies is lumbopelvic pain, a cause of mechanical dystocia in vaginal birth. Because it mainly affects the muscles of the pelvic floor and causes pain in the vaginal opening, thereby presenting a mechanical obstacle during labor (Brown and Johnston, 2013; Dufour et al., 2018). Therefore, we believe using rats in experimental lumbopelvic pain is appropriate regardless of the strain. Because the dimensions of the MD, PD and EBB are pretty similar in each strain, and it is the area on which the vagina is located. Gruss and Schmitt's study (2015) also indicates that pelvic dimensions influence thermoregulation and play a significant role in regulating heat loss from the body surface. Our results suggest that rats could be preferred in studies investigating the effects of pelvic width and depth on the surface area-to-mass ratio and heat loss.

In conclusion, anatomically, Lewis is the most suitable laboratory rat strain that does not predispose to labor dystocia, followed by the Wistar Albino strain. These two strains may be a choice for studies on physiological dystocia and pelvic inlet disorders. On the other hand, Sprague Dawley is less suitable for experimental studies involving the pelvic inlet, particularly those related to labor dystocia caused by anatomical factors. The limitation of this study is that it was conducted exclusively on male subjects. It should be emphasized that the study could be replicated in female subjects to provide a more comprehensive analysis. However, for further studies, evaluation of the pelvic diameters and inlet area by micro-CT imaging is strongly recommended.

Conflict of Interest

The authors stated that they did not have any real, potential or perceived conflict of interest.

Ethical Approval

This study was approved by the Dokuz University Animal Experiments Local Ethics Committee (08.07.2022, 2022/22 Number Ethics Committee Decision). In addition, the authors declared that Research and Publication Ethical rules were followed.

Funding

This study was not supported by any organisations.

Similarity Rate

We declare that the similarity rate of the article is 10% as stated in the report uploaded to the system.

Explanation

It was presented as a summary paper at the III. International Veterinary Anatomy Congress (2023).

Author Contributions

Motivation / Concept: OY
Design: YÜ
Control/Supervision: OY
Data Collection and / or Processing: YÜ
Analysis and / or Interpretation: OY
Literature Review: YÜ
Writing the Article: YÜ
Critical Review: OY

References

Baltus SC, Geitenbeek RTJ, Frieben M, Thibeau-Sutre E, Wolterink JM, Tan CO, Vermeulen MC, Consten ECJ, Broeders IAMJ, 2025: Deep learning-based pelvimetry in pelvic MRI volumes for pre-operative difficulty assessment of total mesorectal excision. *Surg Endosc*, doi: 10.1007/s00464-024-11485-4.

Berdnikovs S, Bernstein M, Metzler A, German RZ, 2007: Pelvic growth: ontogeny of size and shape sexual dimorphism in rat pelves. *J Morphol*, 268(1), 12-22. doi: 10.1002/jmor.10476.

Bolshinsky V, Sweet DE, Vitello DJ, Jia X, Holubar SD, Church J, Herts BR, Steele SR, 2024: Using CT-Based Pelvimetry and Visceral Obesity Measurements to Predict Total Mesorectal Excision Quality for Patients Undergoing Rectal Cancer Surgery. *Dis Colon Rectum*, 67(7), 929-939.

Brown A, Johnston R, 2013: Maternal experience of musculoskeletal pain during pregnancy and birth outcomes: significance of lower back and pelvic pain. *Midwifery*, 29(12), 1346-51.

Chiasson RB, 1994: Laboratory Anatomy of The White Rat. Fifth Edition, WCB/McGraw Hill, United States of America.

Dufour S, Vandyken B, Forget MJ, Vandyken C, 2018: Association between lumbopelvic pain and pelvic floor dysfunction in women: A cross-sectional study. *Musculoskelet Sci Pract*, 34, 47-53.

Faisal Bin Abdur Raheem M, Ng ZQ, Theophilus M, 2024: The impact of pelvimetry data on rectal cancer surgery—a systematic review. *Ann Laparosc Endosc Surg*, 9, 38.

Gruss LT, Schmitt D, 2015: The evolution of the human pelvis: changing adaptations to bipedalism, obstetrics and thermoregulation. *Philos Trans R Soc Lond B Biol Sci*, 370(1663), 20140063.

Handa VL, Pannu HK, Siddique S, Gutman R, VanRooyen J, Cundiff G, 2003: Architectural differences in the bony pelvis of women with and without pelvic floor disorders. *Obstet Gynecol*, 102(6), 1283-90.

Holubar SD, 2024: Unraveling Twisted Pouch Syndrome: A Narrative Review of Classification, Diagnosis, Treatment, and Prevention. *Inflamm Bowel Dis*, izae161.

Hong JS, Brown KGM, Waller J, Young CJ, Solomon MJ, 2020: The role of MRI pelvimetry in predicting technical difficulty and outcomes of open and minimally invasive total mesorectal excision: a systematic review. *Tech Coloproctol*, 24(10), 991-1000.

Link BC, Haveman RA, Van de Wall BJM, Baumgärtner R, Babst R, Beeres FJP, Haefeli PC, 2024: Percutaneous sacroiliac screw fixation with a 3D robot-assisted image-guided navigation system : Technical solutions. *Oper Orthop Traumatol*, 1-11.

Narumoto K, Sugimura M, Saga K, Matsunaga Y, 2015: Changes in pelvic shape among Japanese pregnant women over the last 5 decades. *J Obstet Gynaecol Res*, 41(11), 1687-1692.

Oğuz B, Desticioğlu K, 2021: Pelvis Morfolojisi, Radyolojik ve Klinik Anatomisi. *TSAD*, 2(3), 57-72.

Pavličev M, Romero R, Mitteroecker P, 2020: Evolution of the human pelvis and obstructed labor: new explanations of an old obstetrical dilemma. *Am J Obstet Gynecol*, 222(1), 3-16.

Routzong MR, Rieger MM, Cook MS, Ukkan R, Alperin M, 2024: Sexual Dimorphism in the Architectural Design of Rat and Human Pelvic Floor Muscles. *J Biomech Eng*, 146(10), 101012.

Salk I, Cetin M, Salk S, Cetin A, 2016: Determining the Incidence of Gynecoid Pelvis Using Three-Dimensional Computed Tomography in Nonpregnant Multiparous Women. *Med Princ Pract*, 25(1), 40-48.

Siccardi M, Valle C, Di Matteo F, Angius V, 2019: A Postural Approach to the Pelvic Diameters of Obstetrics: The Dynamic External Pelvimetry Test. *Cureus*, 11(11), e6111.

Silva RGS, Oliveira WDC, Biagiotti D, Ferreira GJBC, 2019: Pelvimetry of multiparous Nellore cows in the cycling and early puerperal stages. *Pesq Vet Bra*, 39(5), 348-354.

Tresch C, Lallemant M, Nallet C, Offringa Y, Ramanah R, Guerby P, Mottet N, 2024: Updating of pelvimetry standards in modern obstetrics. *Sci Rep*, 14(1), 3080.

Üstündağ Y, Yılmaz O, Kartal M, 2024a: Comparison of the Scapula in Human and laboratory Rat Speices from the Perspective of Translational Anatomy. *IGUSABDER*, 22, 320-333.

Üstündağ Y, Dinç G, Bal R, 2024b: Investigation of Some Ion Channel Expressions in Cochlear Nucleus of Tinnitus Induced Rats. *IGUSABDER*, 22, 293-307.