

Research Article

Evaluation of Body Weight and Body Condition Score In 64 European Adult Cats

Gerardo Siani^{1*} and Rebecca Ricci^{2,3}

¹DVM, Salerno, Italy

²Dipartimento di Medicina Animale, Produzioni e Salute, Università degli Studi di Padova, Padova, Italy

³Vetekipp S.r.l., Via del Cristo 326, 35127 Padova, PD, Italy

Abstract

The aim of the present study was to determine the ideal body weight (BW) and to establish if body condition score (BCS) was affected by lifestyle, feeding habits, and health status in adult client-owned European cats population. Sixty-four European adult cats were weighed, scored (BCS 1-9 point scale) and divided into three groups: BCS < 5, 5 and >5. Information on lifestyle (indoor or outdoor), health status (healthy or unhealthy), type of diet (home-made, commercial and mixed diet), food administration (weighed or unweighed) and snacks administration (administration or no administration) were recorded. The ideal BW was established in 5.3 kg for males and in 4 kg for females. In this study population it was shown that BCS was affected by sex status, health status and lifestyle but not by feeding habits. More information on the characteristics of food delivered in terms of energy content and nutrients profile should be collected in order to assess the influence of feeding habits on BCS.

Keywords: Body Condition Score; Cat; Diet

Introduction

Canine and feline obesity rates have reached pandemic proportions similar to those in humans, with a reported prevalence of overweight and obese cats ranging from 11.5% to 63% in developed countries [1,2]. Obesity is currently one of the greatest health and welfare problems facing domestic cats around the world [1]. Obesity is a condition in which an excess body fat has developed to the point that health is adversely affected [3,4]. There is no universally accepted definition of canine and feline obesity [5]. However, the

***Corresponding author:** Gerardo Siani, DVM, Salerno, Italy, Tel: +3318214279, Email: info@drsiani.com

Citation: Siani G, Ricci R (2023) Evaluation of Body Weight and Body Condition Score in 64 European Adult Cats. J Anim Res Vet Sci 7: 055.

Received: October 25, 2023; **Accepted:** November 03, 2023; **Published:** November 10, 2023

Copyright: © 2023 Siani G, This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

American Veterinary Medical Association (AVMA) has endorsed a recommendation for a uniform definition, whereby obesity is present when a dog or cat is >30% above its ideal body weight (BW) [6]. The body condition score (BCS) is the most widely accepted method to document adiposity in companion animals [7] by assessing visual and palpable characteristics, such as subcutaneous and abdominal fat. This method has the advantage to be quick and easy to perform, and its scores have been demonstrated to correlate well with body fat mass determined via dual-energy X-ray absorptiometry (DEXA), both when used by trained individuals and when assessed by inexperienced ones [8]. The 1 to 9 point scale system is the most commonly used and the ideal BCS is considered to be 5/9. Cats with BCS 6/9 and 7/9 are considered overweight with an estimated excess BW of 10 and 20%, respectively, whereas cats with BCS 8/9 and 9/9 are considered obese with an estimated excess BW equal or above 30%, respectively [7]. Overweight and obesity undermine cats' quality of life both directly and indirectly via various diseases known to be associated with these conditions [2,9]. Overweight and obese cats are at increased risk for developing urinary tract diseases, respiratory diseases, orthopaedic problems, reduced insulin sensitivity, diabetes mellitus, hepatic lipodosis, neoplasia, dermatological issues, oral diseases and hypertension [10-13]. Different risk factors have been associated to overweight and obesity in cats: indoor lifestyle, neutering, low activity level, male gender, age, use of treats and ad libitum feeding [2,14-17].

Considering the negative impact of the BCS increase on the health status of the cats, the aim of the present study was to assess the ideal BW in a population of client-owned European cats and to evaluate whether BCS was influenced by lifestyle, feeding habits and health status.

Materials and Methods

Sixty-four European Shorthair adult (≥ 1 year) cats were weighed and BCS was evaluated using a 1 to 9 point scale [7] in a veterinary practice during clinical consultations. Moreover, BW was measured. In all cats, both weight detection and BCS assessment were evaluated by veterinary nutritionists. For each cat, further information were collected such as age, sex status (intact female, spayed female, intact male, spayed female), lifestyle ("indoor" or "outdoor"), health status ("unhealthy" if the cat was presented for a symptom or if a disease was diagnosed, "healthy" if no symptom was present or if no disease was diagnosed), type of diet ("homemade"; "commercial" - dry and/or wet -; "homemade and commercial"), food weighing ("weighed", if a scale was used to weigh food or "unweighed" if a scale was not used or other methods were used such as measuring cups) and administration of snacks including both commercial and home-made snacks ("administration" if snack was given or "no administration" if no snack was given). According to the BCS, cats were divided into three groups: BCS < 5/9 (underweight), 5/9 (lean) and > 5/9 (overweight). In order to assess whether the BCS is affected by this several information, the Anova test was employed as statistical hypothesis test. A p-value ≤ 0.05 was considered statistically significant whereas p-value < 0.10 was considered tendential.

Results and Discussion

The test population included 64 cats: 30 females (28 neutered - 2 intact), 34 males (28 neutered - 6 intact), of which 54 indoor, 10 outdoor, 27 healthy, 37 unhealthy, 56 fed commercial diet (10 only dry food, 44 dry and wet food, 2 only wet food, 8 mixed with homemade ingredients), 8 fed weighed food and 56 fed unweighed food, 57 received snack administration. Twelve (19%) cats were scored BCS <5/9, 33 (51%) BCS 5/9 and 19 (30%) BCS >5/9. (Table 1) shows a descriptive analysis of the cat population as a function of BCS group. The mean BW in the BCS 5/9 group was 5.3 ± 0.6 for males and 4.0 ± 0.7 kg for females. The mean BW in the BCS <5/9 group was 3.6 ± 0.7 kg for males and 3.2 ± 0.4 kg for females. The mean BW in the BCS >5/9 group was 6.7 ± 1.2 kg for males and 6.4 ± 1.5 kg for females. (Table 2) shows the mean \pm standard deviation BW of the cat population according to the parameters considered and divided by BCS group. BCS was significantly affected by sex (males > females, $P < 0.0001$), health status (healthy > unhealthy cats, $P < 0.0001$) and tendentially by lifestyle (indoor > outdoor cats, $P=0.076$), as shown in (Figure 1).

	Total	BCS <5 underweight	BCS 5 lean	BCS > 5 overweight
Sex				
Intact females	2	0	2	0
Spayed females	28	4	16	8
Intact males	6	3	1	2
Spayed males	28	5	14	9
Lifestyle				
Indoor	54	8	28	18
Outdoor	10	4	5	1
Health status				
Healthy	27	2	15	10
Unhealthy	37	10	18	9
Type of diet				
Homemade diet	0	0	0	0
Commercial and homemade	8	2	3	3
Commercial dry	10	1	7	2
Commercial dry and wet	44	9	21	14
Commercial wet	2	0	2	0
Food weighing				
Weighed	8	1	3	4
Unweighed	56	11	30	15
Snacks administration				
Administration	7	1	4	2
No administration	57	11	29	17

Table 1: European cat population divided in BCS groups.

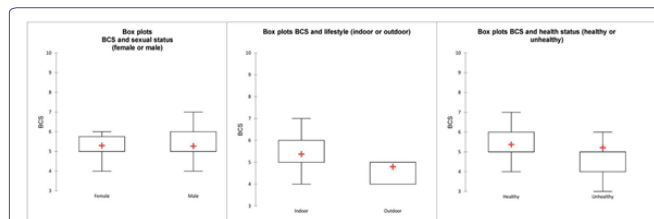


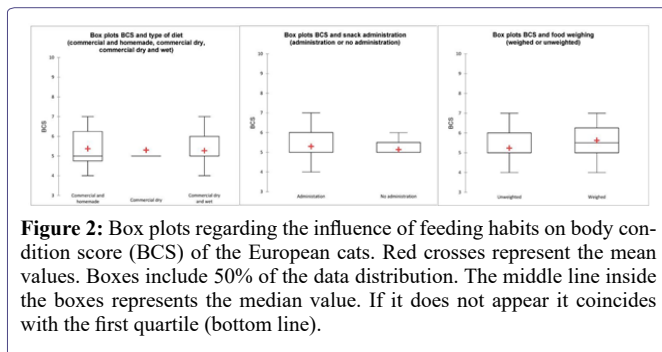
Figure 1: Box plots regarding the influence of gender, lifestyle and healthy status on body condition score (BCS) of the European cats. Red crosses represent the mean values. Boxes include 50% of the data distribution. The median values coincide with the first quartile (bottom line).

	BW (Mean \pm Standard Deviation)		
	BCS <5 underweight	BCS 5 lean	BCS > 5 overweight
Sex			
Females	3.2 ± 0.4	4.0 ± 0.7	6.4 ± 1.5
Males	3.6 ± 0.7	5.3 ± 0.6	6.7 ± 1.2
Lifestyle			
Indoor	3.4 ± 0.6	4.5 ± 0.9	6.7 ± 1.4
Outdoor	3.8 ± 0.7	4.9 ± 0.5	5.7
Health status			
Healthy	3.1 ± 0.6	4.4 ± 1.0	6.0 ± 1.2
Unhealthy	3.6 ± 0.6	4.7 ± 0.8	7.2 ± 1.3
Type of diet			
Homemade diet	/	/	/
Commercial and homemade	3.3 ± 0.3	4.3 ± 1.4	7.4 ± 1.0
Commercial dry	3.0	4.9 ± 0.9	6.5 ± 2.1
Commercial dry and wet	3.6 ± 0.7	4.4 ± 0.9	6.4 ± 1.3
Commercial wet	/	4.9 ± 0.1	/
Food weighing			
Weighed	4.2	4.5 ± 1.2	7.0 ± 0.3
Unweighed	3.4 ± 0.6	4.6 ± 0.9	6.4 ± 1.5
Snacks administration			
Administration	/	5.0 ± 0.6	5.9 ± 1.7
No administration	3.5 ± 0.6	4.5 ± 0.9	6.7 ± 1.3

Table 2: Mean values and standard deviation of BW in different BCS groups of the European cat population.

BCS was not affected by feeding habits including type of diet (dry food > dry and wet food > only wet food > homemade and commercial, $P=0.975$), snack administration (administration > no administration, $P=0.746$) food weighing (weighed > unweighed, $P=0.273$), as shown in (Figure 2).

The aim of the present study was to assess the ideal BW in a population of client-owned European cats and to evaluate whether BCS was influenced by lifestyle, feeding habits and health status. In our study, mean BW in the BCS 5/9 group highlighted a sexual dimorphism suggesting an ideal BW of 4 kg for female European cats and an ideal BW of 5.3 kg for male European cats. Kienzle and Moik estimated the mean BW of cats belonging to several breeds



including European cats [18]. They estimated a mean BW of 4.3 ± 0.77 kg for males and 3.5 ± 0.55 kg for females, confirming the difference between sexes emerged from our results. They proposed that, for the European cats of both sexes, a different ideal BW other than 4 kg should be used or an ideal BW for females and males should be identified. Moreover, they suggested that it is not feasible working with a 4 kg mean BW in a clinical setting or on nutrition guidelines, because it would overestimate a large percentage of the female feline population. However, this statement has not been confirmed by our results that confirmed a mean BW of 4 kg for female European cats [18]. We did not detect any association between food administration system and BCS. German et al. demonstrated inaccuracy in various amounts of commercial dry food measured out (ranging from an 18% underestimate to an 80% overestimate) for dogs and cats when using a measuring cup supplied by the manufacturer [19]. Coe et al. investigated the accuracy of three devices (one graduated-liquid measuring cup, a commercial food scoop and a dry-food measuring cup) and reported an inaccuracy ranged from a 47.83% underestimation to a 152.17% overestimation across all measuring devices and volumes [20]. Both studies, while expressing concern about the consequences of caloric excesses resulting from an inadequate food weight system, did not investigate the impact on BCS. Long terms studies are necessary to establish whether there is a correlation between the inaccuracy of the pet's daily ration weight method and the BCS. Russel et al. found that cats fed with snack administration and *ad libitum* feeding canned food had a higher BCS, concluding that these feeding habits were risk factors for obesity development in cats and suggested that the optimum feeding regimen to prevent obesity would be one based on weighed meals rather than an *ad libitum* meal [17]. This is in contrast with the results of our study that found no significant association between snack administration, *ad libitum* meals and BCS. Russel's study did not take into consideration the health status of the cat population as we did. Our study revealed that sick cats tend to have a lower BCS. Sick cats may have a lower daily energy intake because of a decreased appetite or may need a higher daily energy requirement due to hypermetabolic state resulting from disease. However, other researchers did not confirm this negative association between health status and BCS. A positive association with BCS and dermatopathy, hypertension, asthma, diarrhea, ophthalmic conditions, allergic conditions, arthritis, diabetes mellitus, hepatic lipidosis, neoplasia, gastrointestinal, cardiac, musculoskeletal and oral diseases was reported [13,21]. However, assuming that acute and chronic diseases may affect BCS differently, it would be appropriate to analyze and consider these differences. Another factor that could have affected the discrepancy between our results and the Russell's ones is the type of diet since diets may vary in metabolizable energy and protein, lipid and glucidic ratio. Increased weight gain and fat mass deposition were noted when cats were fed *ad libitum* a low-carbohydrates, high-fat

diet in comparison to a high-carbohydrates, low-fat diet [22,23]. We did not analyze the composition of the diets and this is a limitation of our study. Indoor lifestyle can be a risk factor for overweight as confirmed by some authors [17,24,25]. Some researchers failed to show indoor lifestyle as a risk factor for overweight in cats [24,26]. In our study, indoor cats feature 84% of the studied population (this reflects the urban environment of the clinic where the animals were visited) and have a higher BCS. Since age can be considered a factor influencing BCS [4], this aspect should also have been evaluated in the study. This represented a limitation, because only for a very small percentage of the cats the date of birth was known for sure. Indeed, cats were enrolled on the basis that they had been living with their owner for more than 12 months and therefore considered with certainty to be adults.

Conclusion

This pilot study reveals that BCS is influenced by sex, health status and lifestyle. Our results did not confirm a positive association between feeding habits and BCS. Future studies should also consider the metabolizable energy and nutrient profile of the diets administered to better understand whether diet composition has an influence on BCS. Health status appears to be another parameter to be considered and compared to other factors to determine its influence on BCS.

Ethical approval

All procedures reported in this research were conducted in an ethical and responsible manner, in full compliance with all relevant testing codes and legislation.

Acknowledgment

The authors would like to thank the veterinary clinic Check-up vet (Salerno, Italy), Dr A. Vessa and Dr G. Marinacci, for support during the data acquisition process.

Data availability statement

Data supporting the findings of this study are available upon reasonable request from the corresponding author.

Competing interests

The authors declare that they have no competing interests.

References

1. Wall M, Cave NJ, Vallee E (2019) Owner and cat-related risk factors for feline overweight or obesity. *Front Vet Sci* 6: 266.
2. Chiang CF, Villaverde C, Chang WC, Fascetti AJ, Larsen JA (2022) Prevalence, risk factors, and disease associations of overweight and obesity in cats that visited the veterinary medical teaching hospital at the university of California, Davis from January 2006 to December 2015. *Top Companion Anim Med* 47: 100620.
3. Kopelman PG (2000) Obesity as a medical problem. *Nature* 404: 635-643.
4. Laflamme DP (2005) Nutrition for aging cats and dogs and the importance of body condition. *Vet Clin North Am Small Anim* 35: 713-742.
5. Kipperman B, German A (2018) The responsibility of veterinarians to address companion animal obesity. *Animals* 8: 143.
6. Ward E, German A, Churchill J (2019) The Global Pet Obesity Initiative Position Statement. Association for pet obesity prevention.
7. Laflamme D (1997) Development and validation of a body condition score system for cats: a clinical tool. *Feline Pract* 25: 13-18.

8. German AJ, Holden SL, Morris PJ, Biourge V (2010) Comparison of a bioimpedance monitor with dual-energy x-ray absorptiometry for noninvasive estimation of percentage body fat in dogs. *Am J Vet Res* 71: 393-398.
9. Hanford R, Linder DE (2021) Impact of obesity on quality of life and owner's perception of weight loss programs in cats. *Vet Sci* 8: 32.
10. Biourge VC, Massat B, Groff JM, Morris JG, Rogers QR (1994) Effects of protein, lipid, or carbohydrate supplementation on hepatic lipid accumulation during rapid weight loss in obese cats. *Am J Vet Res* 55: 1406-1415.
11. Scarlett JM, Donoghue S (1998) Associations between body condition and disease in cats. *J Am Vet Med Assoc* 212: 1725-1731.
12. Öhlund M, Palmgren M, Holst BS (2018) Overweight in adult cats: a cross-sectional study. *Acta Vet Scand* 60: 5.
13. Teng KT, McGreevy PD, Toribio JALML, Raubenheimer D, Kendall K, et al. (2018) Associations of body condition score with health conditions related to overweight and obesity in cats. *J Small Anim Pract* 59: 603-615.
14. Anderson R (1973) Obesity in the dog and cat. *Veterinary Annual* 14: 182-186
15. Sloth C (1992) Practical management of obesity in dogs and cats. *J Small Anim Pract* 33: 178-182.
16. Scarlett JM, Donoghue S, Saidla J, Wills J (1994) Overweight cats: prevalence and risk factors. *Int J Obes Relat Metab Disord* 18: S22-S28.
17. Russell K, Sabin R, Holt S, Bradley R, Harper EJ (2000) Influence of feeding regimen on body condition in the cat. *J Small Anim Pract* 41: 12-18.
18. Kienzle E, Moik K (2011) A pilot study of the body weight of pure-bred client-owned adult cats. *Br J Nutr* 106: S113-S115.
19. German AJ, Holden SL, Mason SL, Bryner C, Bouldoires C, et al. (2011) Imprecision when using measuring cups to weigh out extruded dry kibble food. *J Anim Physiol Anim Nutr (Berl)* 95: 368-373.
20. Coe JB, Rankovic A, Edwards TR, Parr JM (2019) Dog owner's accuracy measuring different volumes of dry dog food using three different measuring devices. *Vet Rec* 185: 599-599.
21. Lund E, Armstrong P, Kirk CA, Klausner JS (2006) Prevalence and risk factors for obesity in adult cats from private us veterinary practices. *Int J Appl Res* 3: 88-96.
22. Nguyen PG, Dumon HJ, Siliart BS, Martin LJ, Sergheraert R, et al. (2004) Effects of dietary fat and energy on body weight and composition after gonadectomy in cats. *Am J Vet Res* 65: 1708-1713.
23. Backus RC, Cave NJ, Keisler DH (2007) Gonadectomy and high dietary fat but not high dietary carbohydrate induce gains in body weight and fat of domestic cats. *Br J Nutr* 98: 641-650.
24. Colliard L, Paragon BM, Lemuet B, Bénét JJ, Blanchard G (2009) Prevalence and risk factors of obesity in an urban population of healthy cats. *J Feline Med Surg* 11: 135-140.
25. Rowe EC, Browne WJ, Casey RA, Gruffydd-Jones TJ, Murray JK (2017) Early-life risk factors identified for owner-reported feline overweight and obesity at around two years of age. *Prev Vet Med* 143: 39-48.
26. Courcier EA, O'Higgins R, Mellor DJ, Yam PS (2010) Prevalence and risk factors for feline obesity in a first opinion practice in Glasgow, Scotland. *J Feline Med Surg* 12: 746-753.



- Advances In Industrial Biotechnology | ISSN: 2639-5665
- Advances In Microbiology Research | ISSN: 2689-694X
- Archives Of Surgery And Surgical Education | ISSN: 2689-3126
- Archives Of Urology
- Archives Of Zoological Studies | ISSN: 2640-7779
- Current Trends Medical And Biological Engineering
- International Journal Of Case Reports And Therapeutic Studies | ISSN: 2689-310X
- Journal Of Addiction & Addictive Disorders | ISSN: 2578-7276
- Journal Of Agronomy & Agricultural Science | ISSN: 2689-8292
- Journal Of AIDS Clinical Research & STDs | ISSN: 2572-7370
- Journal Of Alcoholism Drug Abuse & Substance Dependence | ISSN: 2572-9594
- Journal Of Allergy Disorders & Therapy | ISSN: 2470-749X
- Journal Of Alternative Complementary & Integrative Medicine | ISSN: 2470-7562
- Journal Of Alzheimers & Neurodegenerative Diseases | ISSN: 2572-9608
- Journal Of Anesthesia & Clinical Care | ISSN: 2378-8879
- Journal Of Angiology & Vascular Surgery | ISSN: 2572-7397
- Journal Of Animal Research & Veterinary Science | ISSN: 2639-3751
- Journal Of Aquaculture & Fisheries | ISSN: 2576-5523
- Journal Of Atmospheric & Earth Sciences | ISSN: 2689-8780
- Journal Of Biotech Research & Biochemistry
- Journal Of Brain & Neuroscience Research
- Journal Of Cancer Biology & Treatment | ISSN: 2470-7546
- Journal Of Cardiology Study & Research | ISSN: 2640-768X
- Journal Of Cell Biology & Cell Metabolism | ISSN: 2381-1943
- Journal Of Clinical Dermatology & Therapy | ISSN: 2378-8771
- Journal Of Clinical Immunology & Immunotherapy | ISSN: 2378-8844
- Journal Of Clinical Studies & Medical Case Reports | ISSN: 2378-8801
- Journal Of Community Medicine & Public Health Care | ISSN: 2381-1978
- Journal Of Cytology & Tissue Biology | ISSN: 2378-9107
- Journal Of Dairy Research & Technology | ISSN: 2688-9315
- Journal Of Dentistry Oral Health & Cosmesis | ISSN: 2473-6783
- Journal Of Diabetes & Metabolic Disorders | ISSN: 2381-201X
- Journal Of Emergency Medicine Trauma & Surgical Care | ISSN: 2378-8798
- Journal Of Environmental Science Current Research | ISSN: 2643-5020
- Journal Of Food Science & Nutrition | ISSN: 2470-1076
- Journal Of Forensic Legal & Investigative Sciences | ISSN: 2473-733X
- Journal Of Gastroenterology & Hepatology Research | ISSN: 2574-2566
- Journal Of Genetics & Genomic Sciences | ISSN: 2574-2485
- Journal Of Gerontology & Geriatric Medicine | ISSN: 2381-8662
- Journal Of Hematology Blood Transfusion & Disorders | ISSN: 2572-2999
- Journal Of Hospice & Palliative Medical Care
- Journal Of Human Endocrinology | ISSN: 2572-9640
- Journal Of Infectious & Non Infectious Diseases | ISSN: 2381-8654
- Journal Of Internal Medicine & Primary Healthcare | ISSN: 2574-2493
- Journal Of Light & Laser Current Trends
- Journal Of Medicine Study & Research | ISSN: 2639-5657
- Journal Of Modern Chemical Sciences
- Journal Of Nanotechnology Nanomedicine & Nanobiotechnology | ISSN: 2381-2044
- Journal Of Neonatology & Clinical Pediatrics | ISSN: 2378-878X
- Journal Of Nephrology & Renal Therapy | ISSN: 2473-7313
- Journal Of Non Invasive Vascular Investigation | ISSN: 2572-7400
- Journal Of Nuclear Medicine Radiology & Radiation Therapy | ISSN: 2572-7419
- Journal Of Obesity & Weight Loss | ISSN: 2473-7372
- Journal Of Ophthalmology & Clinical Research | ISSN: 2378-8887
- Journal Of Orthopedic Research & Physiotherapy | ISSN: 2381-2052
- Journal Of Otolaryngology Head & Neck Surgery | ISSN: 2573-010X
- Journal Of Pathology Clinical & Medical Research
- Journal Of Pharmacology Pharmaceutics & Pharmacovigilance | ISSN: 2639-5649
- Journal Of Physical Medicine Rehabilitation & Disabilities | ISSN: 2381-8670
- Journal Of Plant Science Current Research | ISSN: 2639-3743
- Journal Of Practical & Professional Nursing | ISSN: 2639-5681
- Journal Of Protein Research & Bioinformatics
- Journal Of Psychiatry Depression & Anxiety | ISSN: 2573-0150
- Journal Of Pulmonary Medicine & Respiratory Research | ISSN: 2573-0177
- Journal Of Reproductive Medicine Gynaecology & Obstetrics | ISSN: 2574-2574
- Journal Of Stem Cells Research Development & Therapy | ISSN: 2381-2060
- Journal Of Surgery Current Trends & Innovations | ISSN: 2578-7284
- Journal Of Toxicology Current Research | ISSN: 2639-3735
- Journal Of Translational Science And Research
- Journal Of Vaccines Research & Vaccination | ISSN: 2573-0193
- Journal Of Virology & Antivirals
- Sports Medicine And Injury Care Journal | ISSN: 2689-8829
- Trends In Anatomy & Physiology | ISSN: 2640-7752

Submit Your Manuscript: <https://www.heraldopenaccess.us/submit-manuscript>