Online ISSN : 2249-4618
Print ISSN : 0975-5888
DOI : 10.17406/GJMRA

Global Journal

of Medical Research: H

Orthopedic & Musculoskeletal System



Peak Oxygen Consumption

Clinical and Radiological Result

Highlights

Irregularity of Tracheal Rings

Presentation of Sarcopenia in Adults

Discovering Thoughts, Inventing Future

VOLUME 24 ISSUE 1 VERSION 1.0

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Volume 24 Issue 17 was originally issued as H1

Global Journal of Medical Research: H
Orthopedic and Musculoskeletal System

Volume 24 Issue 17
Originally issued as H1

Global Journal of Medical Research: H
Orthopedic and Musculoskeletal System

Volume 24 Issue 1 (Ver. 1.0)

Open Association of Research Society

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Global Journal of Medical Research: H
Orthopedic and Musculoskeletal System
Volume 24 Issue 1 Version 1.0 Year 2024
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

Clinical and Radiological Result of Ankle Fractures Matching Surgical Criteria in Elderly Patients

By Dr. Susana Donadeu Sanchez

Abstract- *Introduction:* Ankle fractures are common in the elderly, ranking third after hip and wrist fractures. Elderly patients with ankle fractures often have multiple comorbidities, which can impact treatment outcomes and increase the risk of complications. Prompt recovery is important to preserve their independence. Currently, there are no definitive recommendations favoring one treatment approach over another.

Currently, there are no strong recommendations advocating for better results with one treatment over another.

Materials and Methods: In a retrospective study, ankle fractures requiring surgery between September 2015 and September 2021 in patients over 70 years old were analyzed. Radiographic parameters, demographics, comorbidities, BMI, and complications were assessed. Fractures were classified based on AO/OTA, Weber, and Lauge-Hansen classifications. Functional outcomes were analyzed using the OMAS (Olerud Molander Ankle Score) scale.

Keywords: *ankle fracture, elderly, surgery, complications, comorbilities.*

GJMR-H Classification: *LCC Code: RD681*



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Clinical and Radiological Result of Ankle Fractures Matching Surgical Criteria in Elderly Patients

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Abstract- *Introduction:* Ankle fractures are common in the elderly, ranking third after hip and wrist fractures. Elderly patients with ankle fractures often have multiple comorbidities, which can impact treatment outcomes and increase the risk of complications. Prompt recovery is important to preserve their independence. Currently, there are no definitive recommendations favoring one treatment approach over another.

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Results: The study included 71 patients, with an average age of 76.54 years. 60% were female(n=43). The average follow-up was 14 months (range 8-17). The most common fracture pattern was Supination-External Rotation (60 cases, 84.5%). Among them, 90% were classified as Weber B(n=64). 21 patients had a fracture-dislocation.

Closed reduction with a cast boot was initially performed, until achieving satisfactory reduction, followed by definitive orthopedic management or surgical treatment in 25 and 46 patients, respectively. The most frequently used surgical treatment was open reduction and internal fixation (ORIF) with a low-profile plate on the fibula and a cannulated screw on the medial malleolus (93% cases).

The conservative management group had a complication rate of 36%, but no surgical interventions were required. The surgical management group had a complication rate of 23.9%, including wound complications and hardware intolerance, with a reintervention rate of 20%. There was no increased risk of complications or reinterventions based on diabetes, overweight, or age stratification.

The average OMAS score did not significantly differ between the surgical and conservative groups.

Conclusion: The treatment of ankle fractures in geriatric patients remains controversial. Conservative management with a cast boot after proper reduction yields favorable functional outcomes with minimal complications. Surgical management using conventional techniques has a higher rate of soft tissue complications, suggesting the need for less aggressive approaches to achieve better biological synthesis.

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Keywords: *ankle fracture, elderly, surgery, complications, comorbilities.*

Highlights:

- The patterns of ankle fractures observed in the elderly population are complex, with Weber B and Supination-External Rotation being the predominant patterns.
- Conservative treatment of ankle fractures yields equally satisfactory functional outcomes as surgical treatment in geriatric population.
- Surgical treatment using ORIF in the elderly population has a significant percentage of complications related to wound and soft tissues.

I. Introduction

Hospitals are increasingly facing a larger and ageing population, posing challenges in the treatment of the geriatric population (1,2). It is estimated that by the year 2050, 20% of the population in the United States will be over 65 years old (3). It is calculated that 1 in 3 older adults experiences a fall each year, with 20% of these falls resulting in significant injuries such as fractures (4).

Ankle fractures rank as the third most common fractures in the elderly population, following hip and wrist fractures (5,6). Although they are not considered fragility fractures in themselves, ankle fractures in the elderly often exhibit more complex fracture patterns compared to younger individuals, despite being caused by low or very low energy mechanisms.

Many of these patients have osteoporosis, which increases the risk of fracture, reduces bone quality, and complicates management (7-9). Additionally, they frequently have multiple comorbidities that contribute to perioperative complications, poor baseline physical condition, and limited social and/or familial support, which can impede full recovery to the pre-fracture state.

The treatment objective for ankle fractures should aim to promote early weight-bearing to prevent bed rest, facilitate rehabilitation, and maintain functional independence in performing activities of daily living (ADLs) (10).

Over the past decades, ORIF have been advocated as the preferred approach for ankle fractures,

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aiming to achieve anatomical reduction and perfect joint congruence (11). This approach is believed to improve outcomes and reduce the risk of post-traumatic arthritis. However, in elderly patients with lower functional demands, poorer bone and soft tissue quality, shorter life expectancy, and limited healing and recovery capacity, the rates of delayed healing, wound infection, or implant failure are much higher compared to the younger population (12, 13). Therefore, it is suggested that exact restoration of joint congruence in the elderly may not be as closely related to function and pain (14, 15).

Evidence regarding conservative management of ankle fractures in the elderly is limited. Some studies have shown similar functional outcomes compared to surgical treatment (14,16-20), although complications such as malalignment or loss of reduction may occur (21). Thus, a detailed assessment of each case, considering both the patient and the fracture, is crucial in deciding the most appropriate treatment with fewer complications (14, 22).

The aim of this study is to analyze the radiographic and functional outcomes, as well as the complications, of surgically and conservatively treated ankle fractures with instability criteria in a geriatric population over 70 years old in our institution.

II. Materials and Methods

A retrospective study was conducted between Sep-2015 and Sep-2021. The study included all ankle fractures with an indication for surgical treatment treated in the emergency department of our center, in patients over 70 years old.

Surgical indication criteria included the presence on X-ray of: trans-syndesmotic or supra-syndesmotic fractures with a medial clear space >4mm, tibiofibular clear space <1cm, tibiofibular overlap <6mm, or talar tilt <2^{o}, ankle fracture-dislocations, and fractures with soft tissue injury.

Exclusion criteria were age under 70 years and fractures with an indication for conservative treatment: a total of 293 fractures were analyzed, of which 71 were finally included.

Clinical data of the patients, radiographic studies, and information on the definitive treatment were collected from the hospital's medical records database. Fractures were classified according to the Weber classification, the Lauge-Hansen classification, and the AO/OTA classification for ankle fractures. Clinical assessment was performed using the visual analog scale (VAS), and functional evaluation was done using the Olerud Molander Ankle Score (OMAS).

The statistical program SPSS V26.0 (SPSS Inc., Chicago, IL) was used. Differences between groups with quantitative variables were analyzed using Fisher's exact test (chi-square), and those with qualitative variables were analyzed using Fisher's exact test. Differences were considered significant if the p-value was <0.05.

III. Results

A total of 293 ankle fractures were obtained, of which 71 met the inclusion criteria (flowchart).

The average age was 76.54 years (70-98), with 43 females and 28 males. The majority of patients had more than 2 chronic diseases (n=63), and 30 of them were on multiple medications.

Among the personal history, notable factors include hypertension (n=48), osteoporosis (32), type 2 diabetes mellitus (n=31), previous fractures (n=9), smoking habit (n=7), prior corticosteroid use (n=3), and peripheral vascular disease (n=1). The cohort's average BMI was 26.98 (+/- 3.59) kg/m2. Most patients were classified as overweight (n=42), followed by normal weight (n=17), and a smaller number as obese (n=6).

There were 55 fractures resulting from falls, 12 fractures from ankle twists, 3 fractures from stepping down a stair, and 1 case from a traffic accident. 39 fractures were on the left side. 21 patients had fracture-dislocations, and in 4 cases, there was an additional concomitant fracture along with the ankle fracture.

There were 34 fractures of the lateral malleolus associated with medial malleolus fractures, 19 cases of trimalleolar fractures, and 18 cases of isolated lateral malleolus fractures.

The most common fracture pattern according to the Weber classification was trans-syndesmotic fractures (n=64), followed by supra-syndesmotic fractures (n=7). According to the Lauge-Hansen classification, the predominant pattern was supination-external rotation (n=60), followed by pronation-external rotation (n=7), supination-adduction (n=3), and finally, pronation-abduction (n=1). According to the AO classification, they were distributed as follows: 25 cases of 44B2, 21 cases of 44B3, 15 cases of 44B1, 5 cases of 44C1, 3 cases of 44A1, and 2 cases of 44C3.

Initially, in the emergency department, all fractures were reduced using a closed plaster cast, with satisfactory reduction in 37 cases, suboptimal reduction in 25 cases, and unsatisfactory reduction in 9 cases. A second reduction was necessary in 7 patients, and external fixator (EF) placement was required in 3 cases.

After manipulation and reduction with a plaster cast, improvements were observed in all radiographic measurements (Table 1).

Despite being fractures with surgical indications, conservative management was decided for 25 patients due to their baseline condition, medical complications, or soft tissue complications.

The treatment consisted of a plaster cast for an average of 46 days (+/- 11 days), followed by a WALKER-type immobilizer. Weight-bearing was avoided for the affected limb for an average of 51 days (+/- 10).

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During the follow-up, fracture displacement was observed in 6 cases, with a mean time of 11 days (+/- 3). It did not lead to a change in treatment indication. As for complications of conservative treatment, no clinical complications were recorded, but there were 3 cases of radiographic complications, pseudoarthrosis of the fibula/tibia in 3 cases.

Surgical treatment was decided as the definitive treatment for 46 patients. The most commonly used treatment was ORIF, used in 43 patients. Only in 3 cases, pan-arthrodesis was chosen as the definitive treatment. Among the patients who underwent ORIF, plate fixation for the fibula was performed in 37 cases using low-profile plates, and in 7 cases, canulated screws to the medial malleolus.

Among the patients who underwent surgical treatment, 7 experienced soft tissue distress prior to the intervention. Following the surgery, there were 8 wound complications (4 dehiscences, 2 dehiscences with infection, and 2 infections), as well as 3 discomforts related to the osteosynthesis material. Reintervention was necessary for 9 patients: 6 due to wound complications and 3 due to discomfort with the osteosynthesis material. Material extraction (ME) was performed in 7 cases, and ME with debridement in 2 cases. Additionally, there were 2 cases of a third intervention due to wound complications. There was no increased risk of complication or post-surgical reintervention associated with DM (p 0.061 and p 0.085), overweight (0.34 and 0.55), or age stratified as <75 or >75 years (p 0.44 and 0.51). From a functional perspective, there were no significant differences observed when comparing conservative and surgical treatment in this population. The total score using the OMAS scale was 66.8 points +/- 17.1 points. Among the operated patients, the score was 65.9 points +/- 15.7 points, and for the conservatively treated patients, it was 67.9 points +/- 10.3 points (p 0.719). The 50th percentile on the EVA scale for conservative treatment was 3.0 points, and for surgical treatment, it was 3.3 points, with no differences found (Table 2).

IV. Discussion

Ankle fractures in the elderly population present a challenge today due to their increasing incidence, complex pattern, and the lack of clear treatment guidelines indicating the best approach. Therefore, it remains a controversial topic.

The most common fracture pattern is type B according to the Weber classification. Shivarathre et al. recorded an 83.7% incidence of this pattern, similar to the 90% obtained in our series (23).

Evidence for conservative management of ankle fractures in the elderly is limited. However, several studies show similar functional outcomes with conservative management compared to surgical treatment, with lower complication rates, suggesting it as a suitable option for some patients (14,17-20). However, conservative treatment with immobilization using a cast can lead to complications, especially related to loss of reduction and malalignment (21).

Conservative treatment seems to have lower complication rates or clinically irrelevant complications (20). In our study, 3 patients (12%) experienced complications during follow-up. These were three cases of tibia/fibula nonunion as a radiographic finding without clinical impact. None of the surgically treated patients had consolidation problems. In the study published by David J. Keene, nonunion occurred in 15% of patients treated with a cast compared to 3% of surgically treated patients (20). According to the comparative study published by David W. Sanders et al., 10% of patients in the conservative group had nonunion at 12 weeks compared to 0% in the surgical group (16). These bibliographic data are consistent and similar to those obtained in our study, where we achieved an 88% consolidation rate in the conservative group compared to 100% in the surgical group.

Conventional surgical treatment using plate fixation of the fibula appears to have high complication rates, particularly related to soft tissue evolution and the surgical wound (24). Zaghloul A. et al. describe a wound complication rate of 21.5% in their series of 186 cases, with a reintervention rate of 10.8% for wound debridement, material extraction, and fixation revision (25). Shivarathre et al. reported wound complication rates of 11.6%, with 7% superficial infection and 4.6% deep infection (23). Pagliaro et al. reported a 26% complication rate with a 13% reintervention rate (26). Natasha M.'s study also registered reintervention rates of up to 9% (5), although this lower incidence may be due to the analysis of a slightly younger population (>55 years). In our study, 11 out of 46 (24%) surgically treated patients experienced complications (8 related to the wound and 3 due to discomfort with the osteosynthesis material), requiring 9 (19%) reinterventions. These results are similar to the previously mentioned studies, although the revision rate is slightly higher.

The results from Lyndel et al. are more optimistic, with a 2.90% failure rate of the osteosynthesis material and a 9.9% wound complication rate. They also describe an association between the risk of wound complication and the presence of comorbidities (p = 0.05) (27).

Recently, the use of less invasive techniques in the surgical treatment of ankle fractures (28, 29) has gained relevance. These techniques have shown 0% wound complication rates, and no statistically significant differences have been found in the OMAS scale compared to conventional surgical treatment with a plate (30). The use of smaller incisions, which are more gentle to the soft tissues and do not damage the vascularization of the fragments, has yielded good

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results in complex fractures (31, 32). In the present study, minimally invasive osteosynthesis techniques were not performed, although they are starting to be implemented following this review and other similar works.

The association between surgical wound complications and patient history, such as diabetes, dementia, peripheral vascular disease, or tobacco use, has been documented (23, 25, 33). Particularly, an increased risk of up to 4 times in diabetic patients (34). However, in our study, we have not been able to demonstrate such a statistically significant relationship. This may be due to a small sample size. Stratified age, as previously reported in studies (14), also does not appear to be a prognostic factor.

David W. Sanders et al. (16) also studied the functional differences between conservative and surgical treatment of ankle fractures, obtaining a mean OMAS (35) score of 61.4±23.4 points in the surgical treatment group compared to 56.8±23.8 points in the conservative group, without statistically significant differences (p 0.936) regardless of the follow-up period. Functionally, we did not find statistically significant differences between both treatments, with a mean OMAS scale score of 66.8 points +/- 17.1 points. Among the operated patients, we recorded a score of 65.9+/-15.7 points, and among the conservatively treated patients, it was 67.9+/-10.3 points (p 0.719). These results are consistent with those published by other authors.

On the contrary, the study presented by Salai et al. concludes better outcomes with conservative treatment, with an OFAS scale score of 91.37 ± 8.96 compared to only 75.22 ± 14.38 points after surgery (p 0.001) (14).

This study has several limitations. Firstly, its retrospective nature, with inherent limitations of studies of this kind. Secondly, the sample size may be insufficient to achieve adequate statistical power. Finally, it is possible that small differences in function may not be reflected in the scale used. The OMAS scale assesses the ability to walk or the presence of pain but does not capture subtle differences such as "being able to walk as before the fracture." Additionally, it includes items that are less relevant to the geriatric population, such as jumping or running.

V. Conclusion

There is ongoing controversy regarding the management of ankle fractures in the elderly population. Conservative treatment of ankle fractures appears to be a viable option in these patients, as it demonstrates comparable functional outcomes to surgical intervention. Moreover, surgical treatment carries a notable risk of wound complications. In patients aged 70 years and above, it would be advisable to consider conservative treatment using a cast. There is a need for larger-scale studies, preferably prospective in design, to further assess the efficacy of minimally invasive surgical approaches.

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Global Journal of Medical Research: H
Orthopedic and Musculoskeletal System
Volume 24 Issue 1 Version 1.0 Year 2024
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

Morphological Irregularity of Tracheal Rings in Horses Associated or not with Cervical Malformation (Initial Study)

By Vasconcellos, L. A. S.

Abstract- With the purpose of verifying the existence of irregularities in the tracheal rings of horses and correlating it with the presence of equine cervical vertebral malformation, 45 horses were used, including males and females of different breeds, distributed in two groups, the first being horses with lesions cervical lesion of congenital origin (GI 10 animals) and the second group composed of horses with nom-congenital cervical lesions (GII 35 animals), animals from different parts of Brazil, treated in private practice over a period of 2019-2023 (4 years). It was observed that both horses without congenital lesions and those with congenital lesions had tracheal rings of different shapes that did not compromise air flow in the animals studied, and also that in all animals with congenital lesions in the cervical vertebrae, they had tracheal rings in the dorsal portion of the tracheal rings a "ridge." This was an initial study and we believe that further investigation should be carried out.

Keywords: equine, cervical radiography, tracheal ring anomalies, equine cervical vertebral malformation.

GJMR-H Classification: LCC Code: SF951, RC925, QM25



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Keywords: equine, cervical radiography, tracheal ring anomalies, equine cervical vertebral malformation.

I. Introduction

The trachea of a medium-sized adult horse is made up of a cartilaginous tube (including cartilaginous rings) 70 to 80 cm long with approximately 48 to 60 rings, with the capacity for dorsal expansion thanks to its muscles (tracheal muscle), conducting air from the larynx to the bronchioles. This anatomical structure bifurcates into two bronchi (Carina region), right and left, which in turn branch more and more within the lungs until the unit called pulmonary alveolus or alveolar sac (Vasconcellos, 2019; Budras Et Al, 2011, Clayton Et Al, 2007).

Obstructive tracheal diseases or malformations are observed in neonates with non-productive cough, without other hematological and biochemical changes, as well as in middle-aged horses (tracheal collapse) with low athletic performance (SimmonS et al, 1988).

Because it is also classified as a congenital disease, equine cervical vertebral compressive malformation (ECVCM or ECVM) is a developmental defect of the neck vertebrae (cervical vertebrae) that causes narrowing of the spaces in the cervical spinal canal. It results from injuries that lead to compression of the spinal cord and damage to the spinal cord tracts. One of the most common non-infectious causes of spinal ataxia in horses, CMVC is commonly called "wobbler syndrome", as affected horses are often unstable or uncoordinated, and may be called other names such as cervical vertebral malformation, cervical vertebral instability, cervical spondylotic myelopathy and cervical spinal stenosis (Pezanite Et Al, 2019; Bedenice Et Al, 2022; Vasconcellos, 2021).

There are also spinal compressions resulting from cervical dislocations, compressions due to fractures, lateral deviations due to osteochondritis dissecans (OCD), trauma to soft tissues (muscular and cervical ligament ruptures) but these pathologies are of traumatic origin and acquired (MannaA, et al, 2023, Vasconcellos, 2021).

II. Materials and Methods

The study was carried out over a period of 4 years (2019-2023), jockey clubs, equestrian stables, stud farms, boarding houses for horses in Brazilian territory, where all horses treated had reduced muscle strength in one or more limbs, muscular atrophies focal, hyposensitivity of the skin and limbs, ataxic (28 males and 17 females, aged between 3 and 12 years, 5 Thoroughbred horses, 30 Quarter Horses, 10 Mangalarga Marchador horses, a group with neurological problems based in the region cervical). In this study group (45 animals), 10 horses had neurological problems with non-traumatic etiology (congenital-GI) and 35 horses had acquired neurological problems (traumas, OCD, dislocations, fractures-GII), but both groups with exclusively localized neurological damage in the cervical region.

After clinical neurological examination (Vasconcellos, 2021), horses with neurological problems based in the cervical region were initially x-rayed (left or right latero-lateral position) for screening, with the purpose of separating the acquired cases (35 horses, traumas, OCD, dislocations, fractures) of the congenital cases (10 horses), and after obtaining the images, the cervical tracheal rings were also analyzed in order to verify their morphology, equality and homogeneity. Images from cervical radiographs of animals with

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acquired problems and those with congenital problems were used, with the aim of comparing the tracheal rings and associating changes in them with the group with congenital problems. In atypical cases of tracheal rings identified by radiography, videoendoscopy images were taken in an attempt to visualize changes in the cartilaginous rings and record them when present.

III. Results and Discussion

According to the images in figures 1 and 2, both in the group with congenital problems and in the group without congenital problems, there is a clear irregularity of the tracheal cartilaginous rings, which does not represent any problem of a functional nature, as the important thing is that there is no resistance to the air passed through the trachea both during exhalation and inspiration and that this finding represents only an anatomical confirmation, a fact that is very little reported whether in anatomy textbooks or findings in this scientific essay.

There is indeed a change in the dorsal region of the tracheal rings seen in the radiographs of GI (fig, 3) where there is the presence of a "ridge", seen in all animals in this group, not occurring in the GII group.

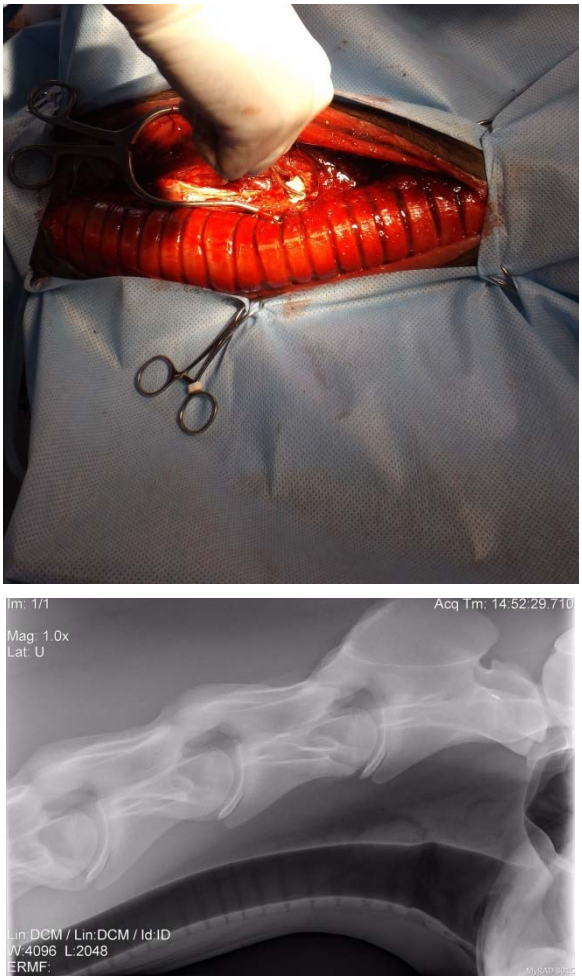


Fig. 1, 2: There is Irregularity of the Tracheal Rings (Blue Arrow)

The image recorded by videoendoscopy (fig. 4) clearly shows the change in the spaces between the rings, visualized and marked, showing a greater space between the rings, clearly showing this irregularity, but only with a visual and superficial assessment, we believe there is no interference in respiratory physiology specifically in this case. The presence of this "ridge" in the dorsal region of the tracheal rings, associated with the cervical malformation in the C6C7 vertebrae (GII), could together with the longus colli muscle, compress the recurrent laryngeal nerve (left or right) causing cases of laryngeal hemiplegia (MAY-DAVIS et al, 2015), which we did not confirm with upper respiratory video-endoscopy, because we did not perform this procedure in all horses in GII..

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Fig. 3: The Tracheal Rings Seen in the Radiographs of GI where there is the Presence of A " Ridge"(Blue Arrows)

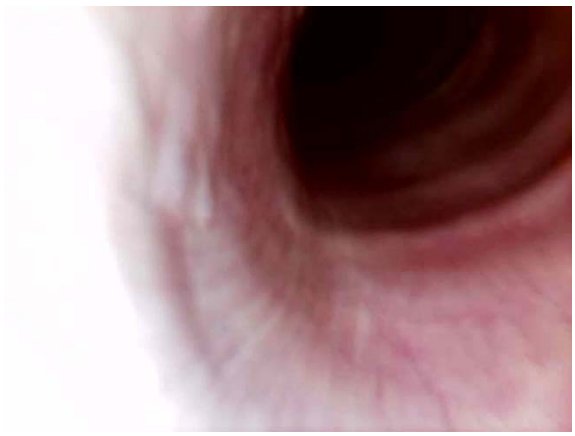


Fig. 4: Videoendoscopy Image Showing Increased Space between the Tracheal Rings of a Horse with Cervical Problems, Non-Congenital Problems (Bule Arrow)

Another important clinical finding in GI and GII were brachial plexus compressions, muscle atrophies in the anterior limbs (right and left), hyposensitivity of the skin (fig. 5) and cervical muscles (fig. 6), (MAY-DAVIS 2015).



Fig. 5: Image showing complete skin hypoesthesia/ anesthesia in a horse with a non-congenital cervical problem



Fig. 6: Cervical region with complete anesthesia resulting, in this case, from a congenital lesion

IV. Conclusions

The simple lateral projection radiographs initially showed that the tracheal rings in all horses from both groups are of different sizes and shapes, regardless of whether the animal has or does not have a neurological problem located in the cervical region. Irregularities in the cartilaginous rings ("ridge"), were present in all horses with congenital cervical malformations, that is, we found this lesion in all horses with congenital cervical problems in this study, but we suggest further studies using better investigation techniques.

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With these simple findings we can indicate the importance of radiographic examination whether for the purchase of animals that will begin high-performance athletic activity or not, in agreement with DASH (2024), and in the case of animals with findings that indicate congenital problems should be prohibited from entering into a reproductive program.

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Global Journal of Medical Research: H
Orthopedic and Musculoskeletal System
Volume 24 Issue 1 Version 1.0 Year 2024
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

Peak Oxygen Consumption and its Relationship with the Presentation of Sarcopenia in Adults Living above 2600 Meters above Sea Level

By Nestor Fernando Fino Hernandez

Resume- Introducción: El envejecer hace parte de un proceso natural y universal muy complejo, donde interactúan variables como el medio ambiente, la genética, las enfermedades crónicas entre otras; esta está asociada a una pérdida de masa muscular, que denominamos sarcopenia, la cual inicia desde la tercera década, pero se hace acentúa en la cuarta década de la vida con una disminución de fuerza de alrededor del 1% por año y que se acelera con el transcurso del tiempo. La sarcopenia es un síndrome que se caracteriza por pérdida gradual y generalizada de la masa muscular esquelética y de la fuerza, con riesgo de presentar consecuencias tales como discapacidad física, deficiencia en la calidad de vida con altos índices de mortalidad.

Palabras Clave: *sarcopenia ([mesh]), consumo pico de oxígeno a 2600 m. s. n. m ("peak oxygen consumption to 2600 m. s. n. m" [mesh]), impedanciometría (impedance" [mesh]), dinamometría, ("dynamometry" [mesh]).*

GJMR-H Classification: *LCC Code: RC953.8.S27, RC681, RA781.7*



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Peak Oxygen Consumption and its Relationship with the Presentation of Sarcopenia in Adults Living above 2600 Meters above Sea Level

Consumo Pico De Oxígeno Y Su Relación Con La Presentación De Sarcopenia En Adultos Que Habitan Sobre Los 2600 M.S.N.M

Nestor Fernando Fino Hernandez

Resume- ***Introducción:*** El envejecer hace parte de un proceso natural y universal muy complejo, donde interactúan variables como el medio ambiente, la genética, las enfermedades crónicas entre otras; esta está asociada a una pérdida de masa muscular, que denominamos sarcopenia, la cual inicia desde la tercera década, pero se hace acentúa en la cuarta década de la vida con una disminución de fuerza de alrededor del 1% por año y que se acelera con el transcurso del tiempo. La sarcopenia es un síndrome que se caracteriza por pérdida gradual y generalizada de la masa muscular esquelética y de la fuerza, con riesgo de presentar consecuencias tales como discapacidad física, deficiencia en la calidad de vida con altos índices de mortalidad. Existen criterios y parámetros para su medición y diagnóstico, en este estudio presentaremos la importancia del Consumo de oxígeno pico (VO_2 pico) como valor fisiológico predictivo significativo ya que depende de la capacidad funcional y de la integración de los sistemas que se requieren para el suministro, transporte, entrega y utilización de oxígeno además como este proceso que se ve afectado en personas que habitan a 2600 m.s.n.m.

Objetivo: Evaluar el consumo pico de oxígeno en adultos mayores de 50 años con y sin sarcopenia que viven sobre los 2600 m.s.n.m

Metodología: Estudio transversal analítico, por muestreo consecutivo a conveniencia para conformar dos grupos de personas. El grupo de estudio con diagnóstico de sarcopenia de acuerdo con criterios descritos por el Consenso Europeo de Sarcopenia actualizado en 2018. La población incluye ambos sexos, residentes en Bogotá, que aceptaron participar voluntariamente en este estudio. El grupo control incluyo pacientes sanos. Se realizó una Ergoespirometría para cuantificar el consumo pico de oxígeno (VO_2 ml/kg/min) utilizando un equipo COSMED, Fitmate PRO. Se efectuaron pruebas para evaluar la distribución de los datos estudiados en orden la masa muscular (kg), índice de masa muscular esquelética (Kg/m2), dinamometría (Kg) y consumo de oxígeno pico VO_2 pico (ml/kg/min) aplicando la fórmula de Shapiro-Wilk y posteriormente se realizó una comparación de medianas aplicando prueba Mann Whitney.

Resultados: Los pacientes mayores de 50 años no sarcopénicos tienen un deterioro de su VO_2 pico alrededor de 5 ml/Kg (lo que corresponde entre un 3% a un 5% por década), mientras los pacientes sarcopénicos que reducen la intensidad y el volumen de sus actividades diarias, volviéndose sedentarios, mostraban mayor deterioro del VO_2 (alrededor del 10% por década) siendo este cambio estadísticamente significativo con una p menor a 0,05. El 96% de los participantes del estudio presentaban una velocidad de marcha baja.

Conclusiones: La Sarcopenia se asocia a condiciones adversas que incrementan en el riesgo de mortalidad, aumento en la frecuencia de caídas y un incremento deterioro de la calidad de vida relacionada con la salud.

La detección e intervención temprana del desarrollo de sarcopenia puede potencialmente mitigar su desarrollo o prevenir su progresión.

El VO_2 pico disminuye con la edad, en un 18% para mujeres y un 24% para hombres por década y alrededor del 5% por década en las personas activas físicamente.

La medición del VO_2 puede ser un método sensible que establece el deterioro muscular de manera temprana y puede identificar la severidad de la sarcopenia. Este hallazgo se puede emplear para estratificar y definir de una forma más precisa esta condición.

Para los profesionales de la salud y de la actividad física podrían utilizarla medición del VO2 pico como un parámetro a tener en cuenta, no sólo en atletas entrenados, sino en el resto de la población que tienen un mayor riesgo por hábitos inadecuados como el sedentarismo, el consumo de alcohol y del tabaco.

Intervenciones como el entrenamiento de fuerza y la suplementación nutricional son estrategias empleadas en el manejo de la sarcopenia. Sin embargo, se requiere de estudios adicionales en el área de la terapia del músculo esquelético.

Palabras Clave: sarcopenia ([mesh]), consumo pico de oxígeno a 2600 m. s. n. m ("peak oxygen consumption to 2600 m. s. n. m" [mesh]), impedanciometría (impedance" [mesh]), dinamometría, ("dynamometry" [mesh]).

I. Introducción

Desde los estudios pioneros de Hill en 1924, las investigaciones se han encaminado a la búsqueda de resultados para entender cuáles son los límites humanos para el consumo máximo de oxígeno (VO_2máx) durante el ejercicio (1, 2). La reducción del ejercicio también provoca la disminución de VO_2máx, ya sea por una disminución en el flujo

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sanguíneo muscular o por la reducción de la demanda metabólica del músculo, como en la reducción de masa muscular. Es así que, la capacidad de difusión de oxígeno al músculo podría contribuir a la disminución del VO_2máx con el envejecimiento. Sin embargo, el número de capilares alrededor de una fibra no disminuye con el envejecimiento, pero la reducción relacionada con la edad en el tamaño de la fibra muscular glucolítica (sarcopenia) muestra una disminución en la densidad capilar consecuente a atrofia severa de las fibras. Por otro lado, se sabe que, a alturas elevadas sobre el nivel del mar, se producen cambios en la dinámica del oxígeno arterial y por lo tanto también a nivel muscular y que a su vez esto se relaciona con el metabolismo del músculo y la sarcopenia. Por conocimiento de los autores, no se han realizado estudios para verificar la dinámica mencionada previamente, en poblaciones que habitan en alturas alrededor o superiores a los 2600 metros sobre el nivel del mar (m. s. n. m.). (3). (31).

Desde el 2010 la medición de la masa muscular empezó a tener gran importancia clínica, debido a que su determinación de una forma precisa, permite diagnosticar de manera certera la sarcopenia, entidad descrita por el primer Consenso Europeo de Sarcopenia (EWGSOP) como un síndrome que se caracteriza por una pérdida gradual y generalizada de la masa muscular esquelética y la fuerza con riesgo de presentar resultados adversos como discapacidad física, calidad de vida deficiente y mortalidad (4). Este primer consenso fue modificado en el 2018 reconociendo la sarcopenia como una enfermedad muscular, "insuficiencia muscular", que puede ser aguda (< 6 meses) o crónica y promovió la baja fuerza muscular como el principal indicador de sarcopenia. (29)

La patogénesis de la sarcopenia es multifactorial y abarca factores sistémicos, perturbaciones del entorno local, procesos específicos intramusculares entre otros (5). Además, estilos de vida que impliquen aumento del tiempo de inactividad física, (sedentarismo), han demostrado que llevan a una disminución de la fuerza muscular antes que a la pérdida de la masa muscular (6).

Por otro lado, la capacidad aeróbica relacionada con el consumo máximo de oxígeno (VO_2máx) disminuye con la edad, en un 18% para mujeres y un 24% para hombres por década y alrededor del 5% por década en las personas activas físicamente (8). Este hallazgo requiere atención, ya que las personas que mantienen la capacidad aeróbica adecuada son menos propensas enfermedades crónicas no transmisibles (9, 10), sin embargo, no hay claridad en la relación que existe de manera crónica en los habitantes de estas regiones. El consumo de oxígeno (VO_2) se define como la cantidad de oxígeno, medido en volumen, que es transportado, captado, transformado y utilizado por los tejidos en la fracción de un minuto. La forma más común para calcular el VO_2 es con la ecuación de Fick (11, 12).

La evaluación de un nuevo parámetro relacionado con la sarcopenia como lo es el consumo de oxígeno sería un hallazgo que podría ayudar a estratificar y definir de una forma más precisa esta entidad, para profesionales de la salud y de la actividad física sería un parámetro a tener en cuenta, no sólo en atletas entrenados, sino en el resto de la población que tienen un mayor riesgo por hábitos inadecuados como el sedentarismo, el consumo de alcohol y del tabaco.

Por consiguiente, el objetivo de esta investigación es determinar si existe una relación entre el consumo pico de oxígeno (VO_2) y la presencia de sarcopenia ligados al nivel de actividad física en personas mayores de 50 años que viven sobre los 2600 m. s. n. m.

Existen métodos directos para la evaluación del VO_2 que requieren un equipo de análisis de gases inspirados y espirados (ergoespirometría) cuyos resultados tienen alta precisión (12). La prueba de consumo de oxígeno o ergoespirometría es una herramienta de evaluación indirecta ampliamente validada, se realiza en una banda sin fin donde el individuo es expuesto a una carga física conocida la cual se progresa bajo un protocolo especial hasta llegar a su máximo esfuerzo, es decir, el individuo debe iniciar caminando y paulatinamente se va aumentando la velocidad de marcha y la inclinación de la banda en determinada fracción de tiempo, hasta llegar al máximo de la capacidad de ejercicio, de forma similar se puede usar diferentes equipos como cicloergómetro (13).

En relación con la sarcopenia varios grupos de expertos recomiendan que el diagnóstico de sarcopenia debe incluir al mismo tiempo baja masa muscular y pobre función muscular, indicadas bien por disminución de la fuerza muscular o del desempeño físico, tal como velocidad lenta de la marcha (14). Se ha señalado que la pérdida de músculo se produce con el envejecimiento y es más notable en los músculos intrínsecos de la mano y del pie (15, 16, 17).

También se han descrito otros factores que favorecen el deterioro de la calidad muscular, como el metabolismo, el aumento de la infiltración grasa, la resistencia a la insulina, la fibrosis y la activación neuronal. La identificación de estos factores puede ayudar a detectar a aquellas personas que se encuentran en riesgo de sarcopenia desde una etapa temprana de su vida. Los factores genéticos, endocrinos y los estilos de vida, como la actividad física realizada, el tabaquismo y la mala alimentación tienen efectos duales, tanto en masa muscular como en la masa ósea en la edad adulta. Respecto al hábito del tabaquismo, pocos estudios han examinado la relación entre la masa muscular y éste, en los últimos datos del estudio del Minos *et al.* (2004) (18). El hábito de fumar

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se asocia con un bajo índice de masa corporal y con bajos niveles de actividad física por lo que podría explicar esta asociación (19, 20).

La dinamometría de mano es la técnica más recomendada para medición de fuerza muscular en sarcopenia, ya que presenta una muy fuerte correlación con la potencia muscular en miembros inferiores; se ha demostrado que realizando la medición de miembros superiores se puede inferir la potencia de los miembros inferiores. De igual manera la dinamometría de mano presenta una buena correlación con la prueba de flexo-extensión de rodilla y el área muscular transversal, lo que la ha convertido en un marcador clínico de pobre movilidad y un buen predictor de desenlaces clínicos como la disminución de la masa muscular (21). Los valores que se toman como referencia en la dinamometría como parámetro de diagnóstico de sarcopenia es de <27Kg de presión en hombres y < 16 Kg en mujeres. Estos datos están descritos en el Conceso Europeo EWGSOP2 del 2018 (29, 32).

El rendimiento físico se evaluó midiendo la velocidad de la marcha (m/s) de los participantes con la caminata de 6 metros ya que tiene un valor pronostico importante en sujetos adultos mayores, de hecho, se asocia con un deterioro severo de la capacidad funcional, que representa una mayor taza de hospitalización y un riesgo elevado de sufrir fragilidad en el examen se permitió el uso de deambulador o bastón cuando era necesario. La velocidad se consideró baja cuando estaba por debajo de 0, 8 m/s, punto de corte establecido tanto en el consenso del EWGSOP1.

El último de los aspectos fundamentales a evaluar es la medición del índice de masa muscular esquelética (IMME). El consenso europeo de sarcopenia indica que esta medición puede ser realizada por medio de la bioimpedancia eléctrica (14), estableciendo el Índice de masa muscular esquelética (IMME), que corresponde a la masa muscular total relacionada con la talla al cuadrado, con rangos propuestos por Janssen *et al*. (2002), estableciendo una disminución de la masa muscular esquelética así: IMME: mujeres: 6,68 kg/m2 y hombres: 8, 31 kg/m2 mientras Sergi (2010) propuso en el EWGSOP2, determinar la masa muscular apendicular (IMMA) como la masa apendicular (de miembros inferiores y superiores) relacionada con la talla al cuadrado estableciendo los puntos de corte inferiores para definir bajo IMMA como < 5,67 kg/m^2 para mujeres y para hombres < 7,23 kg/m^2(28).

En el estudio de Ainsworth *et al.* (2000) se elaboró el compendio de Actividades Físicas (AF) para poder facilitar la codificación de las AF obtenidas de registros y encuestas realizadas a la población, para promover la comparación de los niveles de intensidad de AF codificados de estudios observacionales (25). El esquema de codificación del compendio enlaza un código de cinco dígitos que describe las actividades físicas por categorías principales (ocupación, transporte, etc.) y actividades específicas dentro de cada encabezamiento principal con su intensidad, definida como la proporción de la tasa metabólica de trabajo sobre la tasa metabólica en reposo estándar (MET). El gasto energético en MET-minutos, MET-horas, kilocalorías (kcal) o kcal por kilogramo de peso corporal, se puede estimar para actividades específicas según el tipo o intensidad de METs (18).

II. Métodos

Se llevó a cabo un estudio observacional de corte transversal analítico que evaluó el consumo de oxígeno en individuos con y sin sarcopenia que residen a 2600 m. s. n. m. donde se incluyeron individuos mayores de 50 años de ambos sexos, que vivieran en Bogotá por más de un año, atendidos en el Hospital Infantil Universitario de San José durante el periodo de 2015 al 2023, quienes cumplían con criterios de inclusión que eran; tener más de 50 años, residentes en Bogotá hace más de un año, quienes firmaron consentimiento informado para participar y aquellos que cursaban con patologías crónicas que debían estar controladas los cuales fueron evaluados por medio de una anamnesis realizada por los médicos investigadores .

Se excluyeron personas que estaban recibiendo terapia de reemplazo hormonal, corticoides e insulina, quienes tenían antecedente de enfermedad coronaria, valvular o pulmonar con presencia o no de marcapasos y / o cardio desfibrilador, personas oxígeno requirentes o los que en la evaluación inicial tengan saturación de oxígeno al ambiente (FiO2 al 21%) menor de 90%, los que en el momento de la realización de la prueba física presentaran tensión arterial elevada (TAS:>140 mmHg o TAD:>90 mmHg, o personas con neoplasias de cualquier tipo, individuos con amputaciones y/o limitaciones funcionales en las extremidades superiores e inferiores con y sin reemplazo protésico y por ultimo pacientes catalogados como pre-sarcopénicos.

Para el diagnóstico de sarcopenia se emplearon los criterios definidos por el Grupo de Trabajo Europeo sobre Sarcopenia en Personas Mayores EWGSOP2 del 2018 (32), donde la sarcopenia probable se define con el primer criterio que es la presencia de baja fuerza muscular y se confirma con el segundo criterio que es la baja masa muscular estableciendo una sarcopenia severa o grave ante la presencia del tercer criterio que es el bajo rendimiento físico.

Se realizo la búsqueda de casos por síntomas clínicos de deterioro funcional es decir, caídas, sensación de debilidad, velocidad lenta al caminar, dificultad para levantarse de una silla, pérdida de

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peso/pérdida de masa muscular en estos casos se usa el cuestionario SARC-F, como una forma de obtener autoinformes de los pacientes sobre los signos característicos de la sarcopenia, este cuestionario consta de las siguientes preguntas (¿Qué tanta dificultad tiene para llevar o cargar 4.5 kg? , ¿Qué tanta dificultad tiene para cruzar caminando por un cuarto?, ¿Qué tanta dificultad tiene para subir 10 escalones?, ¿Cuántas veces se ha caído en el último año?) donde se cuantifica de 0 a 2 cada pregunta y los resultados se interpretan como Alta probabilidad de sarcopenia igual a 4 o más probabilidades. Las respuestas se basan en la percepción del paciente de sus limitaciones en fuerza, capacidad para caminar, levantarse de una silla, subir escaleras y experiencias con caídas.

El primer criterio es la medición de la fuerza o Fuerza de agarre (hand grip) se usó el dinamómetro de mano isocinético (CAMRY Modelo: EH 101) que permite realizar mediciones isométricas e isocinéticas de la fuerza como el momento concéntrico a distintas velocidades angulares, para el diagnóstico de sarcopenia se toman valores inferiores de $<$ 27 kg para hombres y $<$ 16 para mujeres.

Para el segundo criterio se utilizó la bioimpedancia eléctrica para calcular el volumen de masa corporal magra y grasa, empleando un impedanciometro BIODY XPERT siguiendo el método de medición y preparación de los sujetos recomendado por el manual inserto de los productores del equipo Aminogram.

El tercer criterio se usó la velocidad de marcha durante un recorrido de 6 mt, que además predice resultados adversos relacionados con la sarcopenia como discapacidad, deterioro cognitivo, necesidad de institucionalización, caídas y mortalidad, los valores de referencia para sarcopenia es de $\leq$0,8 m/s.

Una vez clasificados los individuos con y sin sarcopenia se procedió a realizar la medición de capacidad funcional o medición de VO_2 pico por medio de una Ergo espirometría con un equipo COSMED, Fitmate PRO. Se estableció el VO_2 pico como el máximo valor de VO2 obtenido durante la prueba de esfuerzo sin criterios de máximo consumo de oxígeno. Utilizamos cualquiera de los dos términos (pico o máximo) para indicar que fue el VO_2 hallado en la prueba máxima de esfuerzo realizada.

Todos los datos del estudio fueron recolectados por los especialistas de Medicina de la Actividad Física y del Deporte en formación, vinculados al trabajo; el protocolo empleado en la medición de la fuerza de agarre mediante dinamometría (Dinamometro CAMRY Modelo: EH 101) con la indicación al participante de sostener el dinamómetro inicialmente con la mano dominante, codo extendido y hombro a 90 grados, se indicó realizar la aprehensión máxima en esta posición, inmediatamente posterior se realizó lo mismo con la contralateral, luego se indicó al participante que se retirara los zapatos, las medias, su ropa dejando solo su ropa interior, y que además retirara los materiales metálicos que tenga en su cuerpo (reloj, joyería, ganchos de pelo, etc.) y se le dio una bata de examen desechable única para cada participante, la cual estuvo puesta todo el tiempo de la medición.

Posteriormente, se procedió a la realización de la medición de la composición corporal por medio del impedanciometro BIODY XPERT y el registro de datos de la misma.

Terminando dicha medición se determinó la velocidad de la marcha con la marcación y señalización previa de una distancia de 6 metros, donde se evitara el riesgo de caídas o algún tipo de traumatismo, se dio la orden de salida con medición con cronómetro para que el paciente inicie el recorrido de la distancia señalada con una caminata rápida sin llegar al trote.

Una vez registrados cada uno de los parámetros descritos anteriormente, se procedió a realizar la medición de capacidad funcional o medición de VO_2 (ergoespirometría con equipo COSMED, Fitmate PRO equipo) donde el participante fue monitorizado con una máscara facial además de un monitor de frecuencia cardíaca, luego se inició la caminata en la banda sin fin (METS, Sportfitness, Modelo JS-5000B-1) a una velocidad de 3 kilómetros/hora y ésta se incrementó cada minuto de a 1 kilometro/hora y dependiendo de la capacidad del individuo, se aumentó la inclinación de la banda de 1 grado, hasta lograr la capacidad máxima de ejercicio de cada participante, se le permitió un periodo de recuperación al finalizar la prueba.

La descripción de las variables se realizó por medio de frecuencias absolutas y relativas. Las variables cuantitativas se presentan con medianas y rangos intercuartílicos, para distribución no normal según la prueba de Shapiro-Wilk. Para los análisis estadísticos se utilizó el programa estadístico Jamovi.

Para determinar si existen diferencias estadísticamente significativas entre el consumo de oxígeno pico VO_2 en participantes con o sin sarcopenia, se empleó la prueba de Mann-Whitney.

III. Resultados

Se incluyeron en total 50 participantes (25 con sarcopenia y 25 sin sarcopenia) En relación con el nivel de actividad física se encontró que del total de participantes (50), el 8% (4) presentan nivel saludable, el 68% (34) sedentario no saludable y el 24% (12) sedentario riesgoso, (tabla 1).

Del total de pacientes con sarcopenia 64% (32) al género femenino, la media de la edad fue de 66,06 años con una desviación estándar (DS) de 9,28; en

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cuanto a la talla la media fue de 1,57 con una DS de 0,08 metros; el peso tuvo una media de 69,4 kilos con una DS 14, 8.

Teniendo en cuenta la presencia o no de sarcopenia, se encontró que en cuanto a masa muscular los pacientes con sarcopenia tuvieron una mediana de 16,02 para IMME 6,70 para aprehensión de mano izquierda 16 y para aprehensión mano derecha 19 y para vo2 pico 20 ml/kg/min. Tabla 2 Al analizar la diferencia entre el valor de VO_2 max entre los pacientes con sarcopenia y los pacientes sin sarcopenia se encontró que se presenta una diferencia estadísticamente significativa con un valor p <0,001. Tabla 3.

Se reportó que las mujeres con sarcopenia tuvieron una media en el VO2 de 19,3 mientras que quienes no la tenía fue de 21,5. En los hombres con sarcopenia la mediana fue de 21 mientras que en no sarcopenicos fue de 26, 1. (Tabla 3, figura 1)

En relación con el grupo de edades se observa una diferencia en pacientes con edades entre 50 y 60 en comparación con los demás rangos de edad con valor de p menor de 0,05 (p 0,047); mientras que los demás rangos no presentan cambio en los valores de VO_2 pico. Esta diferencia está relacionada al grupo de edad y presencia o no de sarcopenia.

Tabla 1: Características de la Población

		Frecuencias	% del Total
Edad Categorizado			
50 a 60	No sarcopénicos	9	18.0 %
	Sarcopénicos	5	10.0 %
60 a 70	No sarcopénicos	12	24.0 %
	Sarcopénicos	12	24.0 %
70 a 80	No sarcopénicos	3	6.0 %
	Sarcopénicos	5	10.0 %
80 a 90	No sarcopénicos	1	2.0 %
	Sarcopénicos	3	6.0 %
Genero			
Femenino	No sarcopénicos	16	32.0 %
	Sarcopénicos	16	32.0 %
Masculino	No sarcopénicos	9	18.0 %
	Sarcopénicos	9	18.0 %
Nivel De Actividad Física			
Saludable	No sarcopénicos	4	8.0 %
	Sarcopénicos	0	0.0 %
Sedentario no saludable	No sarcopénicos	14	28.0 %
	Sarcopénicos	20	40.0 %
Sedentario riesgoso	No sarcopénicos	7	14.0 %
	Sarcopénicos	5	10.0 %

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Tabla 2: Distribución De Acuerdo A Presencia O No De Sarcopenia

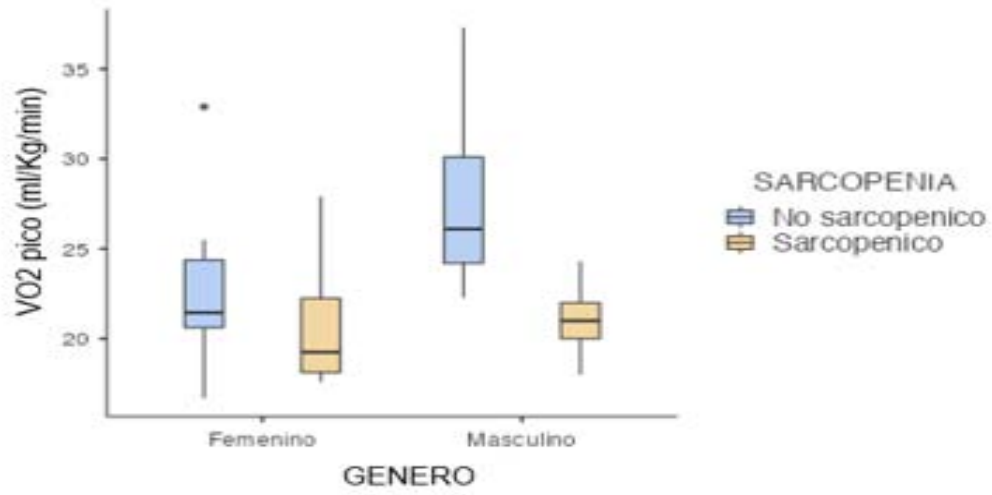
			Percentiles					
	SARCOPENIA	N	Mediana	Mínimo	Máximo	25th	50th	75th
MASAMUSCULAR (kg)	No	25	25.07	19.00	40.50	22.76	25.07	27.90
	Si	25	16.02	13.00	29.00	15.00	16.02	24.00
IMME (kg/m2)	No	25	10.43	8.64	13.53	9.43	10.43	10.95
	Si	25	6.70	5.70	10.65	6.57	6.70	9.44
APREHENSION	No	25	22.20	13.00	37.90	18.00	22.20	30.20
	Si	25	16.00	7.00	25.00	13.00	16.00	18.00
VO2 pico (ml/kg/min)	No	25	23.70	16.70	37.30	21.00	23.70	25.50
	Si	25	20.00	17.60	27.90	19.00	20.00	22.00

Fuente: Elaboración Propia De Los Autores

Tabla 3: Distribución De VO2 Según Género Y Sarcopenia

					Percentiles				
	GÉNERO	SARCOPENIA	N	Mediana	10th	25th	50th	75th	90th
VO2max (ml/kg/min)	Femenino		16	21.5	19.8	20.6	21.5	24.4	25.5
			16	19.3	18.0	18.1	19.3	22.3	24.0
	Masculino		9	26.1	23.4	24.2	26.1	30.1	35.1
		Sarcopenico	9	21.0	18.8	20.0	21.0	22.0	23.4

Fuente: Elaboración Propia De Los Autores



Fuente: Elaboración Propia De Los Autores

Figura 1: Distribución De VO2 Por Género Y Presencia De Sarcopenia

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IV. Discusión

Durante mucho tiempo se ha pensado que la pérdida de peso relacionada con la edad, junto con la pérdida de masa muscular, era en gran parte responsable de la debilidad muscular en las personas de edad avanzada, ahora está claro que los cambios en la composición muscular también son importantes, por ejemplo, la 'marmolización', o infiltración grasa del músculo, reduce la calidad muscular. (12)

En los varones que van envejeciendo aumenta inicialmente el porcentaje de masa grasa y disminuye posteriormente. Este cambio se ha atribuido a una disminución acelerada de la masa magra, junto con un aumento inicial y una disminución posterior de la masa grasa, las mujeres presentan un patrón semejante aumento de la grasa intramuscular y visceral con el envejecimiento al tiempo que disminuye la grasa subcutánea. (8)

Actualmente los consensos internacionales han definido la sarcopenia como un síndrome/enfermedad caracterizada por la pérdida de la masa y función muscular asociada al proceso de envejecimiento. A pesar de tener una definición similar, no hay una total concordancia entre los criterios y evaluaciones diagnosticas para la sarcopenia. (32)

La sarcopenia genera un impacto negativo sobre la funcionalidad y la salud de los adultos mayores.(10) La cual está relacionada con un mayor índice de discapacidad física, caídas, fracturas descompensación de comorbilidades y alta mortalidad en esta población. De este modo, el interés de su estudio ha crecido con el objetivo de crear puntos de corte y criterios para un diagnóstico oportuno para favorecer la prevención y tratamiento en población anciana.

Los pacientes con riesgo de sarcopenia pueden ser identificados de manera rápida en la práctica clínica utilizando los cuestionarios SARC-F y SARC-CalF, Esta evaluación inicial nos permite ampliar a evaluaciones específicas del diagnóstico de la sarcopenia (masa, fuerza muscular y rendimiento físico) en aquellos individuos con riesgo de sarcopenia: SARC-F $\geq$ 4 puntos o SARC-CalF $\geq$ 11 puntos se le deben realizar pruebas específicas (4-32).

Dentro de las pruebas específicas tenemos la dinamometría "fuerza de agarre" con valores de (<26 kg en hombres y <18 kg en mujeres), junto con una disminución del índice muscular esquelético (IMME) por impedanciometría de (<7,0 kg/m2 en hombres y <5,7 kg / m2 en mujeres y La caminata de 6 mts o velocidad de marcha como pronóstico de severidad según el EWGSOP2 tomando como punto de corte (0,8 m/s) (32).

En el estudio encontramos resultados tales como el 96% de los participantes del estudio presentaban una velocidad baja, respecto al consume de oxígeno VO_2 pico. los pacientes mayores de 50 años no sarcopénicos, tienen un deterioro de su VO_2 pico alrededor de 5ml/Kg entre un 3% al 5% por década, mientras los sarcopénicos quienes reducen su intensidad y volumen de actividades volviéndose sedentarios mostraban mayor deterioro del VO_2 pico alrededor del 10% por década. (10)

Las posibles causas de la disminución del VO_2 incluyen la disminución en su componente central (gasto cardiaco) y en su componente periférico (Diferencia. A-VO_2). El Volumen sistólico desciende por un menor retorno venoso y por una menor capacidad de relajación y contracción de la pared ventricular. El descenso de la diferencia A-VO_2, puede deberse a la pérdida de la masa muscular y mitocondrial como a la disminución en la capacidad enzimática aeróbica. (31)

Se logró identificar diferencias significativas en el VO_2 entre los dos grupos estudiados logrando encontrar como los pacientes con sarcopenia versus los que no cursaban con sarcopenia mostraron un cambio en el VO_2, siendo este cambio estadísticamente significativo con una p menor a 0,05.

Igualmente, al comparar por grupos de edad se vio diferencia por edades siendo la más significativa en el grupo de edad entre 50 a 60 años y la diferencia por genero mostro ser más significativa en las mujeres que en los hombres siendo la diferencia en mujeres con o sin sarcopenia.

Los pacientes no sarcopénicos tiene mayor resistencia al ejercicio alcanzando VO_2 picos de 34.5 (ml/kg/min), probablemente debido a que realizan algún tipo de actividad diaria, mientras que los participantes sarcopénicos presentaron VO_2 picos de 27.9 (ml/kg/min).

Puede ser debido a que este grupo realiza poco o nada de actividad física o llevan tiempos prolongados de postración hospitalaria promoviendo un deterioro fisiológico donde presenta transformaciones en la condición física, perdida de independencia funcional, provocando así modificaciones en su estado físico llegando a la fragilidad el cual va a disminuir la resistencia y las reservas fisiológicas del adulto mayor causando mayor riesgo de sufrir efectos adversos para la salud como: caídas, discapacidad, hospitalización, institucionalización y muerte. (27)

Por esta razón podemos definir que la medición del VO_2 pico puede ser un método sensible para establecer el deterioro muscular de manera temprana o puede identificar la severidad del mismo.(31)

La sarcopenia es una condición modificable que podría volver a un estado normal con una intervención temprana. (29) Tales intervenciones pueden ser igualmente importantes para aquellos con presarcopenia, que también es modificable.

El primer paso es identificar y abordar los factores contribuyentes subyacentes. Por ejemplo, el

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tratamiento y la optimización de la salud metabólica y el tratamiento de la obesidad mediante el ejercicio y la restricción de la ingesta calórica reduciendo la miosteatosis, control y adecuado tratamiento de enfermedades crónicas como la insuficiencia cardíaca con terapia médica dirigida por las pautas puede prevenir la progresión de la enfermedad y potencialmente suprimir los procesos inflamatorios que se sabe que contribuyen a los cambios adversos en la fisiopatología muscular que provoca la sarcopenia. (32)

Los programas de intervención de ejercicios, como entrenamiento aeróbico y de resistencia, han demostrado que aumentan la masa muscular, fuerza y el rendimiento físico por ende los programas de entrenamiento se pueden utilizar como una intervención exitosa para el tratamiento de la sarcopenia. En estos programas, los individuos ejercitan sus músculos entre 2 a 3 veces a la semana con una duración entre 12 a 24 semanas. La resistencia y la duración de la sesión aumentan gradualmente con el tiempo dependiendo de la capacidad y el progreso de cada individuo (30).

Con respecto al estudio realizado, podemos decir que promueve la importancia de la medición del VO2 pico como predictor temprano de sarcopenia y sugiere la posibilidad de seguir con mas estudios en esta población o de más temprana edad para obtener el diagnostico y montar de esta forma programas de promoción y prevención con énfasis en cambios de estilo de vida.

Este estudio conto con la limitación de tener una muestra muy baja de pacientes limitados a un hospital, lo que motiva nuevos estudios en escenarios donde la población con sarcopenia es mas robusta .

Agradecimientos

En primer lugar, agradecemos a nuestro tutor, el Dr Juan Carlos Galvis por enseñarnos y acompañarnos en este largo y duro camino en el cual aprendimos a superar dificultades. Gracias por la paciencia y dedicación. A mis compañeros por el esfuerzo depositado en que saliera todo adelante. A los pacientesque participaron en el proyecto, Agradecemos a todos aquellos depositaron su confianza en el trabajo que realizamos. Muchas gracias.

Dedicado a mi familia y amigos que siempre estuvieron allí para dar una palabra de ánimo o para darme algún consejo, de verdad sin ustedes esto no habría sido posible. Muchas gracias.

Declaración De Conflicto De Interes:

Todos los investigadores declaran no tener ningún conflicto de interés.

Declaración De Financiacion Del Proyecto:

El presente proyecto no recibió financiación por parte de ningún ente financiador y los costos fueron cubiertos en su totalidad por los mismos investigadores

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31. Relación del consumo de VO2pico y el porcentaje de masa muscular en adultos que habitan sobre 2600 M. S. N. M, Juan Carlos Galvis MDa a Instructor Asistente. Servicio de Medicina de la Actividad Física y del Deporte, Fundación Universitaria de Ciencias de la Salud. Bogotá DC, Colombia.
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Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.



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Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.



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Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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Global Journal of Medical Research

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ISSN 9755896



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