International Journal of Health Sciences and Research
Vol.12; Issue: 7; July 2022
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Comparison of Grip Strength in Dominant and Non-Dominant hand in Recreational Cyclists

Tamanna D. Sanura[1], Priyanka Gokhale[2]

[1] Intern (BPT), DPO's Nett College of Physiotherapy, Thane.
[2] Assistant Professor, DPO's Nett College of Physiotherapy, Thane.

Corresponding Author: Tamanna D. Sanura

DOI: https://doi.org/10.52403/ijhsr.20220741

ABSTRACT

Recreational cycling is sort of sport that requires a decent level of endurance, and cyclists' riding is determined by several physical abilities, in which muscular strength in upper limb is equally important as the lower limbs. While riding a bicycle, the hand grip turns out to be especially crucial not just for performance and the ability to remain upright in difficult situations and uneven surfaces but also for even moderate endurance and comfort of the rider A total of 60 recreational cyclists, 25-35 years old were included in the study. Grip strength of dominant and non-dominant hand was checked with Jamar hand held dynamometer pre cycling and was checked again after the 20km ride. Normality was checked and Dominant hand data passed the normality test thus, paired t-test was used to determine significance for ($p<0.05$). For Non-dominant hand readings didn't support normality to the optimal level ($p>0.05$) hence non-parametric Wilcoxon signed test was used to determine significance as the samples were dependent. Mann-Whitney test was used to determine significance in Dominant and Non-Dominant hand pre cycling activity as well as comparison of Dominant and Non-Dominant hand post cycling activity, as data was not normally distributed and the samples were independent. ($p>0.05$). Results showed that there is significant difference in dominant as well as non-dominant hand pre and post riding activity with post cycling grip strength being reduced in both Dominant and Non-Dominant hand than the pre-cycling grip strength. Also, Dominant hand grip strength was more than the non-Dominant hand in both pre and post cycling.

Keywords: Recreational cyclists, Grip strength, dominant and non-dominant hand, Jamar hand held dynamometer.

INTRODUCTION

Cycling is considered to be sport an endurance building physical activity using bicycles. Recreational cycling is riding purely for amusement purposes. Individuals who cycle routinely have shown mental health improvements, which also includes less perceived stress and better vitality [1]. A cycle handlebar is the guiding control for bikes. It is what might be compared to a directing wheel for vehicles. Other than directing, handlebars additionally support arm of the rider's upper body weight, depending upon their riding position. Handlebars are designed in such a way that it provides a comfortable riding position to the rider throughout the journey also while providing the adequate leverage to steer the bicycle. Professional cycles have few additional goals [2]: Enabling the rider to assume an aerodynamic position and enabling him to change hand and body positions during long rides, thus forestalling fatigue.

Where the handlebars are situated, concerning the height and length from the seat, determines the reach. At the times it is alluded as 'postural length' is largely

determined by the rider's strength and flexibility of their hamstrings, lower back, thoracic spine, shoulders, neck and arms – almost the entire body's kinetic chain.[3] The placement of the handlebars not only determines the reach but also the angle of the torso or back. This estimation gives a valuable articulation of somebody's general position and reach. The suggested torso angle for recreational cyclists is 45–55 degrees as this permits a casual riding position, regularly with practically no seat to-bar drop in level and an agreeable reach. [3].

One more significant part of handlebar is the legitimate putting of the brake switches. It permits the rider to get to the brakes when their hands are on the grip. The brake switches are set in accordance with the grip, which is determined by the arm's angle of approach to the bar and is generally around 30-40 degrees. Thus, it provides a comfortable position to the rider for braking in and out of the saddle[3].

The two most common handlebars used by the recreational cyclists are: drop handlebar and the flat bar. Drop handlebars incorporate a straight central portion added to the stem, with each end twisting first advances and down, and a while later back towards the rider at a lower position. These are an exceptionally well known kind of handlebar and appropriate for any road riding. Flat bars also called riser bars are the standard handlebars prepared on rough terrain bicycles, and also fixed-gear bikes as well as lever bar street bicycles. Flat bars give more control as they are more extensive and give better leverage and furthermore permit to guide all the more effectively and precisely. Also this type of handlebar is used by the 80% of the sporting cyclists as the parts are effectively accessible and is cost-proficient. Concerning the hand predominance, dominant hand significantly contributes in controlling the handlebar effectively hence participating in the movement as a manipulating hand while the non-dominant hand ensures the stability while riding or while taking a turn, hence active movement on handlebar while taking a turn is initiated and controlled by dominant hand [4] A hand is a perpetual anatomical system consisting of a physical framework of 27 bones and 15 joints with roughly 30 degrees of rotational and transitional freedom designed to grasp and apply force to an assortment of objects of different shapes and sizes and to perform a combination of intricate and finely controlled movements [5].

The fingers in power grasp for the most part function to the clasp on and hold an object into the palm. The fingers assume a position of sustained flexion that usually varies in degree with shape, size, and weight of the object. The palm usually contours to the object as the palmar arches structures around it. The thumb acts as an additional surface to the finger-palm and act like a vies by adducting against the object, or it well might be eliminated from the object.

Cylindrical grip incorporates the usage of flexors to situate the fingers around and maintain grasp on the object [6]. Cylindrical grip is formed by dynamic muscle contraction of hypothenar eminence and wrist in neutral flexion/extension and slight ulnar deviation. Ulnar deviation furthermore places the thumb in accordance with the long axis of the forearm; this alignment better positions the object in hand to be turned during pronation/supination of the forearm [7] as, for instance, turning a door handle or knob. Ulnar deviation of the wrist is the position that improves the power of the long finger flexors. The least flexion force is generated at these joints in wrist flexion [8]. The heavier an object is, the more probable it is for the wrist to go into ulnar deviation.

The hand morphology and utilitarian properties assume a significant part in exhibition in various sports activities which include cycling. Endurance and strength of tight grip is a key indicator of cyclists' readiness to ride. Notwithstanding, the handlebar and seat have been implicated in a wide variety of cycling associated injuries. [10] In cycling, the grip is the primary point of control, essential place of control, and its significance ought to truly not be undervalued. [4] Flat bars allow the rider to

use only one hand position while riding, and does not allow the rider to assume an aerodynamic position. Good grip allows the recreational cyclist to hold the handle bars just loosely enough to be comfortable for hours yet have the response time and speed to get a decent grasp when need want more control while speeding or slowing down. [2] Further, a loose grip can prompt to injuries associated with cycling. [10][11][12]

Frail grip can slow the cyclist down as forearms are fatigued, cyclists have harder time in holding the handlebars and squeezing the brakes, which makes cycling furthermore troublesome leading to hand muscle weakness leading to mishaps and dreaded consequences.[9][10]. Handgrip strength is important in cyclists as it relies on continuous use of digit and wrist flexors in holding the handlebar while cycling and repetitive use can lead to muscle fatigue and affects the performance of the cyclists. [9]

Due to paucity of articles showing the relationship between prolonged cycling leading to change in grip strength, this research focuses on the assessment of handgrip strength associated with cycling. The aim of this research was to assess the grip strength pre and post cycling in dominant and non-dominant hand in recreational cyclists. The objectives were 1) To assess the grip strength of dominant and non-dominant hand using Jamar hand-held dynamometer pre-cycling activity. 2)To assess the grip strength of dominant and non-dominant hand post-cycling activity using Jamar hand-held dynamometer. 3)To compare the grip strength pre and post cycling activity. 4) To compare the grip strength of dominant and non-dominant hand.

MATERIALS AND METHOD

The materials used for the study were Jamar Hand-held dynamometer, a chair, pen and case record sheet in which the grip strength was recorded.

Study design and participants

A cross-sectional study was conducted among cycling clubs across Mumbai. The study population consisted of Recreational Cyclists, between 20-30 years of age, and using Flat handlebar. The study was carried out for 18months.

Data collection

Permission to conduct the Study was be taken from the cycling club members. A written informed consent was taken from all the subjects prior to the study. 60 cyclists willing to participate in the study were be included. Inclusion criteria was 1) Cyclists who are willing to participate in the study 2) Both male and female cyclists, 20-30 years old 3) Cyclists who are regularly cycling for minimum 6 months.4) Cyclists using Flat handlebar 5) Cyclists who can cover a distance of 20kms without break. The Exclusion Criteria was 1) Cyclists using Drop handlebar2) Cyclists involved in any other sports activity.3) Cyclists using any handlebar modification.4) Recent surgeries of upper limb (< 6months)5) Fracture around wrist and forearm.6) Cyclists with history of genetic, psychological, neurological or chronic diseases affecting hand function. All the study subjects were screened as per the inclusion criteria and exclusion criteria. The subjects were explained about the procedure and the purpose of this study.

To assess Grip strength

Subjects were seated in comfortable seating position on a standard chair (46cm) without arm-rests. Jamar hand dynamometer was used to check the grip strength [13] [14] [15]. Shoulder was adducted and neutrally rotated, elbow flexed at 9 0 degrees, forearm in neutral position and wrist in 30 degrees of dorsiflexion and 15 degrees of ulnar deviation. Subjects were asked to squeeze the dynamometer with maximum effort thrice in succession and the best value was used. [10] Grip strength was assessed pre cycling and post cycling in dominant and non-dominant hand.

Data analysis

Data was collected on a data sheet and entered on Microsoft Excel spreadsheet (v.2013) and was encoded for computer analysis. Statistical Analysis was done using R-software (v. 4.2.0) Normality was checked

help of the statistical tool of skewness. The range of mean, median and mode are aligned and skewness was close to zero for dominant hand hence it confirmed Normality. Thus, paired t-test was used to determine significance ($p<0.05$)

For Non-dominant hand readings didn't support normality to the optimal level ($p>0.05$) hence non-parametric Wilcoxon signed test was used to determine significance.

Mann-Whitney U test was used to determine significance in Dominant and Non-Dominant hand pre cycling activity as well as Dominant and Non-Dominant hand post cycling activity, as data was not normally distributed. ($p>0.05$).

RESULTS

A total of 60 recreational cyclists participated in the study out of which 45 participants (76%) were males and 14 participants (24%) were female. The variation had no significant difference on the outcome.

Table 1: Range, mean and standard deviation of dominant hand pre and post cycling

	Range	Mean	Standard deviation
Dominant hand pre riding	8-42	22.26	7.97
Dominant hand post riding	4-40	19.68	8.12

Interpretation: The above data passed the normality test and thus paired t-test was done, which showed a significant reduction in grip strength in Dominant hand post riding ($p<0.05$)

Table 2: Range, mean and standard deviation of non-dominant hand pre and post cycling

	range	Mean	Standard deviation
Non dominant hand pre riding	8-40	18.85	7.57
Non dominant hand post riding	4-40	17.6	7.80

Interpretation: The above data did not pass the normality test and thus Wilcoxon Signed Rank test was done, which showed a significant difference in grip strength in Non-Dominant hand post riding. ($p<0.05$)

Table 3: Range, mean and standard deviation of Dominant and Non-Dominant hand pre-cycling

	Range	Mean	Standard deviation
Dominant hand pre riding	8-42	22.26	7.97
Non dominant hand pre riding	8-40	18.85	7.57

Interpretation: The above data did not pass the normality test, hence Mann Whitney U test was used to determine significance ($p<0.05$) There is a difference in both Dominant and Non-dominant hand grip strength values pre cycling activity with Non-Dominant hand grip strength being less than the Dominant hand grip strength.

Table 4: Range, mean and standard deviation of Dominant and non-dominant hand post cycling

	Range	Mean	Standard deviation
Dominant hand post riding	4-40	19.68	8.12
Non dominant hand post riding	4-40	17.6	7.80

Interpretation: The above data did not pass the normality test, hence Mann Whitney U test was used to determine significance ($p<0.05$). There is a difference in both Dominant and Non-dominant hand grip strength values post cycling activity with non-Dominant hand grip strength being less than the Dominant hand grip strength.

DISCUSSION

Hand grip is a crucial, though often overlooked, component of strength in recreational cyclists. A good grip strength is not only vital for cyclists' performance but also important for injury prevention.

Handgrip strength plays a major role in recreational cyclists as riders have to hold the handlebar during long rides which relies on the continuous use of the flexor muscles of forearm. The function in the fingers is performed largely by the flexor digitorum profundus muscle, especially in the dynamic closing of fingers. In static phase, the flexor digitorum superficialis accompanied by interossei muscles assists when the intensity of grip requires a greater force, for example while squeezing the brakes.

The aim of the research undertaken was to check whether or not there is a difference in grip strength pre and post riding in dominant and non-dominant hand among recreational cyclists.

A total of 60 recreational cyclists, 20-30 years old were included in the study based on inclusion criteria and exclusion criteria. Grip strength of dominant and non-dominant hand was checked with Jamar hand held dynamometer pre cycling and was checked again after the 20km ride. The data was recorded on a data sheet and statistical analysis was done using R- software (v. 4.2.0)

Normality was checked with the help of statistical tool of skewness and the Dominant hand data passed the normality test thus, paired t-test was used to determine significance for ($p<0.05$) For Non-dominant hand readings didn't support normality to the optimal level ($p>0.05$) hence non-parametric Wilcoxon signed test was used to determine significance as the samples were dependent. Mann-Whitney test was used to determine significance in Dominant and Non-Dominant hand pre cycling activity as well as comparison of Dominant and Non-Dominant hand post cycling activity, as data was not normally distributed and the samples were independent.($p>0.05$ Results showed that there is significant difference in dominant as well as non-dominant hand pre and post riding activity with post cycling grip strength being reduced in both Dominant and Non-Dominant hand than the pre-cycling grip strength. Also, Dominant hand grip strength was more than the non-Dominant hand in both pre and post cycling.

It is essential to note that the difference in grip strength post riding might be because of the sustained hand posture while riding for 20kms as flat bars offer the limitation of not being able to change the hand position while riding in contrast to the drop bars. This irregular positioning of the hand to the handlebar can include hands being positioned too widely, leading to the fingers splaying, or too much weight being placed on the hand due to the overall position. Such positioning can compress nerves, resulting in pain, numbness and weakness in flexor muscles of forearm [22]. Median nerve compression leads to numbness of the first three fingers and medial half of the fourth, while the ulnar nerve compression will affect the lateral half of the fourth finger and fifth finger entirely. The ulnar nerve is more prone to injury, followed by the median. The median and ulnar nerves pass near to the surface in and around the wrist and palm and can be possibly constricted by structures around them. This means that they can become compressed when sustained pressure is applied on them – for example when resting the palm of your hand on the handlebar or grasping the brake hoods during long rides. The nerves supply sensory innervation and motor power to the flexor digitorum superficialis, flexor digitorum profundus; as well as lumbricals. Compression or assuming a sustained position alters or blocks the signals, causing to numbness, pins and needles type sensation which is often experienced by recreational riders and sometimes even weakness [3]. This might lead to the reduction of grip strength in both dominant and non-dominant hand after cycling.

The design of a bicycle directly affects the posture of the cyclist. The position of the handlebars also determines the angle of the torso. This estimation provides a useful expression of someone's overall position and reach. The suggested torso angle for recreational cyclists is 45–55 degrees as this permits a casual riding position, regularly with practically no seat to-bar drop in level and an agreeable reach. This allows a relaxed riding position, with minimum strain on arms and forearm. It is generally accepted that handlebar width for road riders should be the width of the rider's shoulders. For the most part, bicycle handlebars are adjusted infrequently and remain fixed after being initially set for the rider. Handlebars that are too wide force the hands into a splayed, extended form, increasing the strain on the forearm, elbow and triceps and thus leading to an increase in the torso angle. Handlebars

that are too narrow force the hands to grip excessively and sometimes increases the strain on biceps and elbow flexors thus leading to reduced torso angle. A combination of this inaccurate bike fit, improper hand position on the handlebar, constant repetitive movement and stress on the wrist can lead to muscle fatigue, discomfort and decreased muscle performance.

In recreational cycling, notwithstanding, issues connecting with ill-advised bicycle fit are in many cases auxiliary in seriousness and nature at the shoulder contrasted with different regions, however they are as yet connected. A study done by Joshi S et al. in "Correlation between grip strength and scapular muscle" concluded that there is a positive co-relation between grip strength and scapular muscles[23]. Riders putting an excessive amount of weight on their hands may notice numbness in that area first, which can be caused by nerve compression as discussed earlier yet this can likewise be related to pain in the shoulder region as well as scapula region. If the body weight is pushed forward direction it can compel the elbows to lock, shifting the attenuation and control of the upper limbs directly on to the shoulder. During long rides perhaps this is inconvenient. A combination of the following: numbness in the hands, elbows locked, duration-related pain in the shoulder blades, might highlight a situation in which too much weight is being put on the handlebars [22]. Hence, this might aid in the further of reduction of grip strength post cycling.

In respect to hand dominance, the Dominant hand results in higher muscle activation as compared to non-dominant hand while riding.[4] It seems that increased surface irregularities during the 20km ride results in higher contribution of dominant hand in controlling the handlebar. Thus, this shows that Dominant hand actively participates in the movement as a manipulating hand while the non-dominant hand is mostly responsible for ensuring the stability during the ride. Hence, there is a difference in Dominant and non-dominant hand pre and post riding with dominant hand showing more reduction as compared to non-dominant hand post cycling (table 3 & 4).

Hence, Recreational cycling is a sport wherein the importance of grip strength should be emphasized as reduced grip strength can be a major reason leading to handlebar injury. This study focuses on the assessment of grip strength pre and post cycling activity and to check whether or not the grip strength changes after cycling for a fixed distance. As the above results show that there is a reduction in grip strength, it is important to discuss whether or not grip strength training should be included in the regular warm-up routine in cyclists along with weight and endurance training. As grip is the primary point of control for steering the cycle as well as its stability, its importance should not be neglected. Assuming, a lot of weight is being borne by the upper limbs which is ultimately borne by the palm of the hands, the proper positioning of rider to the handlebar holds the key. Raising the handlebars and shortening the reach can assist with diminishing the load on hands. Check whether the seat isn't pointing nose down. This tips the rider onto the handlebars from the pelvis-creating pressure on the hands as the upper limbs lock out and endeavour to push back.

Further studies should be done which takes into consideration a larger sample size and also studies should be conducted to find out the exact cause of the reduction in grip strength post cycling.

CONCLUSION

On basis of our analysis our study concludes that there is a difference in grip strength pre and post cycling in both dominant as well as non-dominant hand. Dominant and non-dominant hand showed reduction in grip strength post cycling activity in comparison to pre cycling activity. Also there is a difference in dominant and non-dominant hand pre cycling. Non-dominant hand grip strength was found to be less than the dominant hand grip strength. And there is a

difference in grip strength post cycling activity in Dominant and non-Dominant hand as well. Non-Dominant hand grip strength was found to be less than the Dominant hand grip strength.

Acknowledgement: We would like to express our gratitude to Dr. Vidhi Bhanushali (MPTh. Sports Physiotherapy) for her constant help and guidance throughout the study.

REFERENCES

1. Garrard J, Rissel C, Bauman A. Health benefits of cycling. City cycling. 2012 Jan 1;31:55.
2. Jeukendrup AE, Martin J. Improving cycling performance. Sports Medicine. 2001 Jun;31(7):559-69.
3. Phil Burt, Chris Hoy,Chris Boardman. Bike Fit: Optimise your bike position for high performance and injury avoidance.
4. Arpinar-Avsar P, Birlik G, Sezgin ÖC, Soylu AR. The effects of surface-induced loads on forearm muscle activity during steering a bicycle. Journal of sports science & medicine. 2013 Sep;12(3):512.
5. Cronin J, Lawton T, Harris N, Kilding A, McMaster DT. A brief review of handgrip strength and sport performance. The Journal of Strength & Conditioning Research. 2017 Nov 1;31(11):3187-217..
6. Levangie PK, Norkin CC. Joint structure and function: a comprehensive analysis.
7. Bejjani F, Landsmeer J: Biomechanics of the hand. In Nordin M, Frankel V (eds): Basic Biomehchanics of the Musculoskeletal System (ed. 2). Philadelphia, Lea & Febiger, 1989. 12)
8. Hazelton F, Smidt GL, Flatt AE, et al: The influence of wrist position on the force produced by the finger flexors. J Biomech 8:301, 1975.
9. Silberman MR. Bicycling injuries. Current sports medicine reports. 2013 Sep 1;12(5): 337-45.
10. Schwellnus MP, Derman EW. Common injuries in cycling: Prevention, diagnosis and management. South African Family Practice. 2005 Aug 1; 47(7):14-9.
11. Mellion MB. Common cycling injuries. Sports Medicine. 1991 Jan; 11(1):52-70.
12. Clarsen B, Krosshaug T, Bahr R. Overuse injuries in professional road cyclists. The American journal of sports medicine. 2010 Dec; 38(12):2494-501.
13. Härkönen R, Piirtomaa M, Alaranta H. Grip strength and hand position of the dynamometer in 204 Finnish adults. Journal of Hand Surgery. 1993 Feb;18(1):129-32.
14. Trampisch US, Franke J, Jedamzik N, Hinrichs T, Platen P. Optimal Jamar dynamometer handle position to assess maximal isometric hand grip strength in epidemiological studies. The Journal of hand surgery. 2012 Nov 1;37(11):2368-73.
15. Hamilton GF, McDonald C, Chenier TC. Measurement of grip strength: validity and reliability of the sphygmomanometer and jamar grip dynamometer. Journal of Orthopaedic & Sports Physical Therapy. 1992 Nov;16(5):215-9.
16. España-Romero V, Ortega FB, Vicente-Rodríguez G, Artero EG, Rey JP, Ruiz JR. Elbow position affects handgrip strength in adolescents: validity and reliability of Jamar, DynEx, and TKK dynamometers. The Journal of Strength & Conditioning Research. 2010 Jan 1;24(1):272-7.
17. Wanich T, Hodgkins C, Columbier JA, Muraski E, Kennedy JG. Cycling injuries of the lower extremity. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2007 Dec 1; 15(12):748-56.
18. Abt JP, Smoliga JM, Brick MJ, Jolly JT, Lephart SM, Fu FH. Relationship between cycling mechanics and core stability. The Journal of Strength & Conditioning Research. 2007 Nov 1; 21(4):1300-4.
19. Ahmed T. The effect of upper extremity fatigue on grip strength and passing accuracy in junior basketball players. Journal of human kinetics. 2013 Jul;37:71..
20. Barut Ç, Demirel P, Kiran S. Evaluation of hand anthropometric measurements and grip strength in basketball, volleyball and handball players. Anatomy. 2008;2(1)
21. Marković S, Dopsaj M, Veljković V. Reliability of Sports Medical Solutions handgrip and Jamar handgrip dynamometer. Measurement Science Review. 2020 Mar 1;20(2):59-64.
22. Priya S, Rai M, Joseph DK. Comparison between Handgrip Strength Measurement of Dominant Hand and Non Dominant Hand in Basketball Players. Indian Journal of

Physiotherapy & Occupational Therapy. 2018 Oct 1;12(4).
23. Joshi S, Sathe T. Correlation between grip strength and scapular muscle. Internasional Journal of Advance Research, Ideas And Innovations In Technology. 2018;4(3):2111-7.

How to cite this article: Tamanna D. Sanura, Priyanka Gokhale. Comparison of grip strength in dominant and non-dominant hand in recreational cyclists. *Int J Health Sci Res.* 2022; 12(7):290-297.
DOI: *https://doi.org/10.52403/ijhsr.20220741*

******