International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Comparison of Hand Grip Strength in Cyclists and Age and Gender Matched Non-Cyclists in Central Mumbai Using Jamar Hand Held Dynamometer - A Comparative Study

Riddhi Thakkar[1], Dr. Apeksha Deshmukh[2]

[1]Email: ridddhi21.2000[at]gmail.com

[2]Email: apekshadeshmukh1607[at]gmail.com

Abstract: ***Background: One of the most commonly practiced forms of physical activity by society at large is cycling. While riding a bicycle, the hand grip turns out to be especially crucial for performance and the ability to remain upright under challenging situations and uneven surfaces. Cyclists are subjected to perform repetitive actions which include prolonged handlebar holding, changing gears, and using hands and fingers to squeeze the brake together. Handgrip strength is important in cyclists as it relies on continuous use of digit and wrist flexors in holding the handlebar while cycling. Due to paucity of articles showing the relationship between prolonged cycling leading to change in hand grip strength, this research focuses on how cycling affects and influences the hand grip strength among cyclists and comparison of hand grip strength among cyclists and age and gender matched non-cyclists in Central Mumbai using Jamar hand held dynamometer. Aim and objective: To assess and compare the left and the right-hand grip strength between cyclists and age and gender matched non-cyclists in Central Mumbai using Jamar hand-held dynamometer. Method: This is a comparative study that involves participants between the age of 18 years to 30 years using convenience sampling. The participants were seated in comfortable seating position on a standard chair without arm-rests. Jamar hand dynamometer was used to check the grip strength. The participants were asked to squeeze the dynamometer with maximum effort thrice in succession and the best value of the three was used. Grip strength was assessed for right and left hand in cyclists and age and gender matched non-cyclists. The data was then tested for normality and statistical analysis was performed using SPSS software (v29.0.2.0). Result: The overall research shows that there is a statistically significant difference in both the right and left hand grip strength values in cyclists and age and gender matched non-cyclists with non-cyclists left and right hand grip strength being less than cyclists left and right hand grip strength. Conclusion: On basis of our analysis our study concludes that there is a statistically significant difference in the left and right hand grip strength between cyclists and age and gender matched non-cyclists respectively. Non-cyclists showed reduced left and right hand grip strength in comparison to cyclists.***

Keywords: Cyclists, Non-cyclists, Handgrip strength, Jamar hand held Dynamometer

1. Introduction

Physical activity is a factor affecting the quality of life and longevity [1] One of the most commonly practiced forms of physical activity by society at large is cycling [1] Some people treat cycling as a means of passion, while for others, it is a means of transport [1] Cycling is a sport requiring a decent level of endurance. Cyclists' riding is determined by several physical abilities, in which muscular strength in the upper limb is equally essential as the lower limbs. [2] While riding a bicycle, the hand grip turns out to be especially crucial not just for performance and the ability to remain upright under challenging situations and uneven surfaces but also for even moderate endurance and comfort of the rider. [2] Cyclists are subjected to perform repetitive actions which include prolonged handlebar holding, changing gears, and using hands and fingers to squeeze the brake together. The two most common handlebars used by cyclists are: the drop handlebar and the flat bar [2] A cycle handlebar is the guiding control for cycles. Cycle Handlebars are designed in such a way that it provides a comfortable riding position to the rider throughout the journey also while providing adequate leverage to steer the bicycle. [3]

One more significant part of the handlebar is the legitimate putting of the brake switches. The rider can get to the brakes when their hands are on the grip. The brake switches are set in accordance with the grip. Hand is an anatomical system designed to grasp objects of different shapes and sizes and perform intricate and finely controlled movements. [4] Endurance and strength of tight grip are vital indicators of cyclists' readiness to ride. In cycling, the grip is the primary point of control. [5] Good grip allows the cyclist to hold the handlebars loosely enough to be comfortable for hours yet have the response time and speed to get a decent grasp while speeding or slowing down. Further, a loose grip can prompt injuries associated with cycling and can slow the cyclist down as forearms are fatigued; cyclists have a more challenging time holding the handlebars and squeezing the brakes, which makes cycling furthermore troublesome, leading to hand muscle weakness leading to mishaps and dreaded consequences. [3]

Handgrip strength is vital in cyclists as it relies on the 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. [6] Jamar Hand Held Dynamometer is a reliable and valid tool for the measurement of hand grip strength. (reliability = 0.82, validity = 0.75) [10]

2. Aim and Objectives of the Study

Aim:

To assess and compare the left and the right hand grip strength between cyclists and age and gender matched non-cyclists in central Mumbai using Jamar hand-held dynamometer.

Objectives:

1. To assess the left and the right hand grip strength among cyclists in central Mumbai using Jamar's hand-held dynamometer.
2. To assess the left and the right hand grip strength among age and gender matched non-cyclists in central Mumbai using Jamar's hand-held dynamometer.
3. To compare the left and the right hand grip strength between cyclists and age and gender matched non-cyclists in central Mumbai using Jamar hand-held dynamometer.

3. Methods

Study type-Comparative study

Study setting-Cyclists group in central Mumbai region and non-cyclists from central Mumbai region.

Study population-Cyclists and age and gender matched non cyclists.

Sampling method-Convenience sampling.

Sample size and sample size calculator-53 cyclists and 53 non-cyclists (on open epi at 95% confidence level).

Inclusion Criteria for Cyclists:

1. Participants willing to participate.
2. Participants who treat cycling as a means of transport or physical activity.
3. Males and Females.
4. Participants in the age group of 18-30 years.
5. Participants who have been cycling for at least 6 months.6. Participants who cycle for at least 2 days/week.
6. Participants who cycle for at least 30 kms in a week.
7. Participants using flat handle bars.

Inclusion Criteria for Non-cyclists:

1. Participants willing to participate.
2. males and females.
3. Participants in the age group of 18-30 years.
4. Participants who do not fulfil the inclusion criteria for cyclists.

Exclusion Criteria for Cyclists and Non-cyclists:

1. Participants who are not willing to participate.
2. Participants less than 18 and more than 30 years of age
3. Participants using drop handlebars.
4. Participants with any recent and/or previous hand and/or wrist injury.
5. Participants that are cyclists by profession.
6. Participants involved in racket sports (tennis, badminton, etc.) or any other forms of hand grip strengthening exercises (weight lifting).

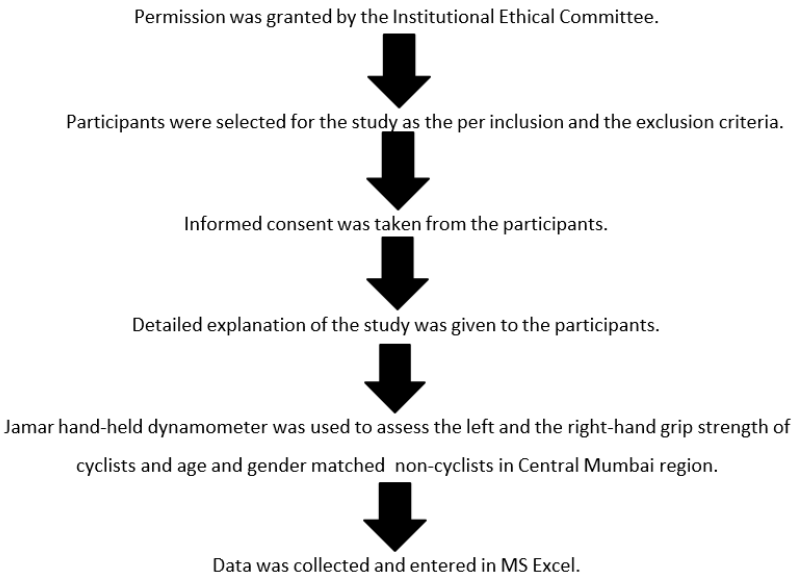
Subject Withdrawal Criteria: The participant can withdraw at any moment during the study

period If he/she does not intend to continue.

Study Instruments or data collection tools:

1. Jamar Hand held dynamometer
2. Case Record form
3. Patient consent form
4. Pen

4. Methodology



Assessment of hand grip strength:

Subjects were seated in comfortable seating position on a standard chair without arm-rests. Jamar hand dynamometer was used to check the grip strength. Shoulder was adducted and neutrally rotated, elbow flexed at 90 degrees, forearm in neutral (midprone) position and wrist in 30 degrees of flexion and 15 degrees of ulnar deviation. Subjects were asked to squeeze the dynamometer with maximum effort thrice in succession and the best value of the three was used. Grip strength was assessed for right and left hand in cyclists and age and gender matched non-cyclists.

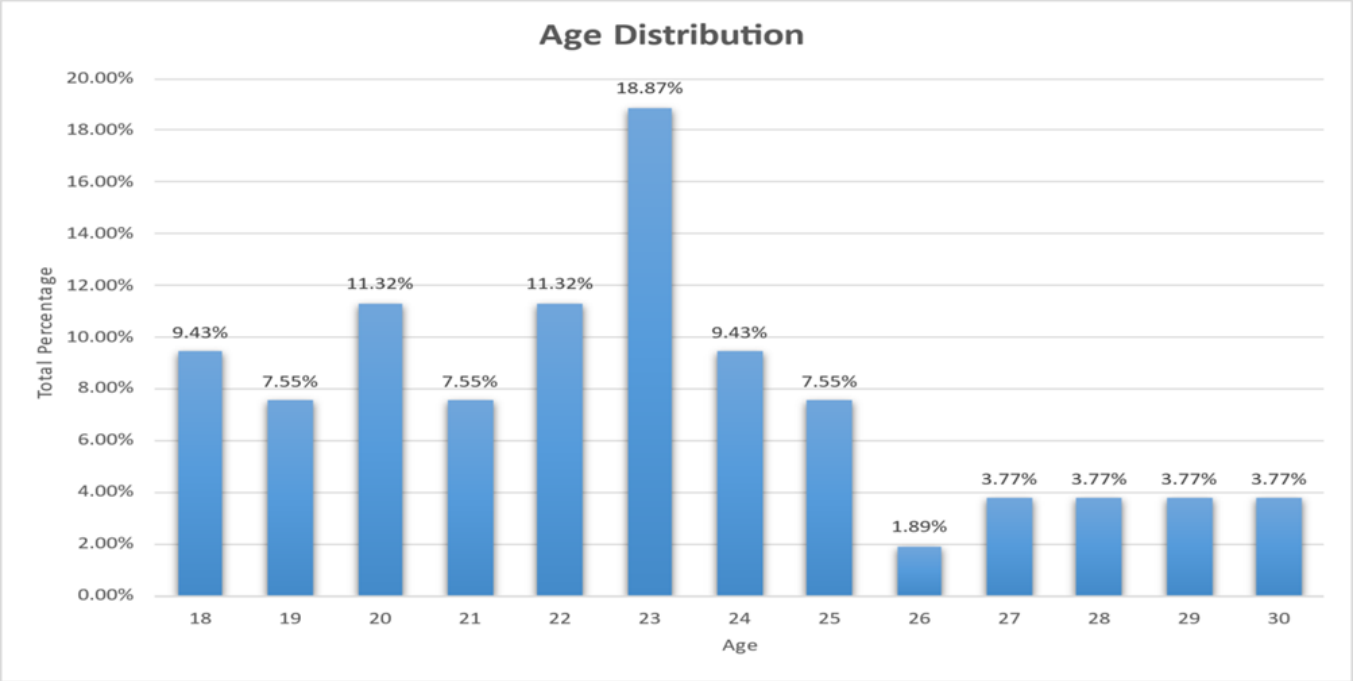
5. Results

Data was collected and was entered in MS Excel.

Descriptive statistics such as mean and standard deviation were calculated in SPSS (v 29.0.2.0). Data was tested for normality.

The data for left and right hand grip strength for Cyclists and age and gender matched non-cyclists did not pass the normality test, hence Mann Whitney U Test was used for statistical analysis using SPSS Software (v 29.0.2.0).

A total of 106 participants in the age group of 18-30 years participated in the study out of which 53 participants were cyclists and 53 participants were age and gender matched non-cyclists from Central Mumbai region.



Graph 1

- **Inference:** Graph 1 shows that the maximum number of participants were of age 23years.
- Out of 53 participants of cyclists and 53 participants of non-cyclists 22 participants (42%) were females and 31participants (58%) were males.

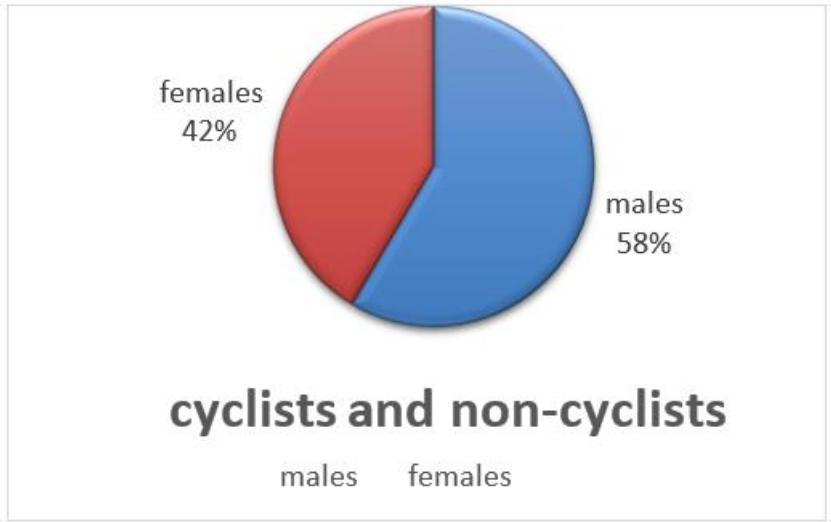


Figure 1

- Out of 53 participants of cyclists and 53 participants of non-cyclists, 2 participants (4%) were left handed and 51 participants (96%) were right handed.

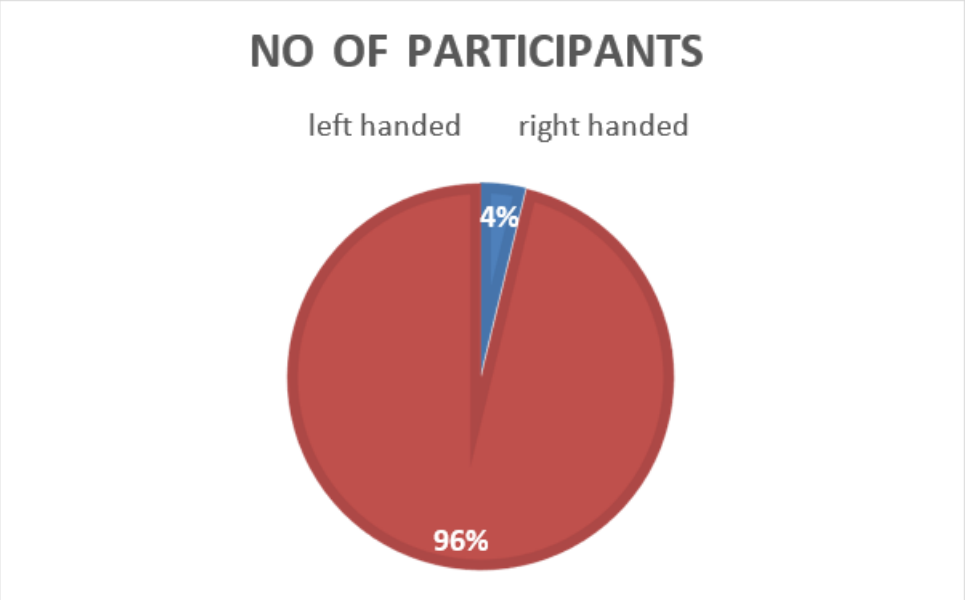


Figure 2

Table 1: Mean and standard deviation of right and left handgrip strength for female cyclists.

	Minimum Value	Maximum Value	Mean	Standard Deviation
Female cyclists (R)	32kg	44kg	36.73kg	±3.35kg
Female cyclists (L)	26kg	42kg	33.73kg	±3.769kg

Inference: The mean hand grip strength of right hand for female cyclists was 36.73±3.35kg and of left hand was 33.73±3.769kg.

Table 2: Mean and standard deviation of right and left hand grip strength for female non-cyclists.

	Minimum Value	Maximum Value	Mean	Standard Deviation
Female non-cyclists (R)	14kg	30kg	22.5kg	±3.764kg
Female non-cyclists (L)	12kg	30kg	19.82kg	±4.043kg

Inference: The mean hand grip strength of right hand for female non-cyclists was 22.55±3.764kg and of left hand was 19.82±4.043kg

Table 3: Mean and standard deviation of right and left hand grip strength for male cyclists.

	Minimum Value	Maximum Value	Mean	Standard Deviation
Male cyclists (R)	42kg	50kg	45.74kg	±2.408kg
Male cyclists (L)	38kg	46kg	41.55kg	±1.912kg

Inference: The mean hand grip strength of right hand for male cyclists was 45.74±2.408kg and of left hand was 41.55±1.912kg.

Table 4: Mean and standard deviation of right and left hand grip strength for male non-cyclists.

	Minimum Value	Maximum Value	Mean	Standard Deviation
Male non-cyclists (R)	28kg	38kg	32.58kg	±2.262kg
Male non-cyclists (L)	24kg	30kg	27.42kg	±1.649kg

Inference: The mean hand grip strength of right hand for male non-cyclists was 32.58±2.262kg and of left hand was 27.42±1.649kg.

Table 5: Test for normality

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
cycr	.157	53	.002	.922	53	.002
cycl	.223	53	<.001	.914	53	.001
noncycr	.204	53	<.001	.912	53	<.001
noncycl	.247	53	<.001	.885	53	<.001

a. Lilliefors Significance Correction

Inference: The data for right and left hand grip strength for Cyclists and age and gender matched non-cyclists did not pass the normality test as shown above, hence Mann Whitney U Test was used for statistical analysis.

Table 6: Statistical analysis - Mann Whitney U Test.

Mann-Whitney Test

Ranks

	cat	N	Mean Rank	Sum of Ranks
data1	1.00	53	78.01	4134.50
	2.00	53	28.99	1536.50
	Total	106		

Test Statistics[a]

	data1
Mann-Whitney U	105.500
Wilcoxon W	1536.500
Z	-8.242
Asymp. Sig. (2-tailed)	<.001

a. Grouping Variable: cat

Cyclists (R) v/s Non-cyclists (R)

Mann-Whitney Test

Ranks

	cat	N	Mean Rank	Sum of Ranks
data2	1.00	53	79.17	4196.00
	2.00	53	27.83	1475.00
	Total	106		

Test Statistics[a]

	data2
Mann-Whitney U	44.000
Wilcoxon W	1475.000
Z	-8.639
Asymp. Sig. (2-tailed)	<.001

a. Grouping Variable: cat

Cyclists (L) v/s Non-cyclists (L)

Inference: There is a statistically significant difference in both the right and left hand grip strength values in cyclists and age and gender matched non-cyclists with non-cyclists left and right hand grip strength being less than cyclists left

and right hand grip strength.

6. Discussion

One of the most commonly practiced forms of physical activity by society at large is cycling [1]. Hand grip is a crucial, though often overlooked, component of strength in cyclists. A good grip strength is not only vital for cyclists' performance but also important for injury prevention. Hand grip strength is a fundamental component of overall physical fitness, Non-cyclists, just like cyclists, can experience various health and functional benefits by maintaining and improving hand grip strength through targeted exercises and activities.

The aim of the research undertaken was to check whether or not there is a difference in the left and right hand grip strength in cyclists and age and gender matched non-cyclists in Central Mumbai using Jamar hand held dynamometer. A total of 106 participants participated in the study out of which 53 participants were cyclists and 53 participants were age and gender matched non-cyclists. Out of 53 participants of cyclists and non-cyclists, 22 participants (41.50%) were females and 31 participants (58.49%) were males The results showed that there was a statistically significant difference in both the right and left hand grip strength values in cyclists and age and gender matched non-cyclists with non-cyclists left and right hand grip strength being less than cyclists left and right hand grip strength.

Handgrip strength plays a major role in 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 [2].

The observed increase in hand grip strength among cyclists can be attributed to several factors inherent to the nature of cycling. One of the primary contributors is the repetitive gripping and releasing of the handlebars during cycling, which engages and strengthens the muscles in the hands, wrists, and forearms. This finding aligns with previous research highlighting the specific muscular adaptations that occur as a result of regular cycling [11]. Non-cyclists might not regularly perform such repetitive gripping motions, leading to less developed hand strength.

Furthermore, the continuous pressure applied to handlebars during cycling contributes to isometric contractions in the hand muscles, promoting strength [11]. Non-cyclists may not experience this sustained resistance, resulting in comparatively lower hand grip strength. Regular use and adaptation play a key role in the differing hand strength levels between cyclists and non-cyclists.

Moreover, the nature of cycling involves maintaining a stable grip for extended periods, promoting endurance in hand muscles. Non-cyclists may not engage in activities that require this prolonged grip, leading to reduced endurance and strength [2]. This constant pressure and resistance serve as a unique form of training for the hands and forearms, promoting both strength and endurance.

The robustness of the observed difference in hand grip strength between cyclists and non-cyclists is further supported by previous studies that have investigated the impact of specific sports on upper body strength. A study by Rønnestad and Mujika 2014 demonstrated that endurance trainees, including cyclists, exhibit increased upper body strength compared to sedentary controls. The findings suggest that the demands of endurance sports, such as cycling, extend beyond the lower limbs, influencing overall muscular development.

7. Conclusion

- On basis of our analysis our study concludes that there is a statistically significant difference in the left and right hand grip strength between cyclists and age and gender matched non-cyclists respectively.
- Non-cyclists showed reduced left and right hand grip strength in comparison to cyclists.

8. Recommendations for Future Study

- Study can be done in a larger area including a larger population.
- Participants from various age groups can be included.
- Study can be done on cyclists using different types of cycles and handlebars and their effects on handgrip strength.

References

[1] Piotrowska SE, Majchrzycki M, Rogala P, Mazurek-Sitarz M. Lower extremity and spine pain in cyclists. Annals of Agricultural and Environmental Medicine.2017; 24 (4).
[2] Sanura TD, Gokhale P. Comparison of Grip Strength in Dominant and Non-Dominant hand in Recreational Cyclists.
[3] Jeukendrup AE, Martin J. Improving cycling performance: how should we spend our time and money. Sports medicine.2001 Jun; 31: 559-69.
[4] 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.
[5] 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.
[6] Silberman MR. Bicycling injuries. Current sports medicine reports.2013 Sep 1; 12 (5): 337-45.
[7] Fathima AV, Dutt AR, Bhat SK, Bhat B, Fakruddin AV. A comparative study of handgrip strength among sedentary and non-sedentary workers. National Journal of Physiology, Pharmacy and Pharmacology.2017; 7 (3): 265.
[8] Kamarul T, Ahmad TS, Loh WY. Hand grip strength

in the adult Malaysian population. Journal of Orthopaedic Surgery.2006 Aug; 14 (2): 172-7.

[9] 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.

[10] 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.

[11] Millet GP, Jaouen B, Borrani F, Candau R. Effects of concurrent endurance and strength training on running economy and. VO (2) kinetics. Med Sci Sports Exerc.2002 Aug; 34 (8): 1351-9. doi: 10.1097/00005768-200208000-00018. PMID: 12165692.

[12] Neumayr G, Hoertnagl H, Pfister R, Koller A, Eibl G, Raas E. Physical and physiological factors associated with success in professional alpine skiing. Int J Sports Med.2003 Nov; 24 (8): 571-5. doi: 10.1055/s-2003-43270. PMID: 14598192.

[13] Rønnestad BR, Mujika I. Optimizing strength training for running and cycling endurance performance: A review. Scand J Med Sci Sports.2014 Aug; 24 (4): 603-12. doi: 10.1111/sms.12104. Epub 2013 Aug 5. PMID: 23914932