

# LONG-COVID IMPACT ON PHYSICAL FUNCTION IN MALES VS. FEMALES

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## BACKGROUND

- COVID-19 or SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) is a respiratory disease that can cause a range of acute symptoms, such as fever, cough, sore throat, loss of taste or smell, body aches, fatigue, and even death (1).
- Some symptoms, however, are **persistent and last longer than four weeks** after initial infection. This is known as Long-COVID, long-haul COVID, post-acute COVID-19 syndrome, or chronic COVID (1,2,3,4).
- Common Long-COVID symptoms** include muscle weakness, difficult or labored breathing, fatigue, brain fog, chest pain, heart palpitations, joint pain, changes in taste or smell, sleep problems, and changes in mental health(1).
- Even with mild cases of COVID-19, early reports suggest these persistent effects on physical and psychological function may have a large impact on the health and quality of life of COVID-19 survivors (1,2,3,4), although the effects on overall physical function and exercise capacity are not known.
- Sex Differences in Long-COVID:** Early reports indicate females suffer higher rates of Long-COVID symptoms than males: as high as 4 females to every 1 male (5). Mortality rates in the acute stages of COVID-19 however are lower in women and they are less likely develop severe complications (10). This may be because of various factors such as different sex hormones, such as estrogens, greater immune response, and women's greater tendency for hand hygiene (8,10).

**AIM:** Determine if cardiovascular, neuromuscular, and physical response to Long-COVID differs between males and females.

**HYPOTHESIS:** Cardiorespiratory and muscle function of COVID-19 survivors will be less than healthy age-matched controls, but this difference will be greater in females than in males.

## METHODS

- Subjects: Control Matched**
  - To date 87 subjects have been tested with 24 pairs of age, sex, race, weight, and height matched controls (See Table).
- Cardiorespiratory Fitness: Aerobic Capacity**
  - Subjects cycled on a recumbent ergometer and expiratory gases and heart rate were continuously recorded. Each subject completed a modified YMCA protocol to predict maximal oxygen consumption (VO<sub>2</sub> Max, i.e. aerobic capacity) involving measurement of steady state heart rate at various submaximal cycling intensities.
- Functional Neuromuscular Assessments**
  - Handgrip Strength**
    - Maximal bilateral hand strength was assessed from a standing position with subjects squeezing as hard as possible for 1-2 seconds using a handgrip dynamometer
  - 30-second Sit-to-Stand (30s STS)**
    - 30s STS was conducted using an armless chair. From a sitting position, subjects stood (and return to sitting) as many times as possible in 30 seconds while maintaining their arms across their chest (9).
- Physical Activity: 7-day Accelerometer monitoring**
  - The GT3X accelerometer records continuous, high resolution physical activity and sedentary information. Participants wore the accelerometer around their hip for 7 days except during sleep and water activities.
- Facit Fatigue Questionnaire**
  - Subjects completed a twelve-question survey concerning their amount of fatigue through Qualtrics on a provided tablet device or laptop.



Functional Assessments: Handgrip Strength (google)

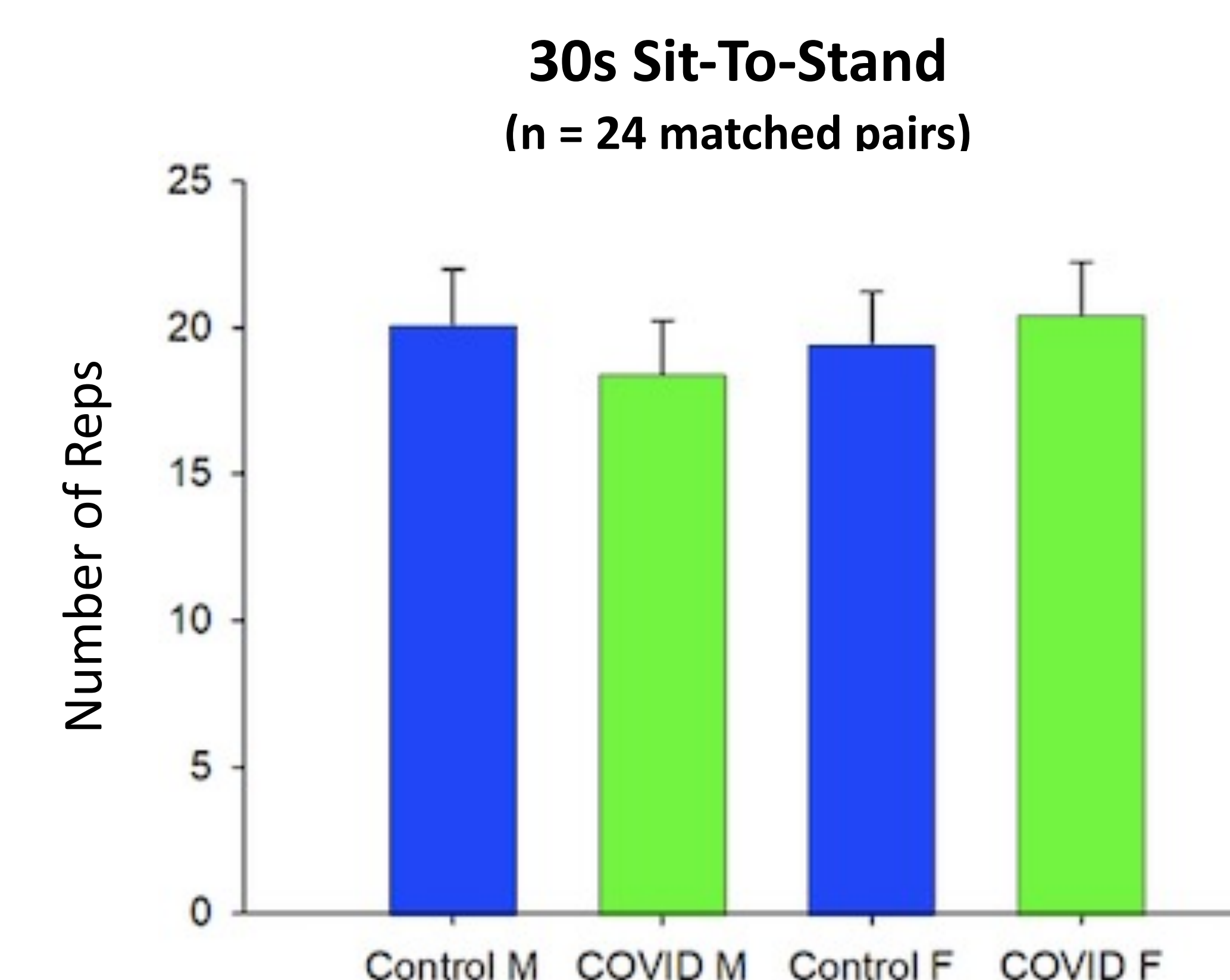
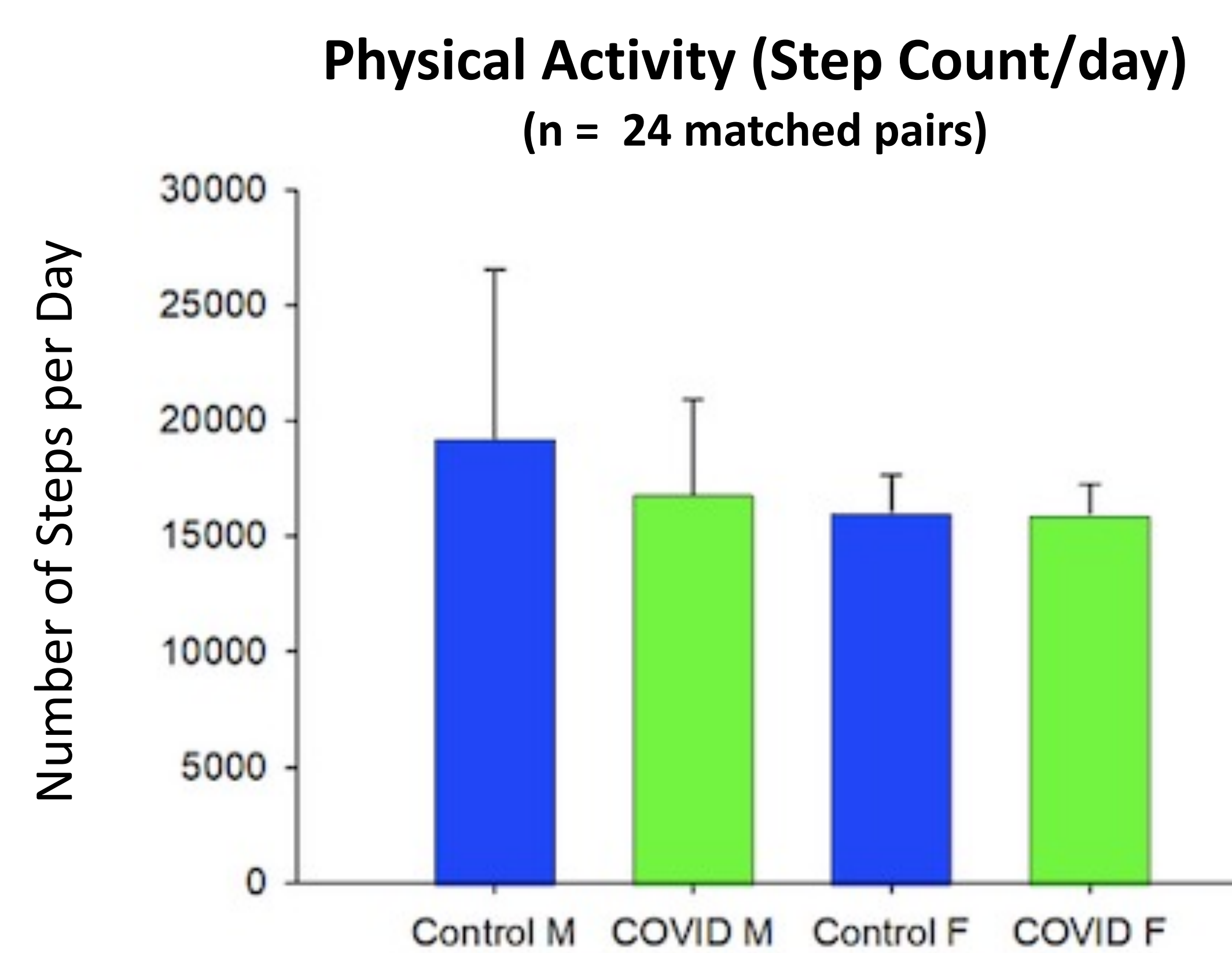
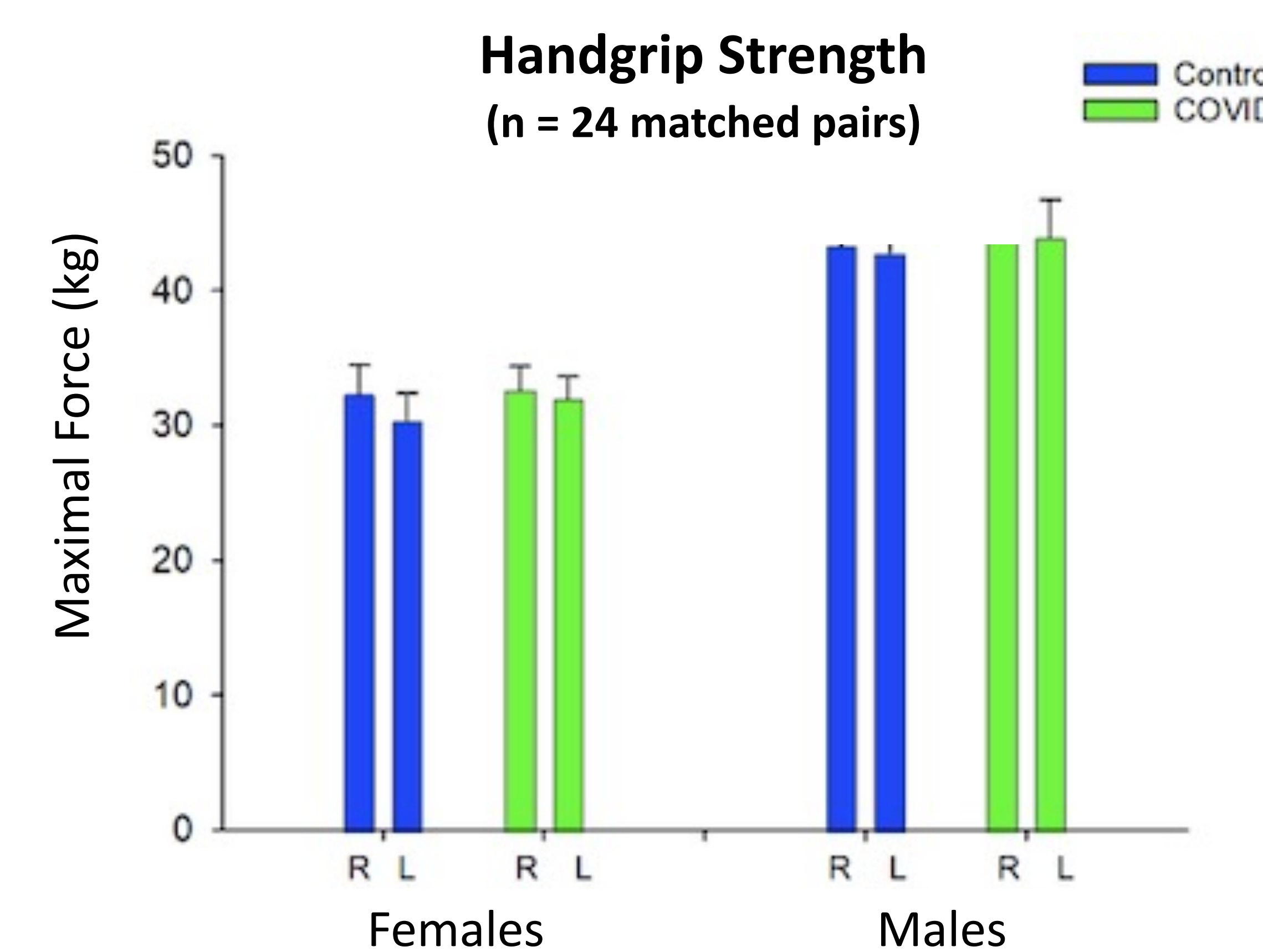
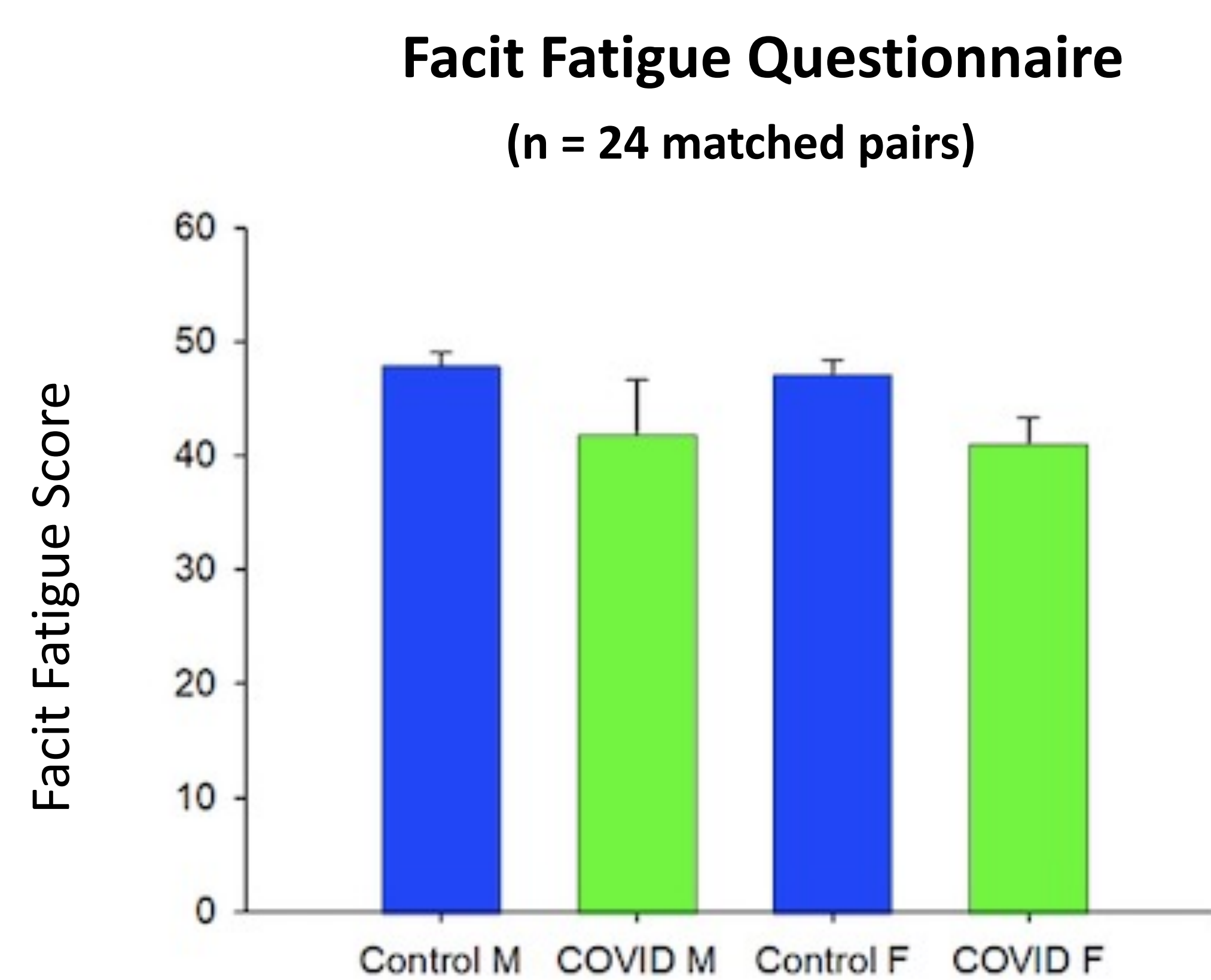
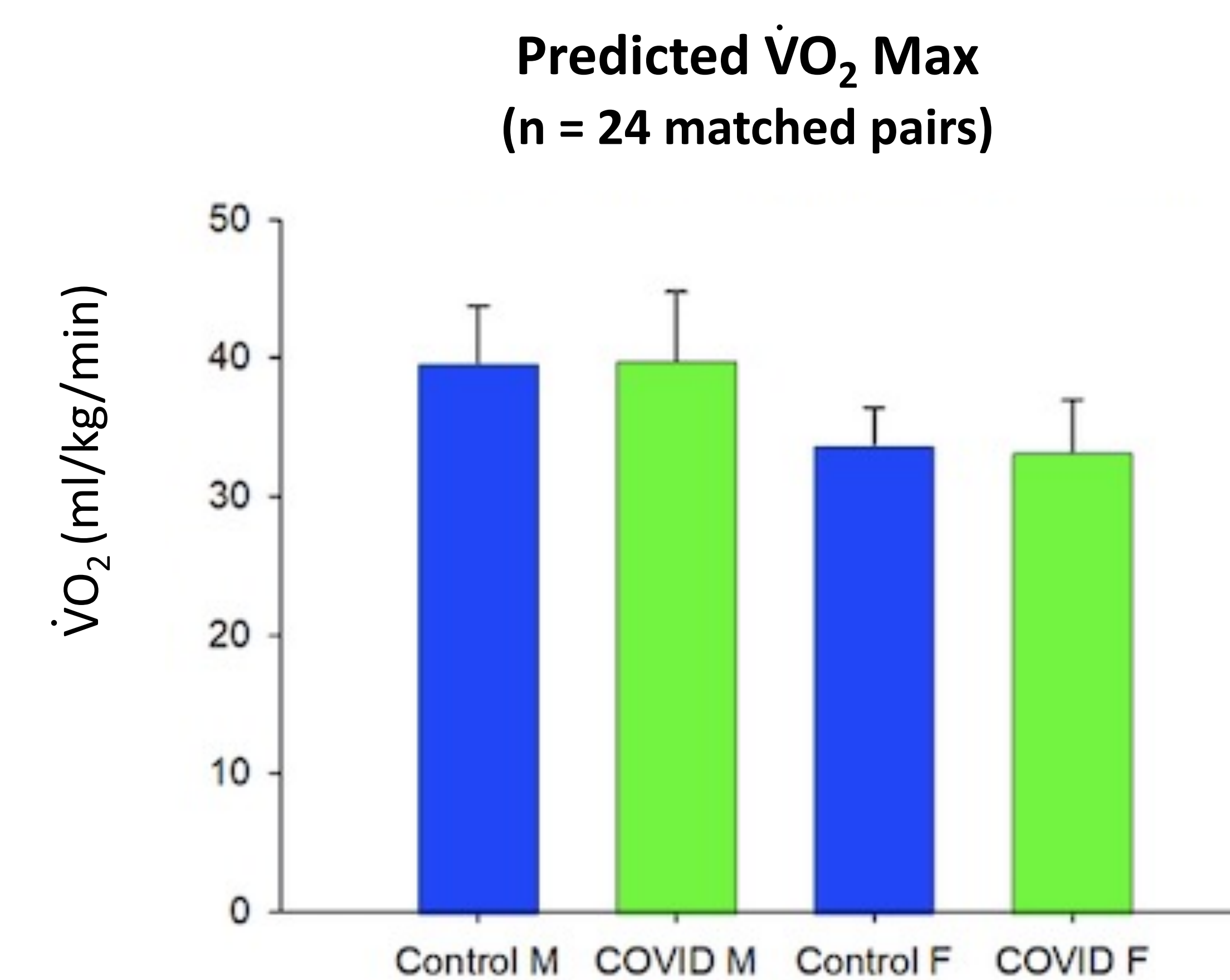
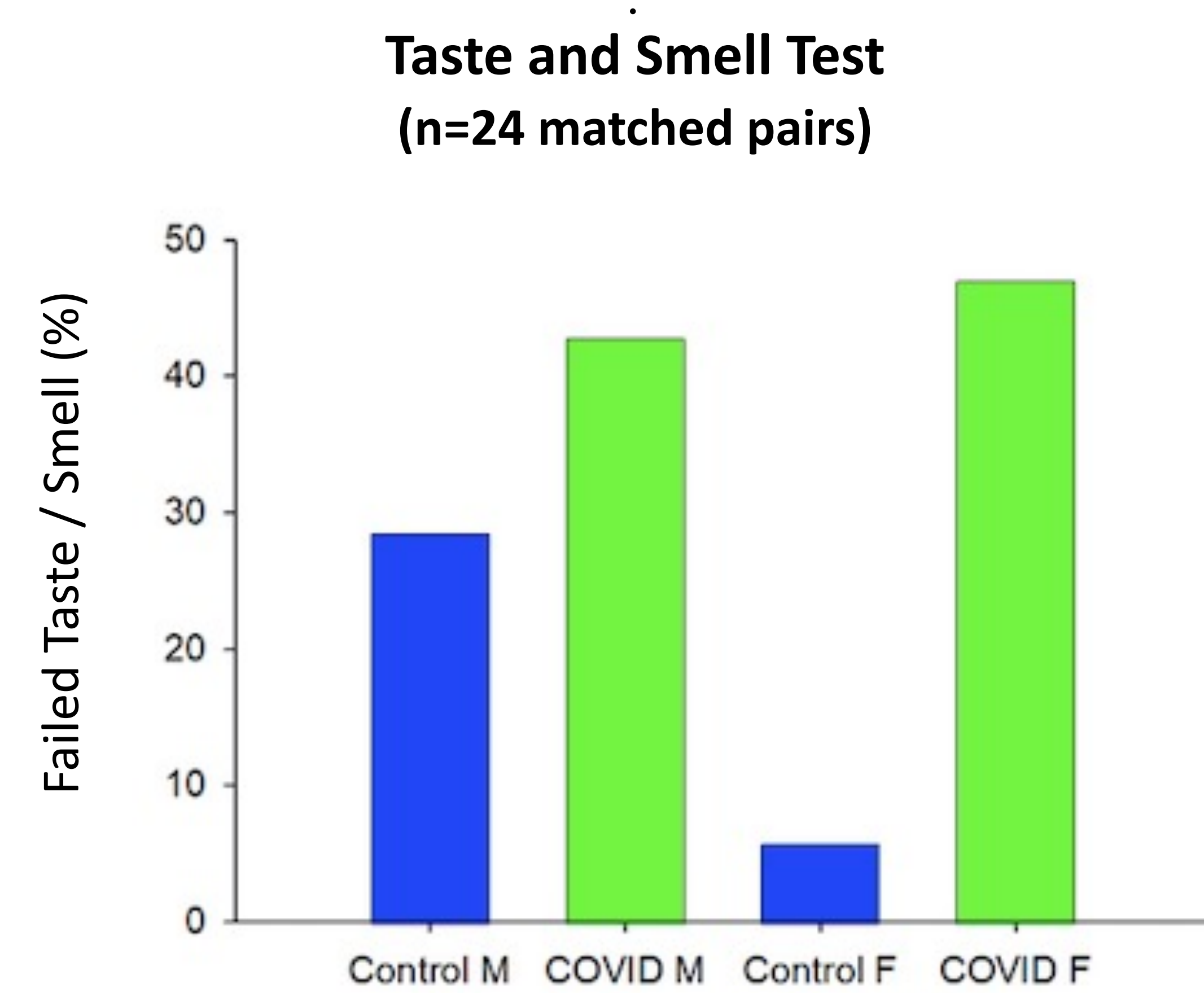
Aerobic Capacity Testing

## RESULTS

Subjects n=87	COVID-19 Survivors		Control	
	Male	Female	Male	Female
Number	17	41	9	20
Age (yr)	45 ± 17 (20-71)	42 ± 18 (19-77)	43 ± 18 (21-66)	34 ± 16 (21-64)
Weight (kg)	84 ± 21 (56-124)	74 ± 18 (49-132)	70 ± 5 (63-82)	64 ± 16 (44-120)
Height (cm)	176 ± 9 (164-196)	168 ± 6 (151-183)	176 ± 5 (164-183)	166 ± 5 (158-173)
Body Mass Index (kg/m <sup>2</sup> )	26.8 ± 5.5 (19-34.2)	26.1 ± 6.5 (19-47.5)	22.6 ± 1.5 (20.6-26)	23.3 ± 5.8 (17.8-44.1)
Failed Taste/Smell (%)	53%	34%	22%	10%

Format: Average ± Standard Deviation (Range)

Control Matched Pairs n=24 pairs (7 Male, 17 Female)	Control Matched Pairs	
	COVID	Control
Age (yr)	39 ± 18	39 ± 18
Weight (kg)	69 ± 13	66 ± 14
Height (cm)	169 ± 6	169 ± 7
Body Mass Index (kg/m <sup>2</sup> )	24 ± 4.7	23.3 ± 5.2
Failed Taste/Smell (%)	46%	13%
Facit Fatigue Score (FACFSS)	41 ± 10 (29-52)	48 ± 4 (40-52)



## RESULTS SUMMARY

Preliminary results:

### A) Data collected in all subjects to date (n=87)

- Average time since infection: 7.5 months
- 5 of 87 were hospitalized: most were mild to moderate cases
- Large age range of people assessed: 19-77 years
- 46% of total COVID survivors failed the taste/smell test

### B) Control-matched comparisons (n=48, 24 pairs)

- For COVID-19 survivors matched for sex and age with controls, there was no significant difference in predicted aerobic capacity (a test of fitness), handgrip strength, sit-to-stand ability, or activity levels in both males and females. However, COVID-19 survivors, male and female, had higher rates of loss of taste and smell more than controls.
- Females reported greater feelings of fatigue post-COVID than control matched females, but males did not.

## CONCLUSION

**COVID-19 survivors ~7.5 months post-infection, had impaired taste and smell in both sexes and greater feelings of fatigue in females. However, there were minimal physical functional deficits relative to controls in both males and females.**

## FUTURE DIRECTIONS

- As we recruit and test more severe COVID-19 cases, we expect Long-COVID will show impaired cardiovascular, neuromuscular, and physical function for both males and females.
- Understanding the long-term and persistent impact of COVID-19 on various body systems will help determine best strategies for rehabilitation and areas to target for each sex.

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