Muscle Strength and Cardiorespiratory Fitness in Children with a Chronic Inflammatory Disease

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Background

- Children with a **chronic inflammatory disease (CID)** often have *low cardiorespiratory fitness (CRF)* & poor tolerance for maximal testing.[1,2,3]
- **Handgrip strength (HGS) test** is an alternative indicator of health, and a valid & reliable measure of muscle strength in children.[4,5,6]
- No study to date has examined the **relationship** between **CRF & HGS** in children.

Objectives

1) Compare (a) CRF and (b) HGS in children with a CID and controls.
2) Determine the relationship between CRF and HGS in children.

Methods

- **Participants:** Ages 7-17 with cystic fibrosis, chronic kidney disease, inflammatory bowel disease, juvenile idiopathic arthritis, or type 1 diabetes for ≥1 yr & healthy controls with no diagnoses.
- **HGS:** Average of both hands using handheld dynamometer.
- **CRF:** Peak oxygen uptake (VO_2 peak) determined using cardiopulmonary exercise testing on a cycle ergometer.

Results

Table 1: Participant characteristics

	CNT	CID
N (% F)	19 (32)	92 (60)
Age (yr)	13.3 ± 2.7	13.1 ± 2.8
Height %ile	64.8 ± 28.7	56.3 ± 27.6
Weight %ile	68.3 ± 26.0	59.7 ± 27.0
YPHV (yr)	0.3 ± 2.3	0.2 ± 2.4

Data presented as mean ± SD. *CNT*, healthy controls; *YPHV*, years to peak height velocity.
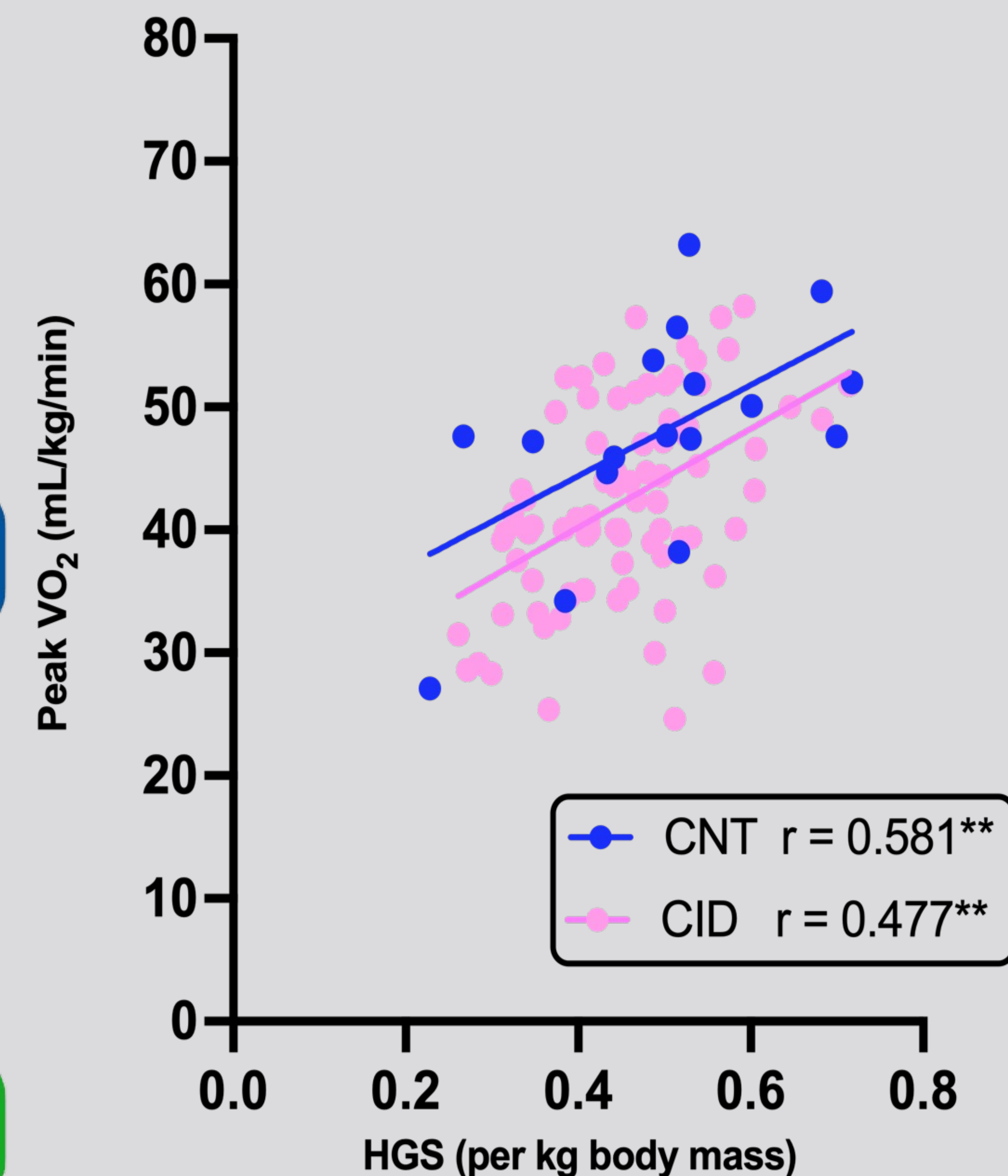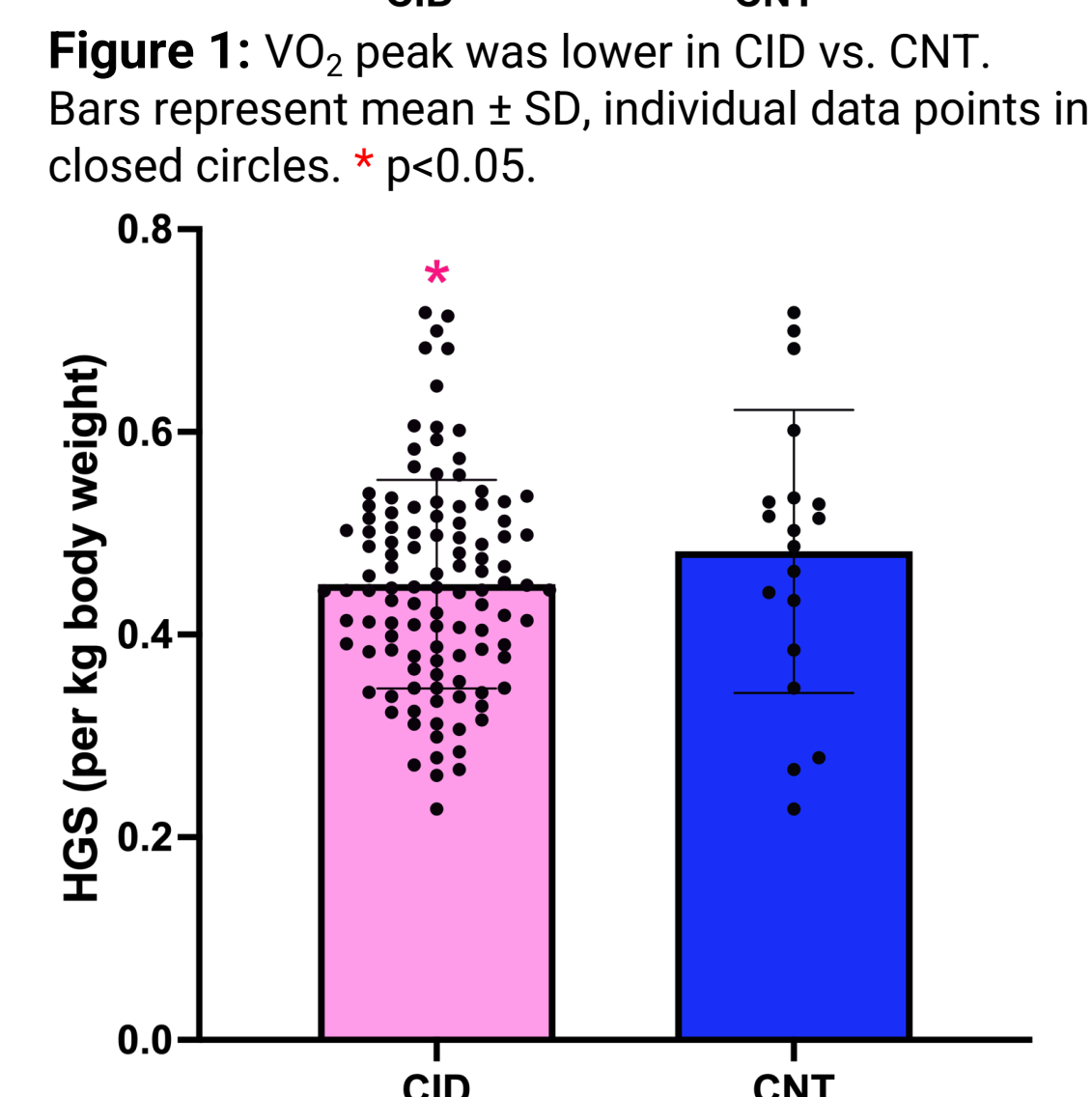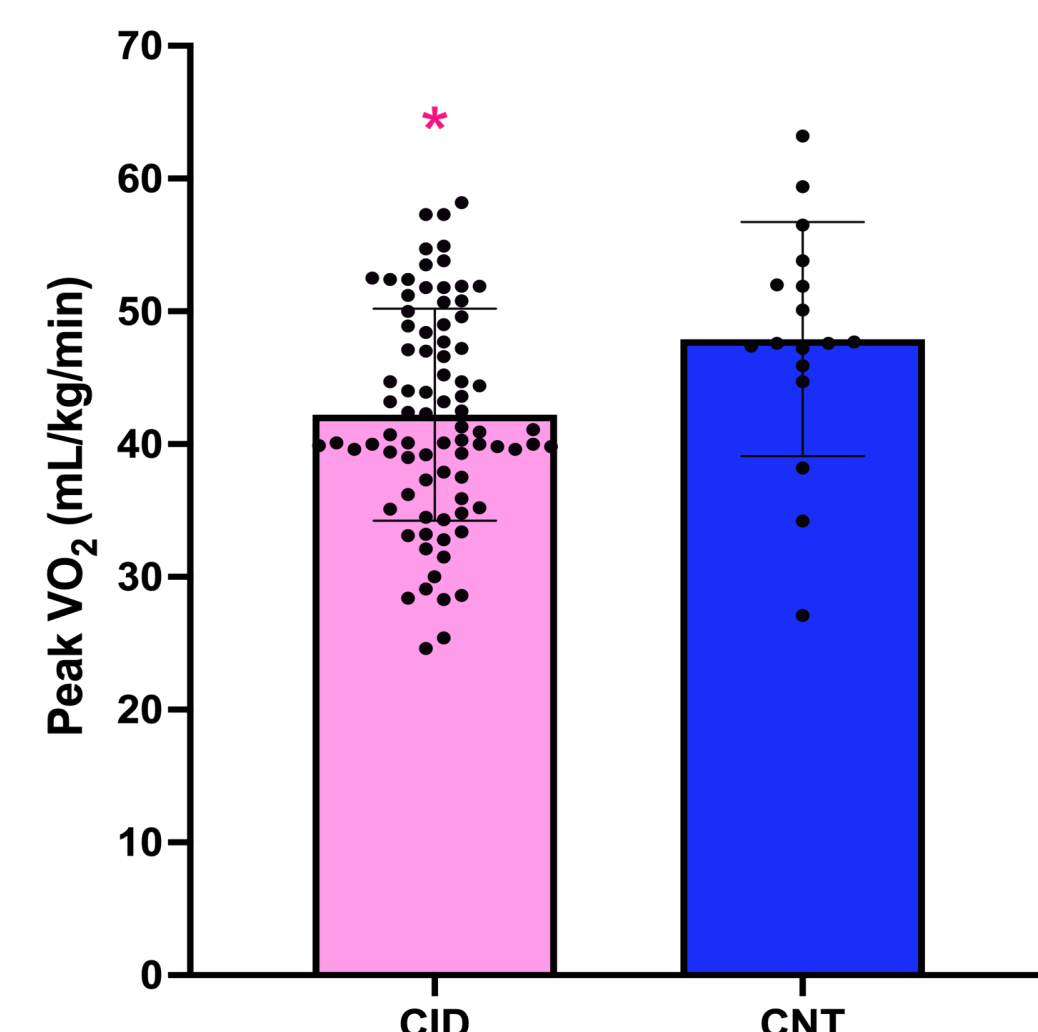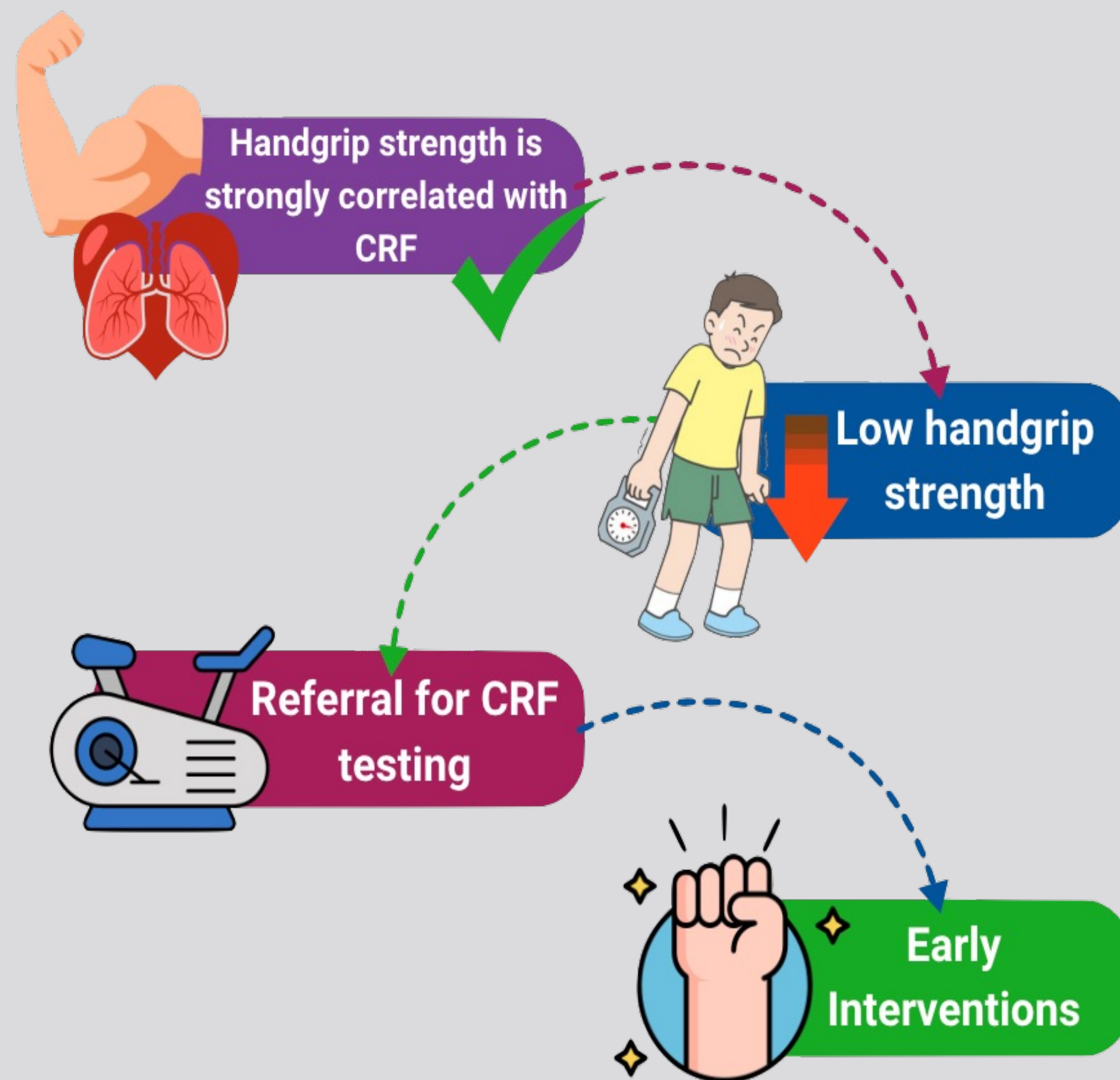
Table 2: HGS was a significant predictor of CRF, defined as relative VO_2peak.

Model 1 ($F_{(3,95)}$=31.912, $p<0.001$)			
Predictors	B	SE	p
HGS	23.339	2.742	<0.001
YPHV	-1.512	0.288	<0.001
Sex	2.533	1.336	<0.001
Model 2 ($F_{(7,91)}$=14.832, $p<0.001$)			
HGS	59.619	11.252	<0.001
YPHV	2.602	2.091	0.217
Sex	11.170	6.195	0.075
HGS * YPHV	-9.528	4.884	0.054
HGS * Sex	-20.674	13.568	0.131
HGS * YPHV * Sex	13.283	6.437	0.042

Figure 1: VO_2 peak was lower in CID vs. CNT. Bars represent mean ± SD, individual data points in closed circles. * p<0.05.

Figure 2: HGS was lower in CID vs. CNT. Bars represent mean ± SD, individual data points in closed circles. * p<0.05.

Discussion

- Although limited by sample size within CIDs, these results suggest HGS testing can screen for low CRF & recommend them for comprehensive CRF testing.
- Identifying deficits will allow for earlier interventions to support and optimize health outcomes.

Handgrip strength may be an indicator of cardiorespiratory fitness in children with and without a chronic inflammatory disease.

Handgrip strength is strongly correlated with CRF

Low handgrip strength

Referral for CRF testing

Early Interventions

CNT r = 0.581**
CID   r = 0.477**

Figure 3: Handgrip strength is a predictor of VO_2peak in children with a CID and healthy controls. Each individual data point represents one participant, with CNT in blue and CID in pink. ** = p <0.01.

References

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Acknowledgements

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