

Giants in Chest Medicine
Karlman Wasserman, MD,
PhD, FCCP



Tomohiko Kisaka, MD, PhD
Daniel Dumitrescu, MD
Harry B. Rossiter, PhD
Kathy E. Sletsema, MD

Karlman Wasserman was born in Brooklyn, New York, in 1927. He graduated from high school in June 1944, and at the age of 17, at the height of World War II, he joined the US Army Specialized Training Reserve Program. Before he was able to complete his studies in engineering at Princeton University, he was called to active duty, serving in the postwar Army of Occupation in Japan from September 1945 to December 1946.

Dr Wasserman used the Servicemen's Readjustment Act, also known as the G.I. Bill, to complete his undergraduate education at Upsala College, New Jersey, in 1947, majoring in chemistry with a minor in biology. A subsequent move to Tulane University provided postgraduate training in physiology in 1948, and kindled life-long interest in experimental physiologic research.

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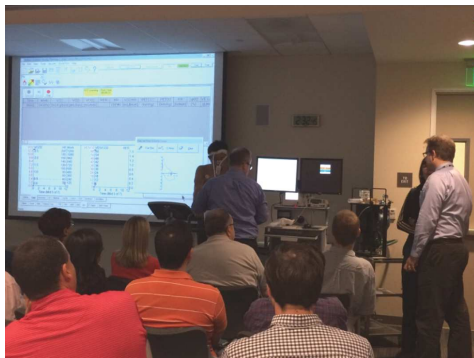
Why?



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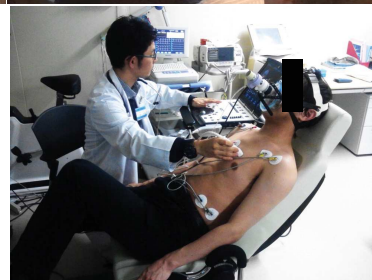
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Kisaka T, et al. Chest. 2017;151(6):1209-1212.



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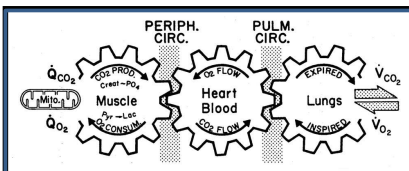
Hear



Heart



[Giants in Chest Medicine]

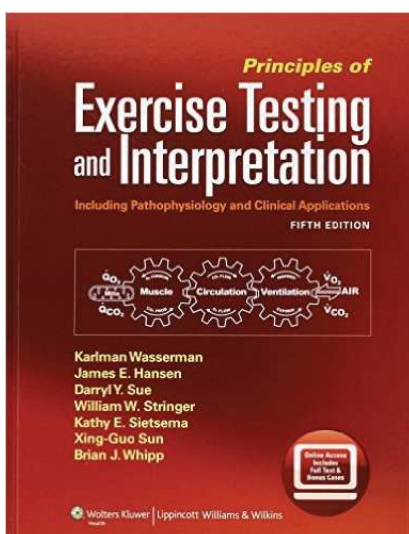


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心不全の緩和ケア：治療をこえて今こそ行動を。
人生の最期を改善するための「生」理学



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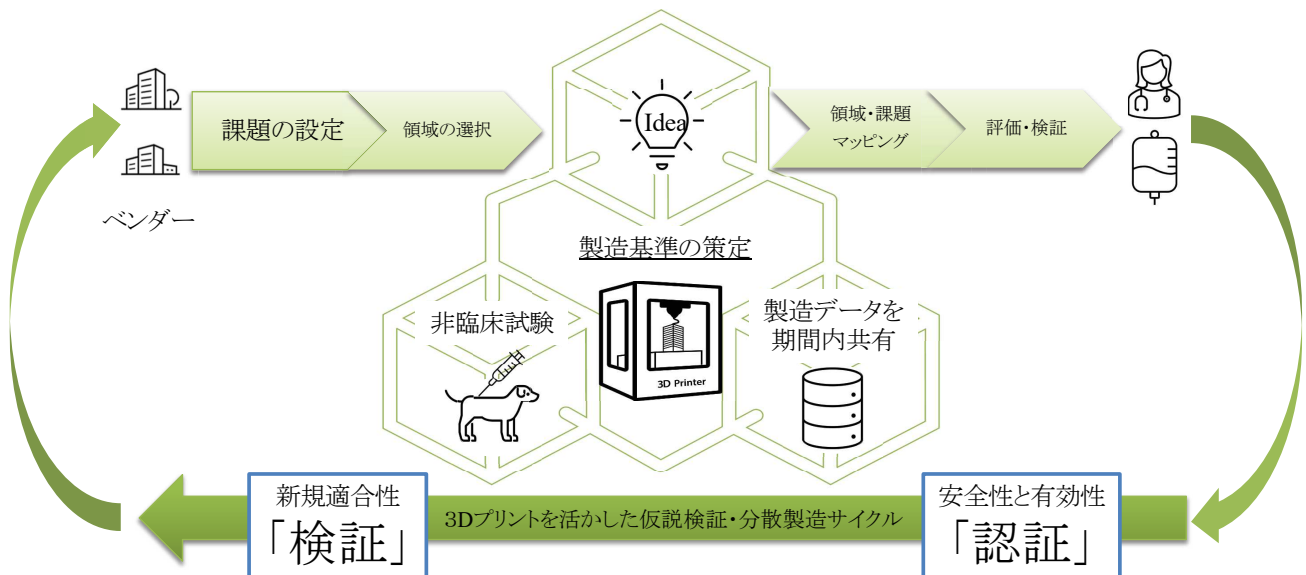
Karlman Wasserman, Tomohiko Kisaka, Melissa L. Bates, Tingyang Zhou, Lei Ni, Robert Banzett, Nassib Chamoun
Journal of Applied Physiology Published 15 August 2015 Vol. 119 no. 4, 423-425 DOI: 10.1152/jappphysiol.00434.2015



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Mechanical Assistance During Unloaded Pedaling Improves the Dynamic Range of the Metabolic Response in Obesity

Tolulope Popoola¹, William Stringer¹, Tomohiko Kisaka², Kathy Sietsema¹

¹Los Angeles Biomedical Institute (LABIOMED) at Harbor-UCLA Medical Center, Torrance, CA. ²Hiroshima University, Hiroshima, Japan.

“KINESITHERAPY APPARATUS AND ANAEROBIC THRESHOLD IDENTIFYING METHOD”

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To hear patients' **Pain; Complaint; Depression**

改良ニーズの場合も、開発初期段階からデザイン思考と、患者や医療者の「痛み」「涙」「不平」「不満」を聴く力が根底にある

ABSTRACT

PURPOSE: Obese individuals have a higher $\dot{V}O_2$ than lean individuals for a given level of cycling exercise due to both higher resting metabolic rate and the higher metabolic cost of lifting heavier legs against gravity. In those with limited exercise capacity, this may result in the majority of the total increase in $\dot{V}O_2$ occurring during the initial phase of an exercise test. This increase may therefore be a poor indicator of the true aerobic capacity of the individual. We hypothesized that mechanical assistance of pedaling early in exercise would reduce the initial increase in $\dot{V}O_2$ of obese subjects, increasing the range of $\dot{V}O_2$ over the incremental phase.

METHODS: 20 obese (O, BMI 40.2 ± 2.1) and 20 lean (L, BMI 24.2 ± 2.2) were randomized to exercise testing and then of unladen (unloaded) cycling (UC) or with mechanical assistance (MA) during the initial phase of an incremental exercise test on a cycle ergometer. The MA protocol consisted of 10 minutes of unloaded cycling (UC), and for the other 10 minutes, there was mechanical assistance to pedaling (MA) using a cycle ergometer. The MA protocol consisted of 10 minutes of unloaded cycling (UC), and for the other 10 minutes, there was mechanical assistance to pedaling (MA) using a cycle ergometer. The MA protocol consisted of 10 minutes of unloaded cycling (UC), and for the other 10 minutes, there was mechanical assistance to pedaling (MA) using a cycle ergometer.

PURPOSE

To evaluate the effect of exercise testing protocol on the metabolic response of obese subjects.

HYPOTHESIS

Mechanical assistance of pedaling early in exercise would reduce the initial increase in $\dot{V}O_2$ of obese subjects, increasing the range of $\dot{V}O_2$ over the incremental phase.

METHODS

Twenty obese and lean subjects were randomized to exercise testing and then of unladen (unloaded) cycling (UC) or with mechanical assistance (MA) during the initial phase of an incremental exercise test on a cycle ergometer. The MA protocol consisted of 10 minutes of unloaded cycling (UC), and for the other 10 minutes, there was mechanical assistance to pedaling (MA) using a cycle ergometer.

RESULTS

Table 2: Resting Metabolic Measurements

	Lean		Obese	
	UM	MC	UM	MC
$\dot{V}O_2$ (L/min)	0.29 ± 0.09	0.34 ± 0.14	0.35 ± 0.07	0.33 ± 0.18
$\dot{V}O_2$ (L/min)	0.27 ± 0.07	0.33 ± 0.14	0.30 ± 0.07	0.30 ± 0.09
REER	0.82 ± 0.11	0.87 ± 0.14	0.86 ± 0.06	0.86 ± 0.06
HR (bpm)	79 ± 12	78 ± 20	78 ± 15	84 ± 17

RESULTS



Figure 2: Proportions of the total range of peak $\dot{V}O_2$. The MA protocol increased the proportion of total exercise response represented by incremental exercise capacity in the obese group when compared to the UM protocol.

Table 3: Warm-up Metabolic Measurements

	Lean		Obese	
	UM	MC	UM	MC
$\dot{V}O_2$ (L/min)	0.50 ± 0.13	0.40 ± 0.08	0.71 ± 0.21	0.54 ± 0.17
$\dot{V}O_2$ (L/min)	0.43 ± 0.14	0.37 ± 0.08	0.61 ± 0.20	0.46 ± 0.15
REER	0.60 ± 0.13	0.69 ± 0.14	0.86 ± 0.06	0.85 ± 0.07
HR (bpm)	84 ± 18	82 ± 18	86 ± 14	80 ± 18

DISCUSSION

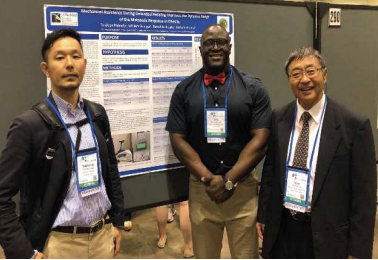
- The Strength Ergo 8 cycle provides mechanical assistance during the initial phase of an incremental exercise test.
- This effect may be most important (even harmful) during exercise testing in patients with a limited ability to exercise aerobically, including metabolic obesity.
- This device may be useful in both exercise testing and training & rehabilitation.

CONCLUSIONS

- A protocol utilizing a cycle ergometer equipped to provide mechanical assistance during the initial phase of an incremental exercise test was effective in increasing the initial increase in $\dot{V}O_2$ with unloaded cycling.
- The modified cycle protocol (MC) extended the range of incremental $\dot{V}O_2$ for the majority of these testing obese and normal weight subjects (~185 and 101 ml of $\dot{V}O_2$, respectively).
- While the effect-size was small relative to peak exercise $\dot{V}O_2$ response in these healthy subjects, it may be a significant proportion of the entire response in a patient with metabolic limitation, and therefore useful in exercise testing and training.

REFERENCES

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ACSM annual meeting 2019, Orlando, FL



BACKGROUND

Standardized measures of functional capacity quantified in metabolic terms by cardiopulmonary exercise testing (CPET) are useful in a range of clinical contexts such as being severity of cardiovascular disease, identifying risk for invasive procedures and estimating prognosis in a number of chronic conditions, as well as for evaluating fitness in healthy populations (1). The most widely used parameters in these reports are the peak $\dot{V}O_2$ and anaerobic threshold (AT) which relate the integrated capacity to sustain, transport and utilize oxygen by the respiratory, cardiovascular, and energy metabolism systems. These variables and others measured during CPET normally vary by age, gender, size and fitness and measures relative to the predicted values of reference values (2). As obesity has become a global pandemic, problems related to characterizing exercise function in obese population are increasingly encountered such as the effect of exercise testing protocol on the ability to reliably measure parameters of exercise function in obese patients. The greater metabolic mass generated by heavier exercise protocols may modify either in steady state or during the initial phase of an exercise test. This increase in $\dot{V}O_2$ is exaggerated by the requirement to raise metabolic weight against gravity (3). As a result, the initial phase of an exercise test may represent a high proportion of total exercise capacity for heavier obese subjects. This can result in rapid termination of the test and limit interpretation of the data, especially with respect to identification of abnormal parameters like AT.



Figure 1: Strength Ergo 8 and screen interface during modified cycling (MC).

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