

Physical Exercise in Cystic Fibrosis

-studies on muscle strength, oxygen uptake and lung function in young adult patients

AKADEMISK AVHANDLING

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- I: Magnusson Thomas E, **Sahlberg M**, Svantesson U. The effect of resistance training on handgrip strength in young adults. *Isokin Exerc Sci* 2008; 16:1-7
- II: **Sahlberg M**, Svantesson U, Magnusson Thomas E, Strandvik B. Muscular Strength and Function in Patients with Cystic Fibrosis. *Chest* 2005; 127:1587-1592
- III: **Sahlberg M**, Svantesson U, Magnusson Thomas E, Andersson B.A, Saltin B, Strandvik B. Muscular strength after different types of training in physically active patients with cystic fibrosis. *Scand J Med Sci Sports* 2008; Doi:10.1111/j.1600-0838.2007.00691.x
- IV: **Sahlberg M**, Eriksson B.O, Sixt R, Strandvik B. Cardiopulmonary Data in Response to 6 Months of Training in Physically Active Adult Patients with Classic Cystic Fibrosis. *Respiration; Accepted for publication*

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Abstract

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Muscular strength, lung function and exercise capacity are internationally reported to be markedly impaired in adult patients with cystic fibrosis (CF). Since 20 years physical exercise is one important part in the treatment of patients with CF in Sweden. Handgrip strength is reported to relate to nutrition and activity of daily living. Decreased handgrip strength has been found in patients with lung disease and a correlation to mortality has been claimed.

The aims of this thesis were to evaluate the effects of different type of training in young adult patients with classic CF on muscular strength, lung function and exercise capacity and to compare baseline data with matched healthy controls. One additional aim was to evaluate the effect of general resistance training (RT) of the upper extremities on handgrip strength in healthy subjects.

The effect on handgrip strength of 8 weeks of RT of the upper extremities was evaluated in healthy young adults. Muscular strength was assessed using 15 different tests representing hand-, arm/shoulder-, leg-, back- and abdominal muscles in patients with CF. Lung function was evaluated with spirometry, and exercise capacity was evaluated using an electromagnetic cycle ergometer. Serum levels of cytokines were investigated with ELISA technique and vitamin E with HPLC. The outcome of three months (m) of endurance training (ET) or RT followed by three m of mixed training performed three times weekly during 30-45 minutes was evaluated.

Healthy female (F) subjects significantly increased handgrip strength after 8 weeks of a general RT program for the upper extremities. A sample of 33 patients with classic CF showed muscular strength comparable to that of healthy age and sex matched control subjects (CS), but F patients were weaker in handgrip strength than CS and did not improve after 6 m of training. At baseline one of the leg tests in each sex and sit-ups during 30 s in male patients also showed lower values than controls. Handgrip strength correlated to $FEV_{1,0}$ in % of predicted values. In 19 patients muscular strength did not increase after 6 m, regardless of the kind of training. Three patients fulfilled the study on a lower and one on a higher frequency level and the result did not differ from the others. Maximal oxygen uptake (VO_{2max}) and work load (Watt/kg) showed significant increase by ET compared to RT after 6 m. The $FEV_{1,0}$ % predicted showed increase in M patients, who mainly performed ET. The results suggested that a 6 m program, 3 times/week of mainly ET may keep or even increase lung function but not muscular strength in young adult patients with CF.

Conclusions: General RT of the upper extremities increased handgrip strength in healthy F subjects but not in CF. Young adult patients with CF, who have regular physical exercise as part of the treatment, showed mainly muscular strength comparable to that of healthy control subjects, a well preserved lung function and good oxygen uptake. Six m of either mainly ET or RT did not increase muscular strength, exercise capacity and oxygen uptake. Lung function, after 6 m with mainly ET, showed improvement compared to RT.

Key words: Lung function, muscle strength, exercise capacity, endurance, resistance training.

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