



شبكة المعلومات الجامعية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ





شبكة المعلومات الجامعية



شبكة المعلومات الجامعية

التوثيق الالكتروني والميكرو فيلم

# جامعة عين شمس

التوثيق الالكتروني والميكروفيلم



نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
على هذه الأفلام قد أعدت دون أية تغيرات



## يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of  
15 – 25c and relative humidity 20-40 %



شبكة المعلومات الجامعية



# بعض الوثائق الأصلية تالفة



شبكة المعلومات الجامعية



بالرسالة صفحات

لم ترد بالأصل

B1.942

***Effect of Inspiratory Muscles  
Training on Functional Capacity in  
Patients with Chronic Heart Failure***

**Thesis**

**Submitted in partial fulfillment of the requirement  
for Doctoral degree in Physical Therapy**

**By**

**Abeer Ahmed Abdel- Hamed Fargaly**

Assistant lecturer at Physical Therapy Department For Cardiopulmonary Disorders  
and Geriatrics

**Faculty of Physical Therapy  
Cairo University  
2007**

## **Supervisors**

***Prof.Dr. Azza Abd El-Aziz Abd El-Hady***

Professor of physical therapy for cardiopulmonary disorders & geriatrics, Faculty of  
Physical Therapy , Cairo University

***Prof.Dr. Zeinab Mohammed Helmy***

Professor of physical therapy for cardiopulmonary disorders & geriatrics, Faculty of  
Physical Therapy , Cairo University

***Prof.Dr .Hamdy Soliman Mahmoud***

Consultant of Cardiology ,National Heart Institute

Effect of inspiratory muscles training on functional capacity in patients with chronic heart failure /Abeer Ahmed Abdel-Hamed/ Supervisors: Prof .Dr. Azza Abd El-Aziz Abd El-Hady. Professor of physical therapy for cardiopulmonary disorders &geriatrics, Faculty of Physical Therapy ,Cairo University, Prof .Dr. Zeinab Mohammed Helmy, Professor of physical therapy for cardiopulmonary disorders &geriatrics, Faculty of Physical Therapy , Cairo University ,Prof.Dr .Hamdy Soliman Mahmoud ,Consultant of Cardiology ,National Heart Institute. Doctoral thesis P.T.,2006

### **Abstract**

The aim of this study was to investigate the effect of inspiratory muscles training on parameters of functional capacity( $VO_{2max}$  and AT) in CHF. and to clarify other possible effects including; sympathetic overactivity and ventilatory function tests and gas exchanges during exercise. Forty male patients with chronic heart failure, Their ages ranges from 50-65 years old with  $EF \leq 40\%$  in stable condition. They were randomly divided into two equal groups: IMT, and control group. IMT group participated in inspiratory muscle training program, three times a week for three months and control group received medical treatment only. The results showed a significant increase in the of  $VO_{2max}$ , AT, and maximum oxygen pulse with significant reduction in VE the IMT group, over the control. While the parameters, peak work load ,and maximum heart rate ,were not significantly altered in both groups. Parameters of HRV, showed a significant increase in HF in the IMT group, with significant reduction of LF/HF where as there was no significant changes in LF with significant increase in the inspiratory muscle strength(MIP) and, rating of the perceived exertion(Borg scale) ,with a significant reduction in the resting cardiovascular parameters .

**(Key Words:** Chronic heart failure – Inspiratory muscle training – Functional capacity – Heart rate variability)



## *Dedication*

*To my **parents** for their support*

*To my **husband** for his help*

*To my **children** for their patience*

## ACKNOWLEDGMENT

**First** and above of the all, I would like to kneel Thank **ALLAH**, who provided me with the effort and patience to complete this work.

I would like to thank Prof **.Dr. Azza Abd El-Aziz Abd El-Hady**, Professor of physical therapy for Cardiopulmonary Disorders &Geriatrics, Faculty of Physical Therapy , Cairo University, for her great support and advice that give me the confidence and encouragement to start and complete this study.

My gratitude appreciation and deep thanks to **Prof. Dr. Zeinab Mohammed Helmy**, Professor of Physical Therapy for Cardiopulmonary Disorders, & Geriatrics. Faculty of physical Therapy, Cairo University, for her valuable advice, comments and kind supervision throughout the study.

I would like also to express my sincere thanks to **prof Dr. Hamdy Soliman mahmoud**, consultant of cardiology at National Heart Institute for his unlimited support and wise counsel.

I would like also to thank **Prof. Dr. Mustafa Hussein Gad**, Professor and head of physical Therapy unit at National Heart Institute, for his cooperation with me through the conduction of this work.

My deep appreciation and profound gratitude to **Dr/Hussam Fawzy** , cardiology specialist at National Heart Institute for his sincere help. I wish also to thank all the staff member of the Holter department at National Heart Institute

Special appreciation to **all members of Physical Therapy** unit at National Heart Institute for their help to conduct this work.

Words fail to express my deepest gratitude, and sincere thankfulness for **prof. Dr. Hanan Ahmed Rushdy** Dean of Faculty of Physical Fitness for Girls, Gezeera ,Helwan University. for her help and cooperation to conduct this work

Last but not least, special thanks for **all patients** participated in the study for their time, and cooperation through conducting of this work.

# List of content

Content	Page
<b>CHAPTER I :</b>	
INTRODUCTION	1
Aim of the Work	3
Significance of the study	4
<b>Chapter II: REVIEW OF LITERATURE</b>	
I)Anatomical and physiological review of cardiopulmonary system	5
Anatomy and physiology of the heart	5
Anatomy of the diaphragm	6
Work of breathing	7
Mechanism of respiration	8
Cardiopulmonary pumps	9
Ventilation and Breathing control during exercise.	11
* Ventilation during exercise.	12
* Factors Control Breathing	15
<i>II)Heart failure syndrome</i>	19
Heart failure classifications	20
Systolic& Diastolic heart failure classification	20
Right and left heart failure classifications	23
Stage classification of Heart Failure	23
Symptomatic classification– NYHA Classification	24
Ventilatory classification system(VC) in patient with heart failure	24
<i>III)Respiratory instability in Chronic Heart Failure</i>	26
I)Exertional dyspnea	26
Assessment & evaluation of dyspnea	38

i)Standard Measures	38
ii)Exertional measure	40
2)Cheyne-Stokes respiration	42
3)Central and obstructive sleep apnea	43
<i>V)Decreased functional capacity in Chronic Heart Failure</i>	44
<i>VI)Respiratory instability and sympathetic dysfunction in CHF and its measurement:</i>	52
Systolic dysfunction and parasympathetic withdrawal	50
Diastolic dysfunction and sympathetic activation.	51
Measurement of sympathetic dysfunction in chronic heart failure	55
1) Heart rate variability (HRV)	52
Definition	52
Physiological background	53
Measurement of HRV	53
1-Time domain methods	53
2-Frequency domain methods	57
2)Muscle sympathetic nerve activity (MSNA)	61
3)Baroreflex Sensitivity	62
4)Cardiac and Total Body Norepinephrine	63
<i>VI)Inspiratory muscle training.</i>	66
1)Modes of application	66
2) Role of respiratory training in sympathetic dysfunction	69
3)Role of respiratory training in functional capacity	71
<b>CHAPTER III: SUBJECTS,MATERIAL &amp; METHODS</b>	74
Subjects	74
Instrumentation	75
Procedures and Methods	81
Statistical procedure	92

<b>CHAPTER IV: RESULT</b>	93
<b>CHAPTER V: DISCUSSION</b>	131
<b>CHAPTER VI: SUMMARY AND CONCLUSION</b>	143
RECOMMENDATION	146
REFERENCE	147
APPENDIX	161
ARABIC SUMMARY	

# LIST OF FIGURES

N	Figures	Page
1	Anatomy of the Heart	6
2	Anatomy of the Diaphragm	7
3	Transition from diastolic abnormalities to diastolic heart failure	22
4	Left ventricular dysfunction and respiratory derangement	28
5	Efferent and Afferent Signals that Contribute to the Sensation of Dyspnea	30
6	Respiratory modulation of the cardiac rhythm	65
7	Relationship between depth of breathing and autonomic nervous system balance	70
8	Oxygen pro(Jager- Germany)cardiopulmonary exercise test unit	76
9	6732 Compact digital recorders	78
10	Spirometry system with shutter	79
11	IMT( Respiromics-USA)	80
12	Ventilatory function test	82
13	Symptoms limited exercise test	84
14	Measurement of Maximum inspiratory pressure	86
15	Lead placement for the 3-channel recording	88
16	Lead placement and carrying the 3-channel recording	88
17	Inspiratory muscle training	90
18	Breathing calisthenics(A, B&C)	91
19	Demographic and clinical characteristics of the studied groups	95
20	Mean values of FVC recorded before and after among studied groups	98
21	Mean values of MIP(cmH <sub>2</sub> o) recorded before and after among studied groups	98
22	Mean values of VO <sub>2</sub> max recorded before and after among studied groups	102
23	Mean values of AT % recorded before and after among studied groups	102
24	Mean values of O <sub>2</sub> pulse(ml) recorded before and after among studied groups	102
25	Mean values of exercise test load(w) recorded before and after among studied groups	103
26	Mean values of MHR(b/min) recorded before and after among studied groups	103
27	Mean values of VE(l/min) recorded before and after among studied groups	103
28	Mean values of HF(Hz) recorded before and after among studied groups	106
29	Mean values of LF(Hz) recorded before and after among studied groups	106
30	Mean values of LF/HF recorded before and after among studied groups	106
31	Mean values of RHR(b/min) recorded before and after among studied groups	109
32	Mean values of SBP(mmHg) recorded before and after among studied groups	109
33	Mean values of d BP(mmHg) recorded before and after among studied groups	109
34	Mean values of rating of perceived exertion(modified Borg scale) recorded before and after among studied groups	110