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Changes in Nutritional, Functional Status and Quality of Life of COPD Out-patients after a Pulmonary Rehabilitation Programme in HUKM: a Pilot Study

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ABSTRACT

This quasi-experimental study was carried out to evaluate the effectiveness of an eight-week multi-disciplinary pulmonary rehabilitation programme in improving nutritional and functional status and quality of life of COPD out patients at Hospital Universiti Kebangsaan Malaysia. A total of 9 COPD outpatients aged 40 years and above (6 men and 3 women) completed at least 50% of 16 sessions of an eight-week pulmonary rehabilitation programme. Their nutritional and functional status and rating of quality of life were measured at baseline (0 day) and after 8 weeks and these were compared to those of the control group matched for age, comprising 13 subjects (11 men and 2 women). Nutritional status was determined using anthropometry, body composition (Bioelectrical Impedance Analysis) and three-day food record. Assessment of appetite for food was also carried out using the Simplified Nutritional Assessment Questionnaire (SNAQ). Functional status was assessed using the Pulmonary Functional Status and Dyspnea Questionnaire-modified version (PFSDQ-M). The handgrip strength was also measured using handgrip dynamometer. The SF36 questionnaire was used to measure the quality of life of the subjects. There was a reduction in dyspnea (-49.0%, $p<0.05$) and fatigue (-47.8%, $p<0.05$) in men after the intervention programme, as compared to their controls (dyspnea -2.9% and fatigue 8.9%). Quality of life in this group was also significantly improved by 31.8% ($p<0.05$) as compared to their controls (-3.0%, $p>0.05$). Similar trends were noted for the women, although the difference was not significant. No significant changes were seen in nutritional status assessed by anthropometry, dietary intake and appetite. However, there was a trend of increased nutrient intake and SNAQ score in the intervention group as compared to control. An eight-week pulmonary rehabilitation programme was effective in improving the functional status particularly in men, by reducing dyspnea and fatigue; and also improving their quality of life, but was not effective in changing the nutritional status.

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INTRODUCTION

According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD), chronic obstructive pulmonary disease (COPD) has been defined as a respiratory disease characterised by limitation of air flow in the lungs causing reduction in ventilation capacity and shortness of breath. It is predicted that COPD will bear the burden of being the fifth leading cause of disease in the world by the year 2020 and will become the world's third largest cause of death (The Asia Pacific COPD Roundtable Group, 2005). In Malaysia, the prevalence of patients with mild to severe COPD calculated using an estimation model is 4.7% (448,000 cases) (Tan *et al*., 2003). A study among rural elderly Malays in Malaysia showed that respiratory disturbance was the third largest chronic disease after high blood pressure and gout or arthritis (Suzana *et al.,* 2007). Furthermore, it is more prevalent among men as compared to women.

Nutritional status among COPD patients is usually poor due to the increment of basal metabolic rate (BMR), reduction in energy intake from food and increased energy cost for physical activity (Congleton, 1999). Poor nutritional status will then change the body composition and cause disturbances in lung function (Ozeki, Fijita & Kida, 2002). Malnourished COPD patients have a significantly lower food intake compared to patients with normal nutritional status (Cochrane & Afolabi, 2004). This situation is probably caused by problems of dyspnea and the severe blockage of air flow during eating (Schols, Mostert & Sketers, 1991).

Functional status assessment is one of the important aspects in evaluating the patient's ability to perform daily activities including food intake. Many tools are used to determine functional status of COPD patients, for example; Pulmonary Functional Status Scale (PFSS) (Weaver & Narsavage, 1992), Pulmonary Functional Status and Dyspnea Questionnaires (Lareau, Carrieri-Kohlma Janson-Bjerklie & Roos 1994), Pulmonary Functional Status and Dyspnea Questionnaires-modified version (PFSDQ-M) (Lareau, Meek & Roos, 1998), London Chest Activity of Daily Living Scale (LCADL) (Garrod, Bestall & Paul, 2000), and Manchester Respiratory Activities of Daily Living Questionnaire (Yohannes *et al.,* 2000). However, the PFSDQ-M was the most commonly used tool. Assessment of body composition among COPD patients using bioelectric impendence (BIA), dual energy x-ray absorptiometry (DEXA) and near-infrared spectroscopy have also received much interest in recent years (Engelen *et al.,* 1998; Engelen *et al.,* 2002; Heijdra *et al.,* 2003; Franssen *et al.,* 2004) as there is a concern to avoid muscle loss that would lead to morbidity and mortality among COPD patients.

The pulmonary rehabilitation programme is usually a complete intervention programme comprising strategies like exercise training, education of self-management, nutrition intervention and psycho-social support (Reardon *et al.,* 2005). It also consists of the non-pulmonary components such as exercise deconditioning, social isolation, increment of muscle function and body weight control (Pauwels *et al.,* 2001), and are designed to reduce symptoms like dyspnea, increase functional status and involvement in physical activities and also to enhance quality of life (QoL) for patients with chronic respiratory problems. The effect of whole body exercise training on body composition and functional capacity among COPD patients have also been assessed (Pedersen & Ssaltin, 2006). However, a comprehensive evaluation of the effect of a pulmonary rehabilitation programme on functional status, nutritional status and quality of life is scarce.

Thus, this pilot study aimed at comprehensively evaluate the effect of an eight-week pulmonary rehabilitation programme on nutritional and functional status, including quality of life among COPD out-patients. The results of the study are

important for health professionals involved in the care of COPD patients in order to improve their health outcome and quality of life.

METHODS

Study design and selection of study subjects

This was a quasi-experimental study among COPD outpatients aged more than 40 years old who registered for an eight-week pulmonary rehabilitation programme between May to August 2006 at the Physiotherapy Unit, Hospital of Universiti Kebangsaan Malaysia (HUKM). Control subjects were chosen among outpatients with COPD who were not involved in the pulmonary rehabilitation programme. Subjects were recruited using a convenient sampling method. Both intervention and control groups were matched for age (± 5 years) and were diagnosed having COPD according to GOLD standard with forced expiratory volume in the first second (FEV_1) <80% from an estimated value and FEV/FVC <70% using COSMED Pony Spirometer Graphic Spirometry. Patients with malignancy and other severe cardio-pulmonary and neurological dysfunctions were excluded. Nutritional and functional status and quality of life of subjects in the intervention group were measured at baseline and after eight weeks of the rehabilitation programme. Similar assessments were carried out for control subjects. Approval for the study protocol was obtained from HUKM Ethics Committee and informed consent was obtained from all subjects.

Study methodology

Nutritional status was determined according to anthropometric indicators including weight, height, arm-span, mid-upper arm circumference (MUAC) and calf circumference (CC) using standard methods (Fidanza, 1991), and dietry intake based on three-day food records. Subjects were asked to record all food and drinks consumed for two weekdays and one weekend using household measures. The food record was then collected during the next follow up at the outpatient clinic. Assessment on food appetite was carried out using the Simplified Nutritional Assessment Questionnaire (SNAQ) (Wilson *et al.,* 2005). SNAQ consists of four questions with multi-choice answers. Scores of ≤14 show that the subject has the risk of losing weight of about 5% in six months. Body composition was measured using the body impedance method (Maltron 916, UK) for which subjects had to fast for 6 to 8 hours and to have voided before measurement (MALTRON BF 900/906 *Body* Composition Analyzer Technical Specification 2003). Functional status was assessed using Pulmonary Functional Status and Dyspnea Questionnaire-modified version (PFSDQ-M) (American Thoracic Society, 1999) after obtaining permission from the designer, Suzanne Lareau. The handgrip strength was also measured using handgrip dynamometer (JAMAR, Sammons Preston, INC.), with maximum strength of 90 kg) (Heijdra *et al*., 2003). The SF36 questionnaire (Kalantar-Zadeh *et al.,* 2001) was used to measure the quality of life of the subjects. This study used the SF36 questionnaire which had been translated back-to-back to the local Malay language (permission was obtained for usage of the questionnaire). Lung function was assessed using spirometry COSMED Pony Spirometer Graphic. Intervention subjects were assigned to an eight-week pulmonary rehabilitation programme instructed by physiotherapists. The program consisted of four main components which were (i) exercise training, (ii)education, (iii)psycho-social and behavioural intervention, and (iv)result assessment (American Thoracic Society, 1999). The control group meanwhile underwent the routine checkup for COPD patients.

Statistical analysis

The data were analysed using SPSS Version 12.0 (SPSS, Chicago, IL, USA). All data were analysed using descriptive analysis (mean frequency). In order to ensure the normality of the data, a normality test (Shapiro-Wilks) was done. Mann Whitney U and Chi Square tests were used to determine the differences between the intervention and control groups. The Wilcoxon signed-rank test was used to observe the differences (baseline and post intervention) for all studied parameters. Sample size was determined using the formula by Dallal (1997) with 80% power and 0.05 as significant level. With drop factors of 10%, mean difference of 11.1 and standard deviation of 18.6 (Griffiths *et al.*, 2000), the total sample size for each group was 55.

RESULTS

Demographic profile

Although the initial calculated sample size was 55, only 35 subjects were recruited in this study (14 subjects in the intervention group; 21 subjects in the control group). The small sample size was due to refusal by some subjects to register for the rehabilitation programme. Three men and two women in the intervention group who did not attend at least 50% of the (8 sessions of the 16 sessions) of the rehabilitation programme, were considered as dropouts, resulting in a dropout rate of 35.7%. Among the controls, complete measurement at baseline and follow up at 8 weeks could not be carried out on eight subjects, resulting in a final dropout rate of 42.8%. Most of the subjects were men. Subjects from the intervention and control groups did not differ statistically with respect to age and working status and COPD Stage (Table 1). However, there were more subjects in the control group (76.9%) who were smokers as compared to those in the intervention group (55.6%) ($p<0.05$).

Anthropometry and body composition

Table 2 shows changes in anthropometry and body compositions of subjects based on gender. According to their BMI classification (WHO Expert Consultation, 2004), 28% of the subjects in the intervention group were underweight (BMI<18.5 kg/m^2), followed by normal (44%), overweight (7%) and obese (21%). On the other hand, the control group consisted of underweight (13%), normal (47%), overweight (33%) and obese (7%) subjects. According to MUAC classification (Ferro-Luzzi & James, 1996), 21% of subjects in the intervention group and 13% of subjects in subjects the control group experienced muscle wasting. As shown in Table 2, there was no significant difference in anthropometry and body composition in both groups at baseline. After 8 weeks, only the control group (men) showed a significant difference in body weight and fat free mass ($p<0.05$) with an increment in body weight of 1.7% and FFM of 2.4%; and a decrement in MUAC (-2.2%).

Changes in intake of food, macronutrients and micronutrients

Although not significant, there was a trend indicating that the mean intake of macro-nutrients and selected micro-nutrients improved after the 8-week intervention among the men (Table 3). Increments in energy, protein, carbohydrate and fat were noted at 13.4%, 20.2%, 9.2% and 16.7% respectively. Similar trends were noted for micronutrient intake, that is, calcium, niacin and riboflavin in men, and vitamin A, fat and vitamin C in women from the intervention group. On the other hand, there was a trend of reduced intake of several nutrients in the control group.

Changes in appetite

The full score for SNAQ questionnaire was 20; a score of 14 or less indicating a risk in body weight reduction of 5% in six months while more than 14 indicates a normal food appetite. Mean score of SNAQ in the

Table 1. Socio-demographic and health profile of subjects [expressed as n (%) or Mean ± SD]

	Intervention (n=9)	*Control (n=13)*
Men/women	6 (66.7%) /3(33.3%)	11 (84.6%)/2 (15.4%)
Age (years)	64.4 ± 8.4	66.2 ± 10.3
Smoking	5 (55.6%)	10 (76.9%)*
Working	1 (11.1%)	2 (15.4%)
*p<0.05, Fisher Exact Test		
COPD stage:Stage I (mild)	2 (14.3%)	3 (19.0%)
Stage II (moderate)	7 (85.7%)	9 (71.4%)
Stage III (severe)	0 (0%)	1 (9.6%)

* p<0.05, Fisher Exact Test

Table 2. Changes in anthropometry and body composition of subjects according to gender [expressed as Mean ± SD and %difference]

	Intervention status.			*Control*		
	Baseline	*After 8 weeks*	*Mean difference (%)*	*Baseline*	*After 8 weeks*	*Mean difference (%)*
Men	(n=6)	(n=6)		(n=11)	(n=11)	
Weight (kg)	59.5 ± 18.7	58.9 ± 18.9	-1.0	58.5±14.4	59.5 ±22.3*	1.7
BMI (kg/m^2)	20.8 ± 6.2	20.6 ± 6.1	-1.0	21.5± 4.1	21.7 ± 4.2	0.9
MUAC(cm)	27.0 ± 6.3	26.7 ± 6.0	-1.1	27.8± 3.6	27.2 ± 3.6*	-2.2
CC(cm)	34.4 ± 6.2	34.1 ± 5.5	-0.9	33.0± 4.4	32.9 ± 4.4	-0.3
Fat (%)	18.6 ± 9.7	17.4 ± 8.3	0.1	21.2± 4.1	19.5 ± 4.4	-0.1
FFM (kg)	47.2 ± 10.9	47.6 ± 11.8	0.8	45.7± 8.9	46.8 ± 9.1*	2.4
FFM (%)	81.4 ± 9.8	82.6 ± 8.2	1.5	78.8± 4.1	80.5 ± 4.4*	2.2
Women	(n=3)	(n=3)		(n=2)	(n=2)	
Weight (kg)	60.1 ± 21.1	59.5 ± 22.3	-1.0	63.9± 8.4	64.6 ± 8.0	1.1
BMI(kg/m^2)	25.8 ± 11.2	25.6 ± 11.6	-0.7	27.2± 4.4	27.5 ± 4.2	1.1
MUAC (cm)	30.5 ± 9.7	28.1 ± 9.9	-7.9	30.0± 1.7	30.1 ± 2 .0	0.3
CC (cm)	33.5 ± 4.7	31.8 ± 5.4	-5	35.7± 2.4	36.1 ± 2.2	1.1
Fat (%)	37.1 ± 22.4	35.3 ± 23.3	0.3	40.6± 3.8	39.7 ± 4.9	-0.1
FFM (kg)	34.8 ± 1.7	35.2 ± 2.6	1.1	37.8± 2.6	38.7 ± 1.6	2.4
FFM (%)	62.9 ± 22.4	64.7 ± 23.3	2.9	59.4± 3.8	60.3 ± 4.9	1.5

BMI- Body Mass Index, MUAC: Mid-upper arm circumference, CC: Calf circumference, FFM: Fat free Mass
*P < 0.05 by using Wilcoxon signed-rank test

intervention group showed a slight increment from 14.3 ± 2.2 at baseline to 15.3 ± 2.7 after the 8-week rehabilitation programme in the men and from 13.3 ± 1.5 to 14 ± 1.0 for the women. However, these changes were not significant. There were no changes in the SNAQ category whereby the intervention group was still in the normal category. In contrast, there was a slight reduction in the SNAQ score among controls, from 14.1 ± 2.6 to 13.4 ± 2.0 in men and 15.5 ± 2.1 to 13.5 ± 0.7 in the women, but the differences were not significant probably due to the small sample size. Figure 1

Table 3. Changes in macro-nutrient and micro-nutrient intake among subjects according to gender (expressed as Mean ± SD and %difference]

	Intervention			*Control*		
	Baseline	*After 8 weeks*	*Mean % difference*	*Baseline*	*After 8 weeks*	*Mean % difference*
Men	**(n=6)**	**(n=6)**		**(n=11)**	**(n=11)**	
Energy (kcal)	1183±282	1341±254	13.4	1086±290	1010±287	-7.1
Protein (g)	56.9±13.9	68.4±10.1	20.2	52.4±16.3	44.1±19.0	-15.8
Carbohydrate (g)	166.7±37.8	182.1±28	9.2	146.4±47.6	150.7±44.0	0.7
Fat (g)	32.4±12.1	37.8±15.5	16.7	29.8±9.7	23.5±13.1	-21.1
Vitamin A (µg/RE)	525.7±210.6	488.9±330.6	-0.1	501.3±347.2	319.9±225.7	-36.2
Thiamine (mg)	0.9±0.2	0.9±0.3	0.0	0.8±0.2	0.8±0.2	0.0
Riboflavin (mg)	1.1±0.2	1.2±0.2	9.1	1.1±0.6	0.9±0.4	-18.2
Niacin(mg)	10.5±1.8	12.2±3.1	16.2	8.4±3.2	9.2±6.6	11.9
Vitamin C(mg)	73.2±32.0	72.8±51.5	-0.5	116.4±120.1	48.6±32.2	-58.2
Calcium(mg)	373.3±102.7	431.0±161.9	15.5	396.9±154.3	382.2±222.0	-3.7
Iron (mg)	12.2±5.6	11.9±1.9	-2.5	11.5±5.0	9.0±3.8	-21.7
Women	**(n=3)**	**(n=3)**		**(n=2)**	**(n=2)**	
Energy (kkal)	1023±210	988±181	-3.5	1092±354	895±453	-18.0
Protein (g)	46.99±19.3	36.0±8.9	-23.4	49.2±13.5	41.2±3.3	-16.3
Carbohydrate (g)	152.5±16.6	148.8±30.6	-2.4	137.4±42.5	134.3±52.9	-2.3
Fat (g)	25.1±8.0	27.7±2.7	10.4	38.5±14.9	31.7±10.6	-17.7
Vitamin A (µg/RE)	343.5±167.8	469.0±396.3	36.5	551.6±139.6	212.5±124.3	-61.5
Thiamine(mg)	0.6±0.2	0.6±0.1	0.0	0.7±0.1	0.5±0.1	-28.6
Riboflavin (mg)	1.0±0.6	1.0±0.4	0.0	0.8±0.2	0.5±0.0	-37.5
Niacin(mg)	7.2±3.3	6.4±2.7	-11.1	10.1±6.4	7.5±4.8	-25.7
Vitamin C(mg)	33.4±12.0	43.6±21.7	30.5	90.6±3.0	17.5±0.9	-80.7
Calcium(mg)	297.9±207.0	278.3±160.0	-6.5	212.0±10.3	119.9±16.9	-43.4
Iron (mg)	8.1±2.6	7.0±1.8	-13.6	9.6±2.1	6.2±3.4	-35.4

NS-Not significant using Wilcoxon signed-rank test

indicates percentage of subjects (from intervention and control group) with SNAQ scores less or equal to 14 and thus at risk in body weight reduction. At baseline, 16% of men and 66.7% of women from the intervention group had a low SNAQ score whilst the corresponding figures for the control group were 36.4% and 0% among the men and women respectively. After the 8-week rehabilitation programme, the percentage of subjects with low SNAQ score decreased to 33.3% among the women from the intervention group. On the other hand, the figures increased to 54.6% and 50% among the men and women respectively in the control group.

Functional status and quality of life (QoL)

There was an improvement in quality of life as measured using the SF36 questionnaire (physical role, physical functioning, bodily pain, general health, vitality and social functioning) in men (31.8%, $p<0.05$) as compared to the control (-3.0, $p>0.05$) (Table 4 and Figure 2). A decrement was noted for dyspnea (-49.0%, $p<0.05$) and fatigue (-47.8%, $p<0.05$) among this group as compared to the control group. Similar

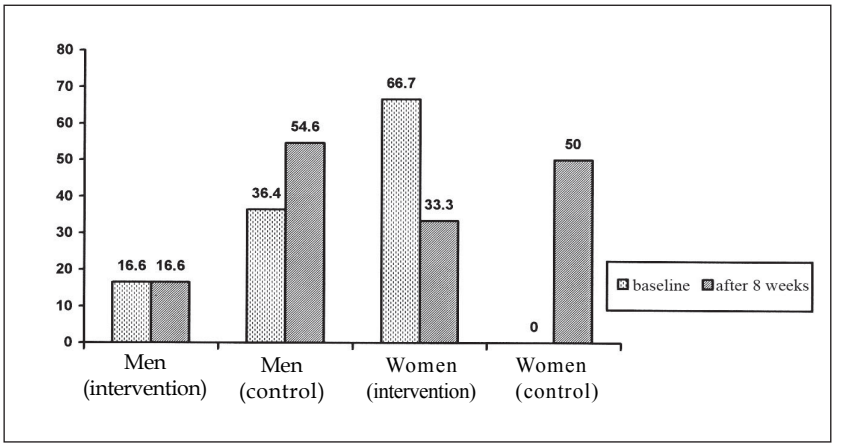

Figure 1. Subject's classification acccording to SNAQ score (at risk <14) in % at baseline and after 8 weeks (post-intervention

Table 4. Changes in quality of life and functional status for intervention and control group (according to gender) (mean ± SD).

	Intervention (n=9)			*Control (n=13)*		
	Baseline 8 weeks	*After difference*	*Mean*	*Baseline 8 weeks*	*After difference*	*Mean*
Men	(n=6)	(n=6)		(n=11)	(n=11)	
SF36 score	54.8±7.7	72.2±16.8*	31.8	50.1±6.7	48.6±8.5	-3.0
PFSDQ-M						
‡Activity	10.3±3.9	5.7±3.4	-44.7	15.7±12.3	14.3±10.5	-8.9
Dyspnea	10.2±3.8	5.2±3.0*	-49.0	13.8±11.1	13.4±9.4	-2.9
Fatigue	9.0±3.1	4.7±1.6*	-47.8	11.2±11.5	11.5±11.6	8.9
Women	(n=3)	(n=3)		(n=2)	(n=2)	
SF36 score	44.0±2.6	71.0±8.7	61.4	59.5±6.4	71.0±22.6	19.3
PFSDQ-M						
Activity	26.3±8.9	7.0±5.0	-73.4	4.0±2.8	9.0±4.2	125
Dyspnea	21.7±7.6	10.7±2.3	-50.7	4.0±2.8	8.5±3.5	112.5
Fatigue	20.7±5.5	10.0±2.6	-51.7	4.0±2.8	10.0±7.1	150.0

*P< 0.05, using Wilcoxon signed-rank test

‡Activity in PFSDQ-M: Men (intervention) brush hair or teeth, climb three stairs, prepare snack, raise arm over head, shower, walk on bumpy terrain, walk on inclines, walk ten feet, wash hair and put on pants.

changes were noted for activity but the difference was not significant. Women from the intervention group showed an improvement in QoL (61.4%) as compared to their control group(19.3%); however, the difference was not significant (Table 4 and Figure 3).

DISCUSSION

The study successfully evaluated the overall effectiveness of an 8-week pulmonary rehabilitation programme among COPD patients on nutritional, functional, QoL and lung function, although the dropout rate was more than 30%. Other studies have also

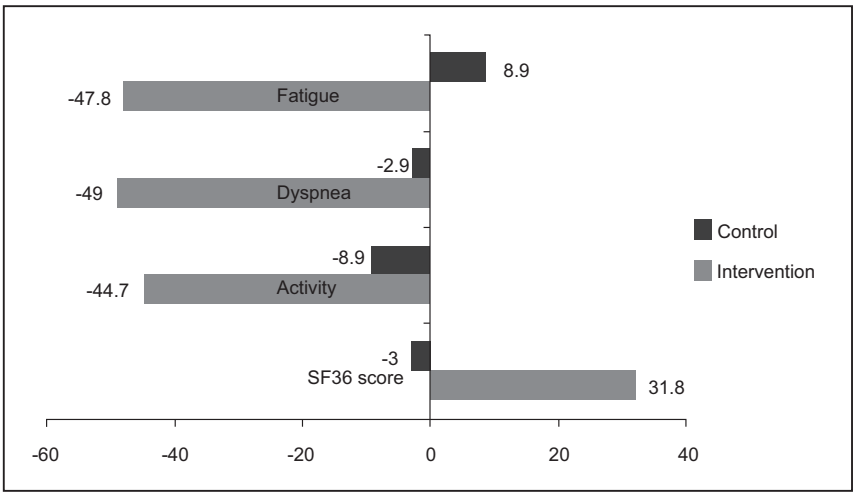

Figure 2. Changes in quality of life and functional status for intervention and control group in men after 8 weeks (expressed as % changes)

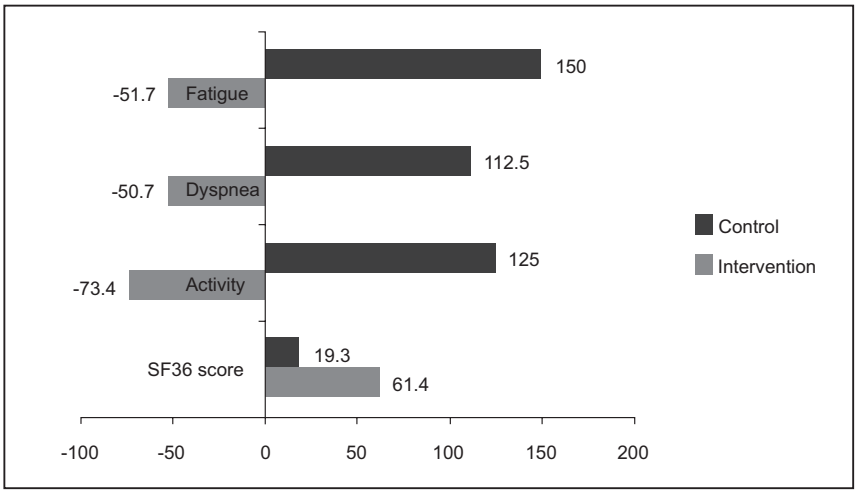

Figure 3. Changes in quality of life and functional status for intervention and control group in women after 8 weeks (expressed as % changes)

reported rather similar high dropout rates (Woo *et al*., 2006). The present study comprised mostly of men, as in past studies (Cochrane & Afolabi, 2004; Gronberg *et al*., 2004). Although the study group and control were matched for age and lung function, most subjects from the control group were smokers and other variables such as socio-economic status should also be matched.

The energy intake of subjects in this study was below the Malaysian RNI (NCCFN, 2005). This finding is also similar to other studies on the elderly in Malaysia (Suriah *et al*., 1996). A more recent study among the Malaysian elderly also described similar results of low energy intake as well as inadequate thiamin, riboflavin and calcium intake (Suzana *et al*., 2007). The 8-week pulmonary rehabilitation programme

seemed to improve the macro- and micro-nutrient intakes among subjects in the intervention group. The improvement in nutrient intake is coherent with the increase in appetite scores as measured using SNAQ at baseline and after the 8-week rehabilitation programme. This finding is in accordance with past studies in which energy, protein and carbohydrate intake among COPD patients increased after attending nutrition counseling sessions (Slinde *et al.,* 2002).

We observed that functional ability as measured using PFSDQ-M improved significantly among men after the 8-week intervention programme, with dyspnea decreasing by 49% and 'feeling fatigue' reducing by 47%. These were probably due to the effect of performing daily activities that increased physical conditioning, which is the main component in the pulmonary rehabilitation programme. Other studies have also reported similar results after a 12-week rehabilitation programme (Trappenburg *et al.,* 2005). The relief in dyspnea and 'feeling fatigue' would certainly lead to a great improvement in QoL as seen in the men from the intervention group. A similar trend was noted amongst the women. However, the changes were insignificant probably due to the small sample size. Other studies also confirmed that QoL of COPD patients increased after attending rehabilitation programmes (Benzo *et al.,* 2000; Boueri *et al.,* 2001; Verrill *et al.,* 2005). Improvements in functional status and QoL would lead to increments in appetite and food intake. It is expected that a longer duration of trial or rehabilitation programme is needed to see some increment in physical and physiological indicators such as anthropometry and body composition, especially among older individuals, of whom there is an age-related decrease in muscle mass and increase in fat. A past study described significant changes in body composition and fat distribution occurring in independently living, weight-stable elderly men and women. These changes are dependent on sex and independent of physical activity, hormones or serum albumin (Zamboni *et al.*, 2003). In conclusion, an 8-week pulmonary rehabilitation programme was effective in improving the functional status particularly in men, by reducing dyspnea and fatigue. It was also effective in improving their quality of life, but was not effective in changing the subjects' nutritional status. Greater improvements in nutritional status are expected to be observed if an intensive nutrition intervention is included in the pulmonary rehabilitation programme. These include dietary counseling and dietary supplementation with a high calorie diet and high protein products to the malnourished subjects. However, it should be noted that the present study was based on a small sample with quite a high drop-out rate. Thus, future studies should consider enrolling a larger sample size probably using a multicentric approach.

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