EFFECTS OF A RANDOMIZED TRIAL OF EXERCISE ON BODY COMPOSITION OF LIVER TRANSPLANTED PATIENTS .

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Abstract

Liver transplantation is used as a only therapy so far, that stop the progression of some aspects of familial amyloidotic polyneuropathy disease (FAP) an autossomic neurodegenerative disease. FAP often results in severe functional limitations. Transplantation requires aggressive medication which impairs bone and muscle metabolism. Malnutrition plus weight loss is already one feature of FAP patients. All this may produce negative consequences on body composition. The effect of exercise training in FAP patients after a liver transplant (FAPTX) is currently unknown.

Purpose: To evaluate the effects of a six months exercise training program on body composition in FAPTX patients.

Methods: Body composition was estimated using Dual Energy X-ray Absorptiometry (DXA) in 40 FAPTX two months after liver transplant (2±3.9 months). Subjects were randomly assigned into three groups: a control group (CG) of 16 FAPTX patients (13 males and 3 females, 33±9 years, BMI 22.5±3.2) without any exercise intervention; an exercise group (EG) of 9 patients (6 males and 3 females; 34±7 years, BMI 20.2±4.2) submitted to a supervised exercise training program 3 times a week and an home-based exercise training group (HB) who exercised at home with a twice-monthly feed-back (4 males; 11 females; 35±5 years, BMI 22.3±4.3).

Results: None of the body composition variables changed in the CG form pre to post -testing. Both EG group and HB group significantly improved (p<.05) their body composition, but the EG group improved more than the HB group showing improvement in total lean mass (43.6kg to 47.5kg vs 41.7kg to 43.5kg), total body skeletal muscle mass (20.6kg to 22.9kg vs 19.6kg to 20.3kg). Only the EG improved (p<.05) absolute, but not relative fat mass, (12.9kg to 15.4kg), weight (59.4 to 65.1) and BMI (20.2kg/m2 to 22.1kg/m2). The EG group also improved their physical disability risk score (skeletal muscle index) significantly more than the HB group (7.0 to 7.8 vs 7.1 to 7.3).

Conclusions: Exercise training improved body composition and increased body weight in FAPTX patients. This improvement was significantly greater in the supervised exercise group, suggesting supervised exercise training should be considered as part of the therapeutic approach in this population.

Introduction

FAP is a neurodegenerative disease caused by hepatic production of a mutated transthyretin gene. This leads to sensory and motor polyneuropathies, with severe functional limitations(1, 2). Liver transplantation is the only available treatment for FAP, requiring medication that negatively affect bone and muscle metabolism(3). The side effects of the medications prescribed post-transplant and the time of immobilization in combination with existing low-level physical function has been shown to contribute to increased length of post-transplant recovery and increased morbidity(4). To date there is no existing data in the literature regarding the effects of exercise on body composition of these patients after a liver transplant(5).

Purpose

Assess the effects of a six months exercise training program on body composition variables, specifically on lean mass, total body skeletal muscle mass and the effects on skeletal muscle index and physical disability risk.

Methods

Sample: Our sample consisted of three groups randomly assigned. A control group (CG) of 16 FAPTX patients (13 males and 3 females) without any exercise intervention; an exercise group (EG) of 9 patients (6 males and 3 females) submitted to a supervised exercise training program 3 times a week (table 1) and an home-based exercise training group (HB) who exercised at home 3 times a week with a twice-monthly feed-back (4 males; 11 females). The exercise prescription for HB group was similar to exercise group but exercises whereperformed with materials of Thera-Band (resistance bands, balls, bars and stability trainer) with the help of an "exercise book" (1 exercise book each month) made specifically for this group.

Body composition was assessed by dual-energy x-ray absorptiometry (DXA) for whole body and dominant lower limb (DLL). Total body skeletal muscle mass (TBSMM) and skeletal muscle index (SMI) where calculated (6) in 40 FAPTX two months after liver transplant (2±3.9 months).

One-way analyses of variance were used for baseline group comparisons and a Scheffé post-hoc analysis was performed when the analysis of variance showed significant differences. To check for within-group changes as a result of exercise training paired Student's t-tests were used within each group. For all statistical tests, differences were considered statistically significant at p<0.05.

Table 1 –Exercise Prescription for Exercise Group

	Type	Intensity; Duration; Frequency; Monitorization
Warm-up	• Low-intensity callisthenic type • Stretching exercises • Activities with big muscular groups (ex: treadmill, bicycle, remo, walking, etc, etc). • Aerobic exercises	• 3 times a week • 10-15 min/session • Borg RPE scale (6-20) should be referenced at no more than 13 • Velocity of treadmill starting at 50% of velocity obtained at 6mwt with increments every 2 weeks accordingly RPE refered by patient.
Endurance fase	• Aerobic activities • Resistance training / exercises with thera-band products • Sensorio-motor activities / Exercises with thera-band products	• 3 times a week • 30 min by session • 2 sets of 8 repetition's, that gradually (over 24 week's) go over 3 set's of 12 repetitions • Each sensorio-motor task should be performed 4 times with 40 seg duration and 20 secondes rest between each repetition • Low intensity to moderate intensity - Borg RPE scale (6-20) referenced at 11 to 14
Cool-down	• Slower walking • Stretching exercises • Relaxation training • Tai-chi (for ex:)	• 3 times a week • Borg RPE scale (6-20) referenced at 6 to 9

Results and Discussion

The three groups where similar in age, weight, height ,BMI and in immunosuppressant medication (table 2).

Table2 – Descriptive characteristics and immunossupressant medication of participants by group (Mean ± SD; Min-Máx)

	Controle (n=16) (13M; 3F)	Exercise (n=9) (6M; 3F)	Home-Based (n=15) (4M; 11F)	*p-value*
Age	34±10 (23-59)	34±7 (28-48)	35±5 (28-44)	NS
Weigth	66,6±11,9 (49,6-95,4)	59,4±16,0 (49,8-101,2)	61,2±12,7 (35,6-75,8)	NS
Heigth	1,71±0,08 (1,56-1,83)	1,71±0,08 (1,56-1,81)	1,66±0,08 (1,53-1,85)	NS
BMI	22,8±3,3 (18,0-28,5)	20,2±4,2 (16,6-30,9)	22,3±4,3 (15,2-30,6)	NS
Prednisone (mg/day)	10,4±3,8 (2,5-15,0)	11,4±7,6 (0,0-20,0)	12,8±4,1 (5,0-20,0)	NS
Tacrolimus (mg/day)	6,1±2,2 (2,0-8,5)	4,9±1,6 (3,0-8,0)	6,3±2,6 (3,0-12,0)	NS

P-value- diffference between the mean of three groups(p<0.05) ; BMI – Body Mass Index;

None of the body composition variables changed in the CG form pre to post –intervention (table 3).

Both EG group and HB group significantly improved (p<.05) Total Lean Mass, Lean Mass of Dominant Lower Limb, TBSMM and SMI, but the EG group improved more than the HB group.

Only the EG improved (p<.05) absolute, but not relative fat mass, weight and BMI.

The EG group also improved their physical disability risk score (skeletal muscle index) significantly more than the HB group. (7.0 to 7.8 vs 7.1 to 7.3).

Table 3 – Selecyed body composition variables by group, pré and post intervention (Mean ± SD; Min-Máx)

	Pré-Intervention	Post-Intervention	p-value
Weigth			
Controle	66,1±11,7 (49,6-95,4)	66,6±12,3 (51,8-95,1)	NS
Exercise	59,4±16,0 (49,8-101,2)	65,1±17,7 (50,8-109,5)	**0,005**
Home-Based	61,2±12,7 (35,6-75,8)	62,8±14,7 (38,8-86,9)	NS
BMI			
Controle	22,6±3,3 (18,0-28,5)	22,8±3,4 (17,7-28,4)	NS
Exercise	20,2±4,2 (16,6-30,9)	22,1±4,7 (17,4-33,4)	**0,006**
Home-Based	22,3±4,3 (15,2-30,6)	22,8±5,2 (16,6-35,3)	NS
Total Lean Mass (kg)[a]			
Controle	49,9±8,0 (36,9-66,4)	49,7±8,1 (35,6-65,8)	NS
Exercise	43,6±8,8 (34,2-63,8)	47,5±11,1 (34,6-72,4)	**0,009**
Home-Based	41,7±8,0 (28,2-57,4)	43,5±8,0 (29,9-59,3)	**0,050**
Lean Mass DLL (kg)[a]			
Controle	7,9±1,6 (5,8-10,4)	7,9±1,7 (5,0-10,8)	NS
Exercise	6,6±1,6 (4,9-10,2)	7,5±1,7 (5,2-10,7)	**0,011**
Home-Based	6,5±1,4 (3,9-9,4)	6,8±1,5 (4,5-9,4)	**0,023**
TBSMM (Kg)[a]			
Controle	24,8±5,3 (17,3-33,6)	24,9±5,3 (15,8-33,9)	NS
Exercise	20,6±5,2 (13,9-31,4)	22,9±5,7 (15,5-34,2)	**0,006**
Home-Based	19,6±4,7 (11,7-29,1)	20,3±4,9 (12,4-29,4)	**0,033**
SMI[b]			
Controle	8,4±1,3 (6,4-10,1)	8,5±1,3 (5,8-10,2)	NS
Exercise	7,0±1,2 (5,7-9,6)	7,8±1,4 (6,4-10,5)	**0,005**
Home-Based	7,1±1,2 (5,0-9,3)	7,3±1,3 (5,5-9,7)	**0,025**
Total Fat Mass (Kg)			
Controle	13,7±6,6 (5,6-26,4)	13,9±6,8 (6,1-25,7)	NS
Exercise	13,0±8,9 (5,3-33,8)	15,4±10,2 (6,3-38,6)	**0,017**
Home-Based	16,4±7,6 (4,9-31,7)	17,3±9,1 (6,3-39,6)	NS
%Fat Mass			
Controle	20,2±7,7 (10,9-35,0)	20,6±8,0 (10,1-34,1)	NS
Exercise	20,9±9,0 (10,7-33,7)	22,7±9,7 (11,2-35,4)	NS
Home-Based	26,2±8,7 (12,6-42,3)	26,5±8,6 (14,7-45,5)	NS

P-value – intra-group difference of means in the two moments of assessment (p<0.05); BMI . Body Mass Index; TBSMM – Total Body Skeletal Muscle Mass; SMI – Skeletal Muscle Index; DLL-Dominant Lower Limb.

[a] Different between groups for the baseline values (p<0.05). Control group is different from HB but not from exercise group

[b] Different between groups for the baseline values (p<0.05). Control group is different from HB and exercise group, but exercise and HB group are similar.

Conclusions

Exercise training improved body composition and increased body weight in FAPTX patients. The increase in muscle mass shows an improvement in SMI and this shows also a probability of a lower risk of physical disability.

This improvement was significantly greater in the supervised exercise group, suggesting supervised exercise training should be considered as part of the therapeutic approach in this population.

References

1. Luís ML. Polineuropatia Amiloidótica Familiar do Tipo Português: do artigo original ao futuro. Sinapse 2006;6(Suplemento):40-42.
2. Munar-Ques M. [Familial amyloid polyneuropathy 2003]. Med Clin (Barc) 2003;121(3):100-1.
3. Monteiro E, Freire A, Barroso E. Familial amyloid polyneuropathy and liver transplantation. J Hepatology 2004;41:188-194.
4. Hussaini SH, Soo S, Stewart SP, Oldroyd B, Roman F, Smith MA, et al. Risk factors for loss of lean body mass after liver transplantation. Appl Radiat Isot 1998;49(5-6):663-4.
5. Kjaer M, Beyer N, Secher NH. Exercise and organ transplantation. Scand J Med Sci Sports 1999;9(1):1-14.
6. Janssen I, Baumgartner RN, Ross R, Rosenberg IH, Roubenoff R. Skeletal muscle cutpoints associated with elevated physical disability risk in older men and women. Am J Epidemiol 2004;159(4):413-21.6

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