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CASE REPORT

Successful Weight Loss in Two Adult Patients Diagnosed with Late-Onset Long-Chain Fatty Acid Oxidation Defect

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Abstract Patients with long-chain fatty acid oxidation defect (LCFAOD) cannot tolerate fasting and are restricted in their physical activity, hence their increased risk of obesity. Experts therefore advise avoidance of catabolic situations and discourage weight reduction in these patients.

Two patients with late-diagnosed LCFAOD undergoing treatment at two academic centers successfully lost weight under supervision of a metabolic dietitian. Patient 1 (male, 47 years) diagnosed with CPT 2 deficiency lost 10 kg body weight in a 3-month period with the help of an energy and LCT-restricted, MCT- and carbohydrate-rich diet in combination with an exercise program. CK levels, C16, C18, and C18:1 levels of his acylcarnitine profile and his blood pressure decreased during the period of weight reduction. Patient 2 (male, 39 years) has a VLCAD deficiency. Dietary advice was energy and LCT restriction, MCT and carbohydrate-enriched food with raw cornstarch added during the night. Patient 2 lost almost 40 kg body weight to 87.6 kg (BMI 25.1) in 2 years. CK, insulin, TG, and ALAT blood levels decreased. Conclusion: Weight reduction without loss of metabolic control seems possible in late-onset LCFAOD patients. No metabolic crisis occurred in these two patients, while the positive effects of weight reduction were clear. The residual enzyme function in late-onset LCFAOD may be one of the reasons that metabolic decompensation was prevented. In addition, dietary adjustments to prevent excessive fatty acid oxidation likely contributed as well. Therefore, expert supervision by a dietician specialized in metabolic diseases is recommended.

Concise Sentence Contrary to the current literature, weight loss in patients with late-diagnosed LCFAOD can be successful. A description of two FOAD patients who lost weight without encountering negative side effects at two academic centers is given.

Abbreviations

ALAT	Alanine-aminotransferase
BMI	Body mass index
BP	Blood pressure
CK	Creatine kinase
CPT 2	Carnitine palmitoyl-CoA transferase 2
FAOD	Fatty acid oxidation defect
LCFAOD	Long-chain fatty acid oxidation defect
LCT	Long-chain triglycerides (long-chain fat)
MCT	Medium-chain triglycerides
TG	Triglycerides (fat)
VLCAD	Very long-chain acyl-CoA dehydrogenase

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Introduction

Obesity is common in adult metabolic patients as well as in the general population. Patients who cannot tolerate fasting and are restricted in their physical activity, for example, patients with long-chain fatty acid oxidation defect (LCFAOD) have an increased risk for obesity. The prescribed diet therapy for these patients is mostly experience-based (Spiekerkoetter et al. 2009, 2010; Gillingham et al. 2007;

Table 1 Diet composition

	Kcal.		En% LCT		En% MCT	
	Patient 1	Patient 2	Patient 1	Patient 2	Patient 1	Patient 2
Intake before intervention	±3,000	±3,000	26	>35	0	0
Prescribed diet	2,100–2,350	2,000–2,500	9	10	8	15
Reported intake during the diet	±2,000	±2,000	9	15	4	10

Laforêt and Vianey-Saban 2010). Experts advise avoidance of catabolic situations and discourage weight reduction in these patients (Gillingham et al. 2007). Since obesity brings new health risks, we face a growing demand for weight reduction in LCFAOD patients.

Case Description

We describe two patients with late-diagnosed LCFAOD and weight reduction guided by a metabolic dietitian at two academic centers.

Patient 1 (male, 47 years) was recently diagnosed with CPT 2 deficiency (homozygous C.338C> T mutation) and overweight (BMI: 27.8). He presented with severe rhabdomyolysis during an episode of pneumonia. Enzyme diagnostics showed a CTP2 activity of 2.2 nmol/(min.mg protein) (normal 9–13). His regular diet contained approximately 3,000 kcal (Table 1). He used to drink 2 l tea with sugar during the day, therefore his en% LCT was relatively low (26 en%) despite the fact that he eats products with a high fat content like cheese on a regular basis. He was given a diet with 2,100–2,350 kcal, which is 250–500 kcal below his estimated energy requirement calculated with the Harris and Benedict formula (Roza and Shizgal 1984) with an activity factor of 1,4 (2,600 kcal). To compensate for fatty acid oxidation of body fat, the diet contained less long-chain fat than defined in the recommendations (Spiekerkoetter et al. 2009). Calories where restricted by taking out most of the LCT and alcohol. Tea with sugar was continued and MCT was added to the diet. He was advised to use MCT margarine on his bread and prepare his meals with MCT oil. In addition, he was advised to use MCT powder before exercise in a dosage of 0.25 g/kg ideal bodyweight according to the recommendations. His total MCT intake with this diet was 8 en%. Due to problems with the refunding of the cost of the MCT margarine and MCT oil, he only used the MCT powder during the first 3 months of his diet. His real MCT intake was therefore lower than planned, around 4 en%, and his total calorie intake was also lower (see Table 1). The aim of the diet was to lose weight without metabolic decompensation and to improve his physical condition. The patient experienced exercise intolerance before his treatment because of his CPT 2 deficiency but also due to asthma. In addition to the diet advice he was revered to a physiotherapist for an exercise program. This exercise program included cardio fitness for a maximum of 15 min whereby his heart rate was monitored. The aim was a heart rate of 100 beats/min. The exercise intervals of 15 min allowed his heart rate to decrease. During the exercise interval he did strength exercises. Total workout time was around 60–75 min per session. The aim was to improve condition and to prevent fat oxidation.

Table 2 Weight, blood pressure, and lab results for patient 1

	Aug 2010	Nov 2010	Feb 2011
Weight (kg)	91.8	81.2	81.4
RR (mmHg)	141/92	120/80	122/82
CK (U/L)	282	106	183
C16 (μmol/l)	0.71		0.32
C18 (μmol/l)	0.24		0.14
C18:1 (μmol/l)	1.06		0.31

With this combined treatment of diet and exercise, patient 1 lost 10 kg body weight in a 3-months period (to BMI 25) and remained in good metabolic control throughout his diet period. CK levels, C16, C18, and C18:1 levels in his acylcarnitine profile and his blood pressure decreased during the period of weight reduction (Table 2). Muscle complaints did not increase and his physical condition improved.

Patient 2 (male, 39 years) was diagnosed with VLCAD deficiency in 1996 (mutations 520G>A (V174M) and 832_834delAAG (K278del), VLCAD enzyme activity 0.41 nmol/(min.mg protein) (normal 1.84–4.80). The previously prescribed prednisone for suspected polymyositis resulted in significant weight gain without improving symptoms. Patient 2 developed significant renal failure and rhabdomyolysis after exercise and needed temporary hemodialysis. Because of his poor condition and muscle complaints, patient 2 is unable to work anymore. The MCT diet was started after the diagnosis, but was discontinued due to poor taste acceptance by the patient. His weight further increased to 126.2 kg (BMI 35.1) with his high

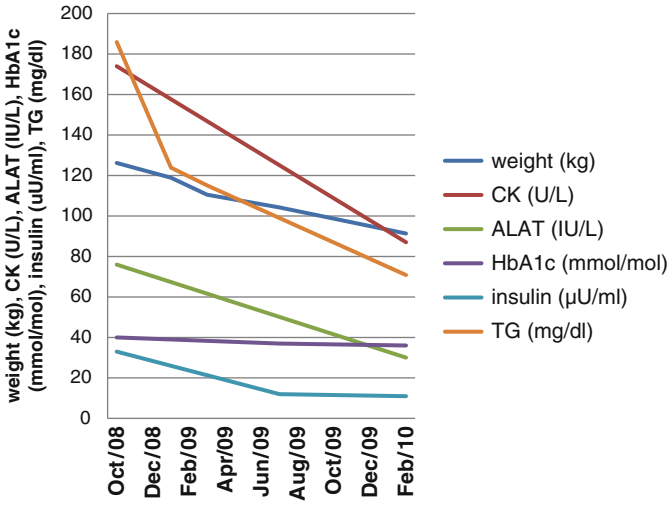

Fig. 1 Weight and lab results for patient 2 (October 2008–February 2010)

caloric diet (±3,000 kcal/day). Dietary advice was therefore modified: significant LCT restriction and carbohydrate-enriched diet with raw cornstarch added during the night (±30 g), of 2,000–2,500 kcal/day (see Table 1). MCT powder is now accepted in smaller dose. He takes 2–3 (10 g) sachets MCT powder a day instead of the prescribed 3–4 sachets depending on activity. Patient 2 lost almost 40 kg body weight to 87.6 kg (BMI 25.1) in a 2-year period. CK decreased from 174 to 87 U/L. Patient 2 feels much better with his reduced weight. Muscular symptoms were decreased since the introduction of raw cornstarch during the night and MCT before exercise. There is a substantial decline in insulin, TG, and ALAT blood levels with weight loss (Fig. 1).

Discussion and Conclusion

Weight reduction without loss of metabolic control seems possible in late-onset LCFAOD patients. No metabolic crisis occurred in these two patients, while the positive effects of weight reduction were clear. The residual enzyme function in late-onset LCFAOD may be one of the reasons that metabolic decompensation was prevented. In addition, dietary adjustments to prevent excessive fatty acid oxidation likely contributed as well. Expert supervision by a dietician specialized in metabolic diseases is therefore advisable.

References

Behrend AM, Harding CO, Shoemaker JD, Matern D, Sahn DJ, Elliot DL, Gillingham MB (2011) Substrate oxidation and cardiac performance during exercise in disorders of long chain fatty acid oxidation. Mol Genet Metab 105(2012):110–115

Gillingham MB, Purnell JQ, Jordan J, Stadler D, Haqq AM, Harding CO (2007) Effects of higher dietary protein intake on energy balance and metabolic control in children with long-chain 3-hydroxy acyl-CoA dehydrogenase (LCHAD) or trifunctional protein (TFP) deficiency. Mol Genet Metab 90(1):64–69

Laforêt P, Vianey-Saban C (2010) Disorders of muscle lipid metabolism: diagnostic and therapeutic challenges. Neuromuscul Disord 11:693–700

Roza AM, Shizgal HM (1984) The Harris Benedict reevaluated: resting energy requirement and body cell mass. Am J Clin Nutr 40:168–182

Spiekerkoetter U et al (2009) Treatment recommendations in long-chain fatty acid oxidation defects: consensus from a workshop. J Inherit Metab Dis 32:498–505

Spiekerkoetter U et al (2010) Current issues regarding treatment of mitochondrial fatty acid oxidation disorders. J Inherit Metab Dis 33:555–561