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Anthropometric and lipid profile of individuals with severe obesity carrying the fatty acid–binding protein–2 Thr54 allele

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ABSTRACT

Objective: The aim of this study was to evaluate the anthropometric and lipid profiles of individuals being considered for bariatric surgery, taking into account the presence of the Thr54 allele of the fatty acid–binding protein-2 (*FABP-2*) gene (rs1799883), and dietary intake.
Methods: In a cross-sectional study, 120 participants being evaluated for bariatric surgery were asked to keep 24-h dietary records (R24 h) for 3 d, and to collect a 24-h urine sample for measurement of urea (as an assessment of the adequacy of food records) during day 3 of the diet record; a fasting blood sample for laboratory and genetic evaluations was collected.
Results: When considering the whole sample, no significant differences were found; however, those who complied with the R24 h (n = 43) had more years of schooling and higher saturated fat intake, but lower weight and body mass index (BMI). When analyzing only the completers, the Thr54 allele carriers showed higher body weight ($P = 0.02$), BMI ($P = 0.03$), hip circumference ($P = 0.02$), basal metabolic rate ($P = 0.02$), and homeostatic model assessment-β ($P = 0.04$) compared with those who were homozygous for Ala54.
Conclusion: When the participants complied with the R24 h, Thr54 carriers were shown to have higher anthropometric parameters and higher homeostatic model assessment-β values than those with the wild genotype, but the lipid profile resulted similar in both carriers and noncarriers.

Introduction

The World Health Organization estimates that 500 million adults worldwide are obese. The main factor for this epidemic seems to be environmental changes that promote excessive caloric intake and low energy expenditure [1]. The expression of the obese phenotype and the development of the disease also seem to require some genetic predisposition [2].

The search for genetic variants that contribute to the predisposition to obesity began in the mid-1990s. Hundreds of genes have been proposed as candidates; however, only a minority has been associated with susceptibility to obesity [2,3]. Among them, the Ala54Thr variant of the fatty acid-binding protein-2 (*FABP-2*) gene has been associated with higher body mass index (BMI) [4–7], metabolic syndrome [8], and insulin resistance (IR) [4]. This is a single nucleotide polymorphism resulting from a substitution of alanine (Ala) by threonine (Thr) at codon 54 (rs1799883).

The *FABP-2* gene is located on the long arm of chromosome 4, and encodes an intracellular protein of the intestinal mucosa, responsible for the absorption and intracellular transport of fatty acids (FA) [9]. These proteins bind to FA, and are important for the transfer of these acids across the cell membrane. *FABP-2* is expressed in enterocytes and limited to the small intestine, especially in the proximal portion [10].

Ala54Thr was initially associated with IR when it was found that the Thr54 mutant allele had a twice the affinity for long-chain fatty acids than the wild type. The hypothesis is that the Thr54 allele increases the absorption of dietary FA, raising the

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conversion to triacylglycerols (TGs) and the transport by chylomicrons to the peripheral tissues [4]. Some studies show that Thr54 allele carriers have higher IR and serum lipid levels than the homozygous Ala54; however, these findings were not controlled for the dietary intake of the individuals, which could account for the difference in serum lipids [5,6,8,11,12].

The aim of this study was to evaluate the possible association between the Thr54 allele and anthropometric and lipid profile of severely obese individuals, taking into account the dietary intake of these participants.

Materials and methods

This was a cross-sectional study involving 120 individuals with severe obesity (BMI $\geq$35 kg/m^2) being evaluated for bariatric surgery according to the Brazilian guidelines [13]. Consecutively, they were seen at the Bariatric Surgery and Endocrinology outpatient units of Hospital de Clínicas de Porto Alegre (HCPA), from March 2010 to December 2014. Individuals were excluded if they had diseases that could interfere with the absorption of fatty acids (such as Crohn disease, celiac disease, or ulcerative colitis); were age <18 y, or illiterate (implicating difficulty in filling the required food records). The criteria of Associação Brasileira de Empresas de Pesquisa were used to stratify the participants according to their purchasing power, income, and educational level [14].

The study was approved by the HCPA Research Ethics Committee and received financial support from Fundo de Incentivo à Pesquisa e Eventos (FIPE-HCPA).

Anthropometric examination

All measurements were performed in accordance with the recommendations of the Brazilian Ministry of Health's Food and Dietary Surveillance System [15]. Weight (kg) was measured with a digital physician scale (Filizola, Brazil) with patients barefoot and wearing lightweight clothes. Height was measured with a wall-mounted stadiometer (Sanny, Brazil), with the patient standing and the head aligned in the Frankfurt plane. BMI was calculated by dividing the weight (kg) by the height (m) squared. All circumferences were measured using non-stretch fiberglass measuring tapes (Wiso, Brazil). Mid-upper arm circumference was measured at the midpoint between the acromion and olecranon, over the posterior aspect of the relaxed arm on the nondominant side. Waist circumference (WC) was measured at the midpoint between the lowest rib and the iliac crest. Hip circumference (HC) was measured at the level of the greatest protrusion of the gluteal area. The waist-to-hip ratio and the body adiposity index (BAI) were then calculated: ([Hip circumference/(height $\times$ $\sqrt{height}$)]–18).

Food consumption

Assessment of dietary intake included three 24-h dietary records (R24 h). Digital kitchen scales (with graduated scales from 1 g) and a measuring cup were provided. Patients were instructed by a trained dietitian on the use of the digital kitchen scales and measuring cups, and on how to record the measured food consumption over 3 d in appropriate forms. Later, the notes were reviewed to resolve incomplete or incorrect data. From the records, an average of the food consumed in 3 d was calculated, obtaining the energy, macro- and micronutrients, and dietary fiber actually ingested. Nutritional calculations were

Table 1
Sociodemographic and clinical characteristics of participants being evaluated for bariatric surgery with and without the Thr54 allele of the fatty acid binding protein-2 gene

	Overall (N = 120)	Ala54/Ala54 (n = 67)	Ala54/Thr54 and Thr54/Thr54 (n = 53)	*P* value
Age, y	45 (11.6)	45.5 (11)	44.2 (12.3)	0.53*
Female (%)	79.2	80.6	77.4	0.66*
Race (%)				
White	70.8	68.7	73.6	0.63†
Black	10.8	10.4	11.3	
Mulatto	9.2	9	9.4	
Others	9.2	12	5.8	
Economic classification (%)				
A	0.8	1.5	0	0.49†
B1 and B2	6.8	49.3	49	
C1 and C2	42.4	43.1	47.1	
D and E	5.1	6.2	3.8	
Education (%)				
Elementary school	46.3	46.9	45.3	0.49†
High school	31.9	33.3	30.2	
Complete and incomplete graduation	21.8	19.7	24.6	
Smoking				
Smoker	3.3	3	3.8	0.64†
Former smoker	35.8	32.8	39.6	
Nonsmoker	60.85	64.2	56.6	
Physical activity				
Active	41.4	42.2	40.4	0.84†
Sedentary	58.6	57.8	59.6	
Quality of life (SD)				
Total	31.3 (2.9)	31.1 (2.7)	31.6 (3.1)	0.36*
Physical health	11.6 (1.9)	11.5 (1.8)	11.7 (1.9)	0.41*
Mental health	19.7 (2.5)	19.6 (2.5)	19.9 (2.6)	0.58*
Binge-eating disorder (%)				
Negative	52.1	53	50.9	0.93*
Moderate	26.9	27.3	26.4	
Serious	21	19.7	22.6	
Hypertension (%)	71.7	77.6	64.2	0.10*
OSAHS (%)	44.1	47.3	40.4	0.77*
Type 2 diabetes mellitus (%)	34.2	34.3	34	0.97*
Dyslipidemia (%)	24.2	26.9	20.8	0.44*
Statin use (%)				
Yes	22.5	20.9	24.5	0.64*
No	77.5	79.1	75.5	

OSAHS, obstructive sleep apnea/hypopnea syndrome
* χ^2 test.
† Fisher's exact text. α differences between groups.