

Insulin resistance correlates to cognitive fatigue dimensions in non-diabetic obese children

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Background:

Alterations in endocrine functions and low-grade systemic inflammation represent fundamental characteristics of obesity. These biological systems have been repeatedly linked to fatigue symptoms.

Objectives:

To assess the relationship between fatigue symptoms and metabolic/inflammatory markers in a sample of non-diabetic obese children.

Methods:

The study was conducted in 41 obese (median BMI-SDS 4.2 [25-75th percentiles: 3.6-5.1]) children, median aged 12 [9-15] years, recruited in a pediatric tertiary center. Three dimensions of fatigue were assessed using the Pediatric Quality of Life Inventory Multidimensional Fatigue Scale: **general fatigue**, **sleep/rest**, **cognitive fatigue**. Moreover, a principal component analysis extracted relevant additional symptom dimensions (**concentration**, **energy**, **self-perceived cognitive efficiency**, **sleep/rest** and **motivation/anhedonia**).

Anthropometric and metabolic data from the population study

		Total population (n=41)
Age (years)		11.9 (2.7)
Men n,%		19 (46)
Body weight (kg)		78.6 (23.7)
BMI (kg/m ²)		31.9 (6.0)
BMI-SDS French references		4.3 (1.1)
BMI-SDS IOTF references		2.9 (0.5)
WC (cm)		102.6 (14.3)
WC-SDS		3.3 (0.6)
SBP-SDS		0.4 (1.1)
DBP-SDS		0.5 (1.4)
Glycaemia (g/l)		0.83 (0.10)
Insulin (µU/l)		14.1 (6.9)
HOMA-IR		2.9 (1.4)
HbA1c (%)		5.3 (0.2)
Uricemia (mmol/l)		332 (78)
hs-CRP (mg/l)		5.8 (5.9)
Total Peds-QL Fatigue score	18 items	58 (18)
Peds-QL® dimensions		
General fatigue	6 items	61 (20)
Sleep/Rest fatigue	6 items	58 (22)
Cognitive fatigue	6 items	55 (23)
PCA extracted dimensions		
Concentration	5 items	53 (25)
Energy	4 items	62 (22)
Perceived cognitive efficiency	3 items	51 (27)
Sleep/rest	4 items	54 (26)
Motivation/Anhedonia	2 items	76 (27)

Results are expressed as Mean (Standard Deviation). BMI, body mass index; BMI-SDS, BMI-standard deviation score; hs-CRP, high sensitive-C Reactive protein; DBP-SDS, diastolic blood pressure-standard deviation score; HOMA-IR, homeostatic model assessment-insulin resistance; SBP-SDS, systolic blood pressure-standard deviation; WC, waist circumference

Correlations between fatigue scores and metabolic/ inflammatory markers. ^ap<0.01; ^bp<0.05; ^cp<0.20

	Total fatigue score	Peds-QL® dimensions			PCA extracted dimensions				
		General fatigue	Sleep/Rest fatigue	Cognitive fatigue	Concentration	Energy	Self-perceived cognitive efficiency	Sleep/rest	Motivation/Anhedonia
Glycemia	-0.16	-0.04	-0.16	-0.21	-0.11	-0.14	-0.09	-0.10	-0.06
Insulin	-0.29 ^c	-0.27 ^c	-0.13	-0.34^b	0.04	0.09	-0.22 ^c	-0.08	-0.43^a
HOMA-IR	-0.32 ^c	-0.27 ^c	-0.16	-0.36^b	0.00	0.06	-0.26 ^c	-0.11	-0.45^a
Uricemia	-0.32 ^c	-0.20	-0.33^b	-0.27 ^c	-0.05	-0.19	0.00	-0.12	-0.39^b
hs-CRP	-0.19	-0.22 ^c	-0.05	-0.18 ^c	0.03	-0.20	-0.18	0.16	-0.36^b

Multivariate linear regression analysis between metabolic/inflammatory markers and fatigue

	Total fatigue score		Peds-QL® dimensions				PCA extracted dimensions					
	β	P	General fatigue		Sleep/Rest fatigue		Cognitive fatigue		Self-perceived cognitive efficiency		Motivation/Anhedonia	
Model controlling for age and sex												
Insulin	-0.15	0.34	-0.17	0.29	-0.01	0.92	-0.22	0.17	-0.21	0.21	-0.46	0.004
HOMA-IR	-0.21	0.17	-0.19	0.23	-0.03	0.82	-0.30	0.06	-0.25	0.13	-0.47	0.003
Uricemia	-0.20	0.30	-0.14	0.48	-0.12	0.53	-0.24	0.23	0.02	0.89	-0.54	0.005
hs-CRP	-0.17	0.27	-0.21	0.18	-0.02	0.88	-0.20	0.22	-0.16	0.31	-0.37	0.02
Model controlling for age, sex and BMI-SDS												
Insulin	-0.10	0.60	-0.19	0.36	-0.00	0.98	-0.08	0.67	-0.19	0.35	-0.40	0.04
HOMA-IR	-0.20	0.31	-0.23	0.26	-0.07	0.70	-0.20	0.31	-0.27	0.21	-0.42	0.03
Uricemia	-0.15	0.50	-0.10	0.67	-0.18	0.41	-0.09	0.67	0.13	0.59	-0.43	0.05
hs-CRP	-0.14	0.47	-0.24	0.24	-0.08	0.66	-0.04	0.82	-0.13	0.52	-0.26	0.19

Results:

Cognitive fatigue dimension and **reduced motivation/anhedonia** dimension were both associated with BMI, independently of sex and age.

Cognitive fatigue was correlated to insulin concentration and HOMA.

Reduced motivation/anhedonia was correlated to insulin concentration, HOMA, uric acid and hs-CRP concentrations. The association with insulin concentration and HOMA persisted when BMI was taken into account.

Conclusion

Among several fatigues dimensions, specific dimensions of **cognitive fatigue** and **reduced motivation/anhedonia** relate to **insulin resistance** in non-diabetic obese children.

Disclosure statement: The authors declare no conflict of interest.

Ref: Varni, J. W., C. A. Limbers, et al. (2010). "The PedsQL multidimensional fatigue scale in pediatric obesity: feasibility, reliability and validity." *Int J Pediatr Obes* 5(1): 34-42.

