



# Eat2beNICE

Effects of Nutrition and Lifestyle on Impulsive, Compulsive, and Externalizing Behaviours

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## Executive Summary

In this manuscript we assessed whether, after following 3 years of intervention with Mediterranean diet, impulsive personality traits in an older adult population with type 2 diabetes (T2D) had a predicting role in long-term weight control and glycemic management. Impulsivity has been associated with T2D and may negatively impact its management. For the assessment of impulsive personality traits, we used the Impulsive Behavior Scale (UPPS-P) at baseline. Results showed higher total baseline scores of UPPS-P and higher positive urgency in individuals with T2D compared to those without T2D. The regression analysis in patients with T2D showed that sensation seeking, and lack of perseverance predicted weight loss at follow-up. By contrast, traits impulsivity did not predict follow-up levels of HbA<sub>1c</sub>. In conclusion, the present findings suggest that higher impulsive traits in individuals with T2D seem to affect long term weight control but not glycemic control.

## Abbreviations

<b>BMI</b>	Body mass index
<b>HbA<sub>1c</sub></b>	Glycated haemoglobin
<b>MedDiet</b>	Mediterranean Diet
<b>T2D</b>	Type 2 diabetes



## 1. Deliverable report

It has been previously proposed that impulsivity leads to a lack of planning and insufficient regulation of behavior, so impulsive traits may be expected to predispose to poor weight control and reduced self-management of T2D in the long term. In line with this view, recent results in patients with T2D showed a negative correlation between impulsive traits and diabetes self-management, and a positive correlation with self-reported HbA1c levels, that is an indicator of glycemic control. In addition, impulsive personality has been shown to predict exercise and diet adherence indirectly and negatively via diabetes management self-efficacy. Nevertheless, the cross-sectional design of these studies did not provide a conclusion as to whether the impulsive personality could have a long-term impact on diabetes self-management. Regarding the relationship between BMI and impulsive traits in T2D, a study in a large population of individuals with T2D showed that higher scores in the Barratt Impulsiveness Scale (BIS-11) were related to higher BMI. In a recent study performed in an older adult population with obesity, individuals with lower impulsive traits achieved higher BMI decrease at one-year follow-up. Longitudinal studies are needed in patients with T2D, to elucidate the impact of impulsive personality traits on long-term weight management.

The present study first aimed to compare impulsive personality traits between Mediterranean older adult individuals with obesity in presence or absence of T2D, and to explore the relationship between impulsivity and diabetic metabolic indicators among the population with T2D. A second aim was to identify in patients with T2D if impulsive personality traits are predictors of weight loss and diabetes control after 3 years of lifestyle interventions. We hypothesises that patients with T2D would be characterized by more impulsive personality traits, according to the UPPS model, and impulsivity is expected to negatively affect weight-loss and glycemic control after an intervention with Mediterranean Diet (MedDiet).

This longitudinal analysis was performed in the framework of the PREDIMED-Plus-Cognition sub-study (n = 487), a subset sample of the clinical trial PREDIMED-Plus, a large multicentric randomized study that aimed to assess the effect of an energy-restricted Mediterranean diet, physical activity promotion, and behavioral intervention on the primary prevention of cardiovascular disease. Participants were community-dwelling adults, with Metabolic Syndrome (with any 3 of 5 risk factors), aged between 55 and 75 years, with a BMI between 27 and 40 kg/m<sup>2</sup>. Participants with diabetes constituted approximately 25% of the final total sample. Individuals were recruited in 23 Spanish health centers that participated in the study, and randomly assigned to either the intervention group or the control group. The intervention is based on an energy restricted MedDiet, with behavioral support and physical activity. The individuals randomized into the control group were advised to follow an unrestricted MedDiet without any further indication. Fasting blood samples were taken at baseline, 1-year and 3-year of follow-up to determine the levels of fasting blood glucose, glycated HbA1c, insulin and lipid profile. The Impulsive Behavior Scale (UPPS-P) was administered as a measure of impulsive traits at baseline. Stata17.0 was used for the statistical analysis. The comparison between the groups (presence/absence of T2D) at baseline (T0) was based on chi-square tests for categorical variables and T-tests for independent samples for continuous variables. Partial correlation coefficients (adjusted by sex, age and the education levels) assessed the association at baseline (T0) between the UPPS-P measures with the insulin related metabolic conditions. Multiple regression assessed the predictive capacity of the impulsivity levels at baseline (T0) on the BMI, weight and HbA1c measures at 3 years of the follow-up (T3).

After comparing participants with and without T2D at baseline, our results showed no differences between the groups for the sociodemographic, however the participants in the T2D group were older, and had higher levels of HOMA-IR, glucose and HbA1c. Regarding the UPPS-P scores, although the UPPS scores were subclinical in both groups, positive urgency and total UPPS-P score was higher within T2D participants. Regarding the association of impulsivity with markers of glucose metabolism, no relevant associations were found between the UPPS-P scores with the HOMA-IR, plasma fasting

glucose and HbA1c levels at baseline. All the partial correlations obtained non-significant results ( $p < 0.05$ ) and coefficients were within the low effect size range. When assessing the predictive capacity of the impulsivity at baseline on BMI, weight and HbA1c among the diabetic population, our results showed higher scores in the lack of perseverance subscale at baseline was associated with higher BMI levels at the end of the study, while higher total score of UPPS-P predicted higher weight at year 3. Additionally, higher scores of sensation seeking predicted lower decreases in the BMI and the weight. The impulsivity levels at baseline were not associated with the HbA1c levels at 3 years of follow-up, nor with the decrease in the HbA1c comparing the values at the end of the study with the baseline.

Overall, our study results showed that, in this older adult population, there were differences in personality traits in individuals with or without T2D, where UPPS-P scores, positive urgency and total factor registered higher mean within individuals with T2D, indicating that higher scores of impulsivity scale are associated with T2D, and these are predictors of weight loss but not of diabetes control after 3 years of MedDiet and lifestyle intervention. Further research is required to determine whether a clinic impulsive trait could influence the diabetes control.

## 2. Tables and other supporting documents where applicable and necessary

**Table 1.** Descriptive of the sample at baseline.

		Total ( <i>n</i> = 447)		T2D(-) ( <i>n</i> = 308)		T2D(+) ( <i>n</i> = 139)		
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>p</i>
Sex	<i>Men</i>	216	48.3%	146	47.4%	70	50.4%	0.563
	<i>Women</i>	231	51.7%	162	52.6%	69	49.6%	
Civil status	<i>Single</i>	17	3.8%	12	3.9%	5	3.6%	0.886
	<i>Married</i>	351	78.5%	244	79.2%	107	77.0%	
	<i>Divorced-separated</i>	29	6.5%	20	6.5%	9	6.5%	
	<i>Widowed</i>	50	11.2%	32	10.4%	18	12.9%	
School	<i>University (high)</i>	42	9.4%	30	9.7%	12	8.6%	0.985
	<i>University (grade)</i>	36	8.1%	25	8.1%	11	7.9%	
	<i>Secondary</i>	130	29.1%	89	28.9%	41	29.5%	
	<i>Primary</i>	239	53.5%	164	53.2%	75	54.0%	
Employment	<i>Unemployed</i>	81	18.1%	61	19.8%	20	14.4%	0.307
	<i>Work at home</i>	47	10.5%	35	11.4%	12	8.6%	
	<i>Retired</i>	287	64.2%	189	61.4%	98	70.5%	
	<i>Unemployed</i>	32	7.2%	23	7.5%	9	6.5%	
Group weight	<i>Overweight</i>	124	27.7%	91	29.5%	33	23.7%	0.145
	<i>Obesity I (BMI 30-35)</i>	217	48.5%	150	48.7%	67	48.2%	
	<i>Obesity II (BMI 35-40)</i>	102	22.8%	63	20.5%	39	28.1%	
	<i>Obesity III (BMI &gt; 40)</i>	4	0.9%	4	1.3%	0	0.0%	
Intervention group	<i>Control</i>	228	51.0%	161	70.6%	67	29.4%	0.425
	<i>Experimental</i>	219	49.0%	147	67.1%	72	32.9%	
Age (years-old)		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
		65.19	4.60	64.83	4.59	65.97	4.53	<b>0.015*</b>
HOMA-IR		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
		5.43	3.05	4.86	2.51	6.69	3.71	<b>&lt;0.001*</b>
Glucose		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
		116.60	29.68	103.61	12.95	145.37	35.55	<b>&lt;0.001*</b>
Glycated hemoglobin (HbA <sub>1c</sub> )		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
		6.15	0.78	5.80	0.39	6.91	0.87	<b>&lt;0.001*</b>
UPPS-P Lack of premeditation		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
		19.85	5.60	19.69	5.59	20.18	5.62	0.397
UPPS-P Lack of perseverance		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
		18.92	5.01	18.83	5.06	19.14	4.89	0.547
UPPS-P Sensation seeking		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
		20.51	7.14	20.29	7.22	20.99	6.97	0.338
UPPS-P Positive urgency		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
		23.10	8.28	22.52	8.08	24.38	8.60	<b>0.028*</b>
UPPS-P Negative urgency		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>p</i>
		24.57	7.35	24.21	7.11	25.38	7.84	0.118

UPPS-P Total score	106.95	22.62	105.55	22.40	110.07	22.86	<b>0.049*</b>
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Note. T2D(-): diabetes absent. T2D(+): diabetes present. SD: standard deviation. BMI: body mass index. HOMA-IR: Homeostasis Model Assessment of Insulin Resistance index. UPPS-P: impulsive behavior scale. \*Bold: significant comparison.

**Table 2.** Significant predictors at 3-yrs of the follow up considering impulsivity measures at baseline: final models adjusted by sex, age, education and intervention group (results for the subsample of patients with T2D).

Criteria (3 yrs)	UPPS-P (at baseline)	B	SE	Beta	p	95%CI B	
BMI	Lack of perseverance	0.122	0.064	0.160	0.048	0.005	0.250
Changes in BMI	Sensation seeking	-0.067	0.022	-0.259	0.002	-0.110	-0.025
Weight	Total score	0.125	0.048	0.196	0.010	0.030	0.219
Changes in weight	Sensation seeking	-0.218	0.058	-0.305	<0.001	-0.333	-0.103
Hb1Ac	<i>No significant predictors</i>						
Changes in Hb1Ac	<i>No significant predictors</i>						

Note. UPPS-P: impulsive behavior scale. B: non-standardized coefficient. SE: error standard. Beta: standardized coefficient. 95%CI: 95% confidence interval. BMI: body mass index. HbA1c: Glycated hemoglobin.

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