Proceedings of the Nutrition Society (2016), **75 (OCE3)**, E114 doi:10.1017/S0029665116001294

Summer Meeting, 11–14 July 2016, New technology in nutrition research and practice

Investigation of the role of riboflavin, vitamin B6 and MTHFR genotype as determinants of cognitive health in ageing

K. Porter[1], C.F. Hughes[1], L. Hoey[1], M. Ward[1], K. Moore[1], J.J. Strain[1], A. Molloy[2], C. Cunningham[3], M. Casey[3], K. Pentieva[1] and H. McNulty[1]

[1]*Northern Ireland Centre for Food and Health, Ulster University, Coleraine, BT52 1SA,* [2]*Institute of Molecular Medicine, School of Medicine, Trinity College, Dublin 2, Ireland and* [3]*Mercers Institute for Research on Ageing, St James's Hospital, Dublin, Ireland.*

Cognitive impairment and dementia are important public health issues in ageing. Nutrition has been identified as a modifiable risk factor for cognitive dysfunction and this may be important in preventing the onset of dementia in older age[(1)]. A growing body of evidence from observational studies and randomised controlled trials (RCTs) suggests that one-carbon metabolism and the related B-vitamins may be important for cognitive health in ageing[(2)]. To date however, research has focused on the roles of folate and vitamin B12, with few studies considering vitamin B6 or riboflavin. The aim of this study was primarily to examine the roles of riboflavin, vitamin B6 and genetic interaction with the 677C → T polymorphism in *MTHFR,* as predictors of cognitive performance in ageing.

This investigation was conducted in Irish adults (⩾60 years; n = 5186) from the Trinity, Ulster, Department of Agriculture (TUDA) Ageing Cohort Study. Detailed clinical, nutritional and lifestyle data were collected and cognitive performance was assessed using a battery of tests, including the Folstein Mini-Mental State Examination (MMSE) and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Riboflavin status was determined by the erythrocyte glutathione reductase activation coefficient (EGRac) assay. Vitamin B6 was measured by reversed-phase HPLC with fluorescence detection. Biomarkers of folate and vitamin B12 were also measured. The *MTHFR* 677C → T polymorphism was identified using the KASPer method and was performed by LGC Genomics (Herts, UK).

	Cognitive Performance Tests[1]			
	MMSE		RBANS	
B-vitamin status[2]	OR (95 % CI)	*p*	OR (95 % CI)	*p*
Low Riboflavin	0·98 (0·81- 1·18)	0·805	1·20 (1·05–1·37)	**0·009**
Low Vitamin B6	1·51 (1·25–1·82)	**<0·001**	1·23 (0·98–1·30)	0·101
Low Riboflavin*Low B6	1·50 (1·18–1·90)	**0·001**	1·30 (1·09–1·56)	**0·009**
TT (versus CC/CT) genotype				
Low Riboflavin* TT[3]	0·92 (0·60–1·43)	0·720	1·53 (1·05–2·21)	**0·026**

[1]Logistic regression was performed with adjustment for age, education, depression and other vitamin biomarkers. Cognitive dysfunction defined as MMSE score ⩽25; RBANS score <80.[2] Riboflavin status categories were identified using established cut-off values for EGRAC: low ⩾1·3 versus reference category (<1·3) and tertiles for vitamin B6 concentrations: lowest tertile versus reference category (top two tertiles).[3] TT, homozygous mutant genotype for the 677C → T polymorphism in MTHFR.

Results showed that low biomarker status of vitamin B6 and riboflavin were each found to be significant predictors of cognitive dysfunction (Table). Furthermore, combined low biomarker status of both vitamins was associated with a 30–50 % increased risk of cognitive dysfunction after adjustment for cofounding variables. Additionally, although the *MTHFR* 677C → T polymorphism was not significantly associated with cognitive dysfunction, when combined with low biomarker status of riboflavin, the *MTHFR* 677TT genotype was associated with a 53 % increased risk of cognitive dysfunction (RBANS). In conclusion, these findings suggest that interactions of vitamin B6, riboflavin and the *MTHFR* 677TT genotype, although often overlooked, are important determinants of cognitive health in ageing. Further research is warranted including targeted RCTs in order to determine whether a causative relationship exists.

1. Morris MS (2012) *Advances in Nutrition* **3**, 801–812
2. Bailey LB, Stover PJ, McNulty H *et al.* (2015) *J Nut* **145**, 1636S–80S