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AETIOLOGY OF URINARY STORAGE SYMPTOM SYNDROMES: EVALUATION OF A DIET AND LIFESTYLE MODEL INVOLVING DIABETES AND OBESITY IN WOMEN

Hypothesis / aims of study

Previous studies implicate diabetes in the pathogenic process for Overactive Bladder (OAB) (1) and obesity as causal for Stress Urinary Incontinence (SUI) (1). The aims of this study were to test the hypothesis that diet and lifestyle factors implicated in the development of diabetes and obesity are causal for OAB and SUI and to identify specific predictors.

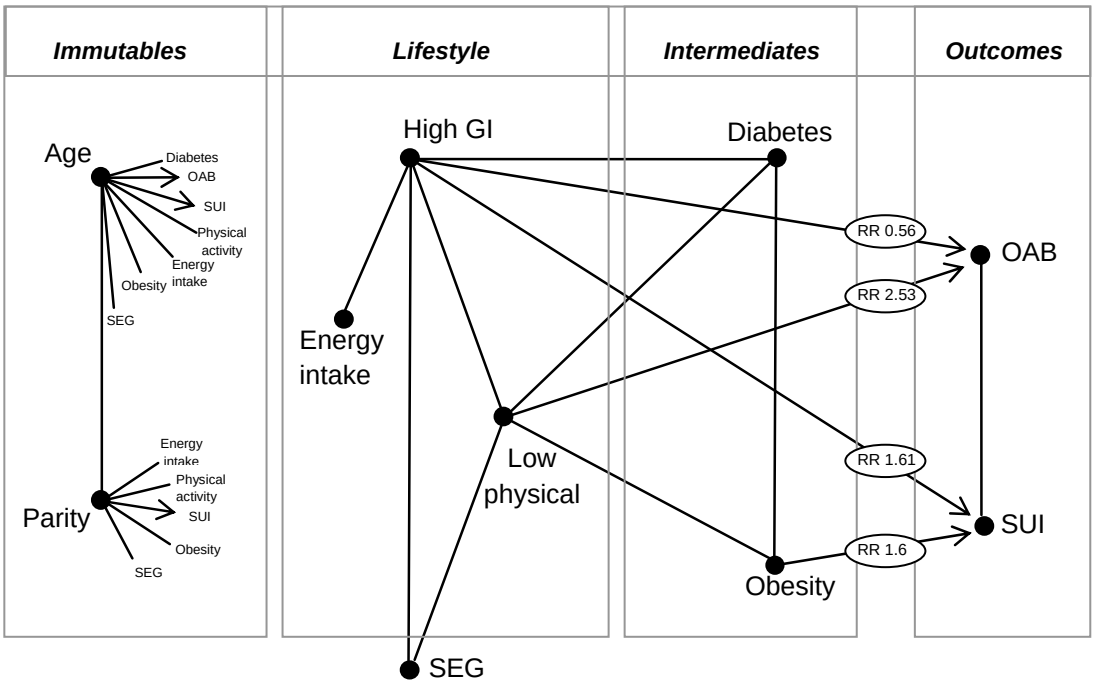
Study design, materials and methods

This study evaluated an evidence-based epidemiological model involving lifestyle factors and morbidities in relation to the onset of OAB and SUI. The following model was developed as a logical causal chain within which potential factors were grouped into 4 successive blocks: "immutable" (parity and age) → "modifiable lifestyle" (dietary glycemic index (GI), energy intake and physical activity) → "intermediate morbidity" (diabetes and obesity) → ''urinary outcomes'' (OAB and SUI). A standardised literature review of epidemiological studies was undertaken to identify those prospective (i.e. longitudinal) and cross-sectional associations that were supported by 3 or more previous epidemiological studies and this formed the basis for an initial defined model. The modifiable and intermediate prospective associations identified by the review were: high GI to diabetes and obesity; low physical activity to diabetes and obesity; high energy intake to obesity; diabetes to obesity; and obesity to OAB and SUI. Similar cross-sectional associations were: high GI with high energy intake; high physical activity with high energy intake; and OAB with SUI. Prospective associations for immutable factors were: age (positively) to OAB, diabetes, obesity, physical activity and (negatively) to energy intake; plus parity (positively) to OAB, SUI and obesity. The directions of associations identified in the review were consistent with the sequence within the logical causal chain model. This evidence-based model was evaluated in 3 stages. Firstly, the defined model was tested (i.e. containing only the specific associations between the variables identified from the literature review). Secondly, a generated model containing all potential associations between the same set of variables was tested. Thirdly, the generated model with adjustment for socio-economic group, using the recognised indicator of car-ownership, was tested. Graphical Modelling was used to identify relationships between all the variables and thereby provide an appreciation of all the potential confounding effects.(2) MIM and Stata software involving stepwise regression (p 0.05) were used to estimate specific associations (prospective relative risk – RR; cross-sectional odds ratio – OR) and goodness of fit. This secondary analysis was performed using data from a prospective community-based cohort of 7000+ women aged 40 and over, which originally collected reported information on diet (EPIC food frequency questionnaire), lifestyle, morbidities at baseline and urinary outcomes newly incident at one year follow-up, using validated measures (3).

Results

In the initial defined model, all associations identified in the literature review were confirmed within the data except: energy intake with obesity and physical activity; and GI with obesity. Using identical variables, the generated model, allowing *all* potential associations, additionally revealed that: low GI predicted OAB and SUI; low physical activity predicted OAB; and the goodness of fit was improved. Adjustment of the generated model for socio-economic group (SEG) confirmed all associations, did not reveal any further associations within the model and produced the best fit. Prospective associations in this final model of best fit were: high GI to OAB, RR 0.56 (95% CI: 0.37-0.84) and high GI to SUI, RR 1.61 (95% CI: 1.11 – 2.32); low physical activity to OAB, RR 2.53 (95% CI: 1.85 – 3.44); and obesity to SUI, RR 1.6 (95% CI: 1.54 – 2.74) (see Fig 1). Indirect (and cross-sectional) associations in the final model featured low physical activity in association with: high GI, OR 1.62 (95% CI: 1.17 – 2.25); obesity, OR 7.89 (95% CI: 5.89 – 10.55) and diabetes, OR 2.89 (95% CI: 1.83 – 4.57). Immutable factors that were predictive within the model were older age to OAB and higher parity to SUI. SEG was not predictive for OAB or SUI.

Figure 1: Generated model adjusted for socio-economic group



Key: ——→ Prospective associations *(p <0.05)*; ——— Cross-sectional associations *(p <0.05).*

Evaluation of the evidence-based model confirmed the original hypothesis that diet and lifestyle factors associated with diabetes and obesity are potential primary causes of urinary storage symptom syndromes. Associations for all the factors shown in the model (Fig 1) were significant at the 5% level. Specific direct predictors for the onset of SUI were obesity and high GI (as well as parity); and for the onset of OAB were low physical activity and low GI diet. These findings reproduce the well-established causal relationship between obesity and SUI whilst the other findings have rarely been studied. The relationship between GI and OAB may represent a protective effect for some aspect of a high carbohydrate diet and an adverse effect for some aspect of a high fat or protein diet. The strength of the current study lies in the extent to which it investigates all potential associations in the model and thereby reveals hidden confounding factors as potential mechanisms within the model. Behind the prospective associations lies a web of cross-sectional associations representing possible indirect causes. For example, low physical activity was strongly implicated as part of a mechanism in which obesity leads to SUI and appeared to depend on a relatively high GI diet. This is consistent with previous studies concerning physical activity in relation to obesity but a link between high GI diet and low physical activity has not been identified before. There was insufficient epidemiological evidence in the review to link diabetes directly to OAB and, in the model, it was only indirectly linked via obesity and SUI. Adjustment for SEG had little impact but was associated with other lifestyle factors within the model of best fit, suggesting a possible indirect contribution to the urinary outcomes.

Concluding message

This is the first epidemiological study to specifically implicate physical activity and dietary glycemic index as direct primary modifiable causes of urinary storage symptom syndromes, based on evaluation of an a priori hypothesis involving diabetes and obesity. Confirmation of these findings by clinical trial is recommended.

References

1. J Epid & Pub Hlth (1999); 53(8):453-458
2. Introduction to Graphical Modelling; New York, Springer 2000
3. Neurourol & Urodyn (2005); 24(2):100-105

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HUMAN SUBJECTS: This study was approved by the Leicestershire Local Research Ethics Committee and followed the Declaration of Helsinki Informed consent was obtained from the patients.