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LIFE EVENTS AND THE CONTROL OF DIABETES MELLITUS*

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Abstract—The experience of stressful life events was found to be associated with disturbances of diabetic control. Increases in the incidence of glycosuria, changes in prescriptions and frequency of clinic attendance were associated with increases in the reported occurrence of life events. The experience of life events was not reflected in blood glucose measures. Any increases in blood glucose appeared to be registered as glycosuria. Analysis of variance showed that insulin treated groups scored higher on 'disturbance measures' than the tablet treated groups. Insulin requiring diabetics were more inclined to have problems with their diabetic management in association with life events than the tablet treated diabetics.

GRANT, KYLE, TEICHMAN and MENDLES [1] used a modification of Holmes and Rahe's Schedule of Recent Events inventory to examine the relationship between the occurrence of life events and the course of illness in a group of diabetic patients. Their findings suggested a relationship between the occurrence of life change and aggravation of the diabetic state although this relationship was not statistically significant. Various of their subgroups of patients (juvenile vs adult onset diabetes; males vs females; insulin requiring vs non-insulin requiring) showed no significant differences in the life events reported, nor in the association between life events and change in physical state. Instead of examining the individual indices of physical state available, Grant and his colleagues used that information to make an overall evaluation of the patients' condition at each visit. This evaluation was made by a rater who had no contact with the patients.

The present study is a development of that of Grant and his colleagues [1]. It examined individual measures of physical state in relation to retrospective measures of life events experienced over a 12 month period. It was hypothesised that the experience of stress in the form of life events would lead to problems in the management of diabetes which would be reflected in poorly controlled blood glucose levels, episodes of glycosuria and changes in treatment requirements.

METHOD

Subjects

One hundred and fourteen diabetic patients from the outpatient clinic at the Nottingham City Hospital participated in this study. The subjects were divided by sex and treatment into four groups (see Table 1).

TABLE 1.—NUMBERS OF DIABETIC SUBJECTS PARTICIPATING IN STUDY

		Sex	
		Male	Female
Treatment	Insulin	45	32
	Tablet	18	19

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The patients' ages ranged from 16 to 81 years. (The sample included a range of occupations from professional to unskilled workers as well as housewives and those who had retired from work.)

Questionnaires

The version of life events inventory employed by Lundberg, Theorell and Lind [2] was used in this study. The events were rated for 'upsetting' or for 'adjustment' using analogue scales. Subjects were asked to tick those events they had experienced during the past year. Subjects also completed a Maudsley Personality Inventory.

Procedure

The questionnaires were distributed and collected in during the diabetic outpatient clinic sessions at the Nottingham City Hospital. After giving routine blood samples in the hospital laboratory the patients waited while the samples were analysed. Questionnaires were completed during this waiting period prior to consultation with the physician.

Information concerning the patients' treatment and condition during the previous 12 months was gathered from the medical records.

Data analysis

The data were factor analysed using principal component analysis (leaving unity in the diagonals of the correlation matrix). The factors of interest were rotated to simple structure using the varimax rotation.

The dependent variables for the insulin treated groups were as follows. (a) Mean rating of all life change items. (b) Sum of ratings of experienced events. (c) Number of experienced events. (d) Age. (e) Neuroticism. (f) Extraversion. (g) Blood glucose level on the day. (h) Mean blood glucose level (over 12 months period). (i) Variance of blood glucose levels. (j) Urine glucose (number of times present). (k) Weight (difference between actual and ideal weight). (l) Number of changes of insulin or tablet prescription. (m) Number of insulin units taken (on day). (n) Number of clinic attendances (over 12 months period).

Variables for the tablet treated groups were as above with the exception of the insulin unit data (m) which were replaced by zeros.

The data from all 114 subjects were factor analysed. Separate analyses of variance were then carried out to examine differences due to sex and treatment. When the results from subjects rating for upsetting were combined for analysis with the results from subjects rating for adjustment, data dependent upon these variables were excluded (i.e. a and b).

RESULTS AND DISCUSSION

Table 2 shows that four factors were elicited with Eigen-values greater than 1.0 which together accounted for 62.7% of the variance. The rotated factor matrix is shown in Table 3. The first two factors are the most interesting in the present context and will be considered in detail.

TABLE 2.—FACTORS ELICITED FROM THE PRINCIPAL COMPONENTS ANALYSIS

Factor	Eigen-value	Percentage of variance	Cumulative percentage
1	2.73399	24.9	24.9
2	1.76189	16.0	40.9
3	1.31526	12.0	52.9
4	1.07911	9.8	62.7
5	0.92857	8.4	71.2

Those variables with a loading higher than 0.4 were assumed to characterise each factor.

The number of life events experienced during the year (c), the number of incidences of glycosuria (j), changes of insulin or tablet prescrption (l) and the number of clinic attendances (m) all loaded highly together on factor 1 (see Table 3). The pattern of relationships of these variables provided support for the hypothesis that the occurrence of life events is associated with problems in diabetic management. This factor has been labelled 'disturbance measures'.

Factor 2 was characterised by the three measures of blood glucose and also by urine glucose measures. Higher blood glucose levels were, as would be expected, associated with greater incidence of glycosuria.

The factor analysis suggested that there was little association between the experience of life events

TABLE 3.—VARIOUS ROTATED FACTOR MATRIX

	Variable	Factor 1	Factor 2	Factor 3	Factor 4	Commuality
(c)	No. of life events	*0.54089*	−0.10786	0.20321	0.10205	0.35591
(d)	Age	−0.13844	−0.07911	−0.30148	*−0.73665*	0.65897
(e)	N	0.05080	0.14861	*0.70675*	−0.12918	0.54086
(f)	E	0.04202	−0.10506	−0.14842	*0.72205*	0.55620
(g)	BGL on day	0.01288	*0.71599*	−0.24768	0.15567	0.59839
(h)	BGL mean	0.05180	*0.87941*	0.10868	−0.15272	0.81117
(i)	BGL variance	0.08169	*0.71451*	0.32097	−0.14338	0.64078
(j)	Urine glucose No.	*0.50611*	*0.48838*	−0.23918	0.19093	0.58833
(k)	Weight	0.00660	−0.10075	*0.65539*	0.20053	0.47994
(l)	Prescription changes	*0.89491*	0.18064	−0.03413	−0.02527	0.83529
(m)	No attendances	*0.90207*	0.07617	−0.01571	0.06808	0.82442

and measures of blood glucose which loaded highly on a separate factor (factor 2). Rather, it appeared that the disruptive effects of life events were reflected in the spillage of glucose into the urine.

Analysis of variance: results and discussion

In order to examine quantitative differences between sex and treatment groups the individual factor scores were computed for each subject. Two way analysis of variance was carried out and the results of the analysis of factors 1 and 2 are considered here.

Factor 1: '*disturbance measures*'

Differences in the factor scores of males and females were not significant. However, insulin and tablet groups differed significantly in the extent to which they scored on this factor ($F = 14.386$; d.f. 1, 110, $p = 0.00024$). Observation of the raw data means showed that insulin requiring diabetics reported that they had experienced life changes slightly more often than tablet treated diabetics. They also manifested a greater incidence of glycosuria, their prescriptions were changed more frequently and they attended the clinic more often than the tablet treated diabetics (see Table 4). Although the insulin requiring diabetics did not differ greatly from the tablet treated diabetics in terms of the number of events they reported, they were more prone to the physiological disruption of their diabetic control which was associated with life change in factor 1.

TABLE 4.—MEAN FACTOR SCORES FOR VARIABLES LOADING OF FACTOR 1

	Insulin		Tablet	
	Males	Females	Males	Females
No. exp. events	2.2	2.3	2.9	1.1
Urine glucose	2.3	2.8	1.7	1.2
Prescription change	1.7	2.4	0.7	0.5
No. attendances	4.6	5.1	3.6	3.8

Factor 2: '*glucose measures*'

There were no significant differences in glucose measures due either to sex ($F = 2.333$, d.f. 1, 110, $p = 0.12949$, n.s.) or to treatment ($F = 2.208$, d.f. 1, 110, $p = 0.14016$, n.s.). Data means are presented in Table 5. Differences due to treatment were reflected in urine glucose measures and blood glucose variability with insulin requiring diabetics showing a higher incidence of glycosuria and greater variability in blood glucose levels. Measures of absolute blood glucose level were not affected by treatment differences. Female insulin requiring diabetics tended to have higher scores on all blood glucose measures and greater incidence of glycosuria than the male insulin requiring diabetics. No such sex differences were apparent in the tablet treated groups.

Mean blood glucose levels for all groups exceeded the normal renal threshold. Any further increase in the already high blood glucose levels was registered as greater spillage of glucose into the urine. The measure of physiological disturbance which was associated with life change was the incidence of glycosuria rather than the measures of blood glucose.

Grant *et al.* [1] arrived at an evaluation of each patient's physical state by assigning an overall rating to the following indices: weight, blood pressure, blood sugar, urine sugar, urine protein, changes in existing complications relating to diabetes, emergence of new medical conditions, intercurrent infections and general physical condition. They also considered the patient's evaluation of his own physical status since the last visit, the number of hypoglycaemic episodes, changes in diet

TABLE 5.—MEAN FACTOR SCORES FOR VARIABLES LOADING ON FACTOR 2

	Insulin		Tablet	
	Males	Females	Males	Females
B.G.L. means	202.8	224.7	218.7	197.6
B.G.L. variance	68.6	77.8	57.7	38.3
B.G.L. on day	119.0	233.2	216.2	217.9
Urine glucose	2.3	2.8	1.7	1.2

and the dose of oral hypoglycaemics and insulin. The results of the present factor analytic study, however, suggest that of these indices only urine glucose and prescription changes are directly associated with life events experienced. There was little association between life events and blood glucose measures and weight. It appears that the combination of specific measures to form a general measure served to dilute the association between certain specific measures of physical state and the experience of life events which was found in the present study.

Furthermore the present study found significant differences between insulin and tablet treated diabetics in their factor 1 scores. Insulin treated diabetics experienced more 'disturbance' than tablet treated diabetics. It appeared that the insulin treated diabetics were more likely to have problems with the management of their disorder which were associated with life events. Insulin requiring diabetes is a more severe form of the disorder where there is little or no effective insulin produced endogenously. Control is dependent upon the careful balance between insulin dose, diet and glucose metabolism. The hormonal changes associated with stress will alter glucose metabolism while the amount of insulin available remains constant. Tablet treated diabetics, on the other hand are likely to have some degree of endogenous homeostatic control and hence will suffer less physiological disruption in response to stressful experiences.

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