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A Study on The Relation between Psychological Stress and Stress Hormone, Nutritional Status of Patients with Non-Insulin Dependent Diabetes Mellitus

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ABSTRACT

This study estimated the relation between psychological stress and stress hormones, nutritional status of patients with non-insulin dependent diabetes mellitus(NIDDM). Psychological stress such as depression and anxiety in 34 diabetics was analyzed in relation to nutrient intake, blood components such as fasting blood sugar(FBS), hemoglobin A_1C, stress hormones and amino acids. The levels of depression and anxiety were measured by The center for epidemiological studies-depression scale(CED-S) and Spielberger's State-Trait Anxiety Inventory-State(STAI-S) respectively. Nutrients intake was measured by 24 hour usual recall methods. The levels of catecholamine, hemoglobin A_1C and amino acids were measured by high performance liquid chromatograpy(HPLC). The cortisol and glucagon were measured by radio immuno assay(RIA).

Analyses revealed that the levels of depression and anxiety in diabetics were higher than those of normal controls. Anxiety score of diabetics was significantly higher than normal controls. Among diabetics the mean values were 329.18±111.49pg/ml for total catecholamine (norepinephrine and epinephrine) and 233.95±73.99pg/ml for norepinephrine, 94.03±75.97pg/ml for epinephrine, 13.18±5.55μl/dl for cortisol and 171.50±62.50pg/ml for gulcagon respectively. The levels of stress hormones in diabetics such as total catecholamine, norepinephrine, cortisol and glucagon were significantly higher than those in normal control. The level of epinephrine was higher in diabetics but the difference was not significant. The calorie intake in diabetics was 1762±292kcal which is 81.4% lower than Korean recommended dietary allowances(RDA). Calcium intake was slightly low but other nutrients intakes were higher than RDA. The value of fasting blood sugar(FBS), usual fasting blood sugar(usual FBS) which reflect average FBS during 3 months and hemoglobin A_1C in diabetics was 184.18±74.22mg/dl, 177.76±42.77mg/dl and 8.84±2.82% respectively. The distribution of plasma amino acids in diabetics was generally in the normal range. The level of anxiety in diabetics was positively correlated with norepinephrine, concentration and usual FBS. The levels of glucagon, usual FBS and hemoglobin A_1C were positively correlated with the branched chain amino acid(BCAA : leucine, isoleucine and valine). (*Korean J Nutrition* 29(8) : 889~898, 1996)

KEY WORDS : diabetes mellitus · depression · anxiety · stress hormone · amino acid.

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Introduction

The number of diabetics as well as the death rate among the diabetics in Korea have been increased very rapidly. Diabetes mellitus is a common disease that needs continuous control. Patients need to control blood glucose by continuous diet, exercise and drug therapy. To manage diabetics, diet therapy is the most important, but psychological factors also play roles for nutrients intake, energy expenditure and nutrients metabolism. When stress builds up, the way the patient copes with it makes the sugar level in blood go up[1-4]. Among the normal as well as diabetics it was found that the gluconeogenesis and protein breakdown increased by the action of stress hormones such as glugacon, cortisol and catecholamine[5-11]. And the secrection of insulin is inhibited by catecholamine[12].

Stein and Chares[13] for example reported that stress itself can be a cause for diabetics and diabetics have more stressful background. Many studies have been done on stress. Physical excitement, disease, depression, fear and anger can be causes for stress, which in turn bring about changes in internal hormone secretion and induce significant increases in pulse, blood pressure and non-esterified fatty acid levels[1)4)14)15)].

Many studies reported that patients with non-insulin dependent diabetes mellitus(NIDDM) showed that in case of high blood glucose level, higer level of catecholamin, plasma branched chain amino acid and alanine[5-10)16)]. In Baker's study[17], when stress was given to a girl who was an diabetics, levels of corticoid, growth hormone and epinehprine were increased and sugar level in blood was continously increased for an hour.

According to Bruce[18], in case of NIDDM, when stress was built up for a long time, the levels of cortisol and growth hormone were affected. That is, chronic psychological stress will increase fatty acid level, inhibit sugar metabolism and insulin sensitivity and finally bring about glucose intolerance. When stress builds up, depression is more often there and this psychological condition causes physical changes and nutritive conditions and eventually worsens diseases. Peyrot and Mcmarry[14] reported that there was more hemoglobin A_1C when one deals with stress with anger, impatience and anxiety than stoicism. Many researchers said that relaxation training is more effective to control blood sugar level[19-23]. In Korea, Park's et al.[24] and Moon and Hong's study[25] also found that the level of depression in diabetics was higher and that was positively related to fasting blood sugar.

As shown in above mentioned studies, psychological factors play very important roles in diabetics. However there are not enough studies done on nutrition and psychological condition for diabetics in order to keep balanced sugar level and nutrition. It is necessary to approach psychologically when studying nutrition for diabetics or even when educating and couseling them.

The purpose of this study is to analyze the relation between psychological stress and stress hormones, nutritional status in NIDDM(Fig. 1).

Hypotheses are as follow ;

1) The level of depression and anxiety in diabetics will be related to that of stress hormone and fasting blood sugar.

2) The level of depression and anxiety in diabetics will be related to nutrient intake and physical activity energy expenditure.

3) The level of stress hormone in diabetics will be related to hematology such as FBS, Hemoglobin A_1C and amino acid.

Materials and Method

1. Subjects

The subjects consist of 34 NIDDM patients without other disease who was inpatients or outpatients. They filled out questionnaires on psychological stress

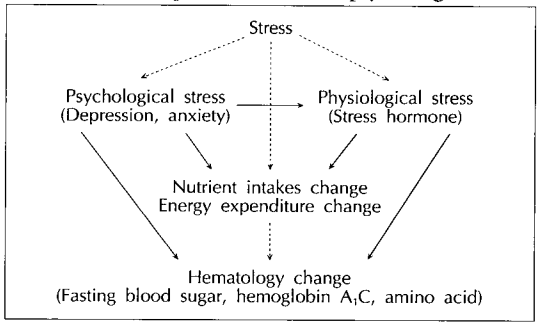

Fig. 1. Hypothetical model.

and received hematology test at a clinical appointment. And 11 normal controls were healthy and similar age distribution. The control group served as baseline for the level of psychological stress, stress hormones and amino acids.

2. Materials

A qestionnaire was formulated for general status data of diabetic patients and normal controls. And following measures were administered by 5 assistants who were trained interviewing skill for collect data of psychological stress using questionnaire and also nutrients intake data using usual 24 hour recall method with food models and pictures.

1) Psychological analysis

The 20 item questionnaire of the center for epidemiological studies-depression scale(CED-S) was used to measure depression[26]. Spielberger's State-Trait Anxiety Inventory-State(STAI-S) questionnare consisting of 20 items was used for the measure of anxiety[27].

2) Biochemical Analysis

Blood samples(10ml) from the diabetics and the normal controls were taken in the morning after overnight fast. FBS(fasting blood sugar) concentrations were measured by the autoanalzer glucose oxidase method. And the usual FBS calculated average FBS level during 3 months from medical record before sampling blood of FBS. The level of serum catecholamine, serum hemoglobin A_1C and plasma amino acids were measured by high performance liquid chromatograpy(HPLC). The level of serum cortisol and serum glucagon were measured by radio immuno assay(RIA).

3) Nutrients Intakes and physical activity energy expenditure analysis

Nutrients intakes were measured by a 24 hour usual recall method by trained interviewers. Nutrients analysis was done with the computer program developed by Hong[28]. The physical activity energy expenditure was calculated activity costs based on a record of usual activity over a 24-hour period[29][30]. Acording to these data, the physical activity energy expenditure was analyzed ussing the computer program developed by Hong[28].

3. Statistical Analysis

Data were analyzed using SPSS PC. Student's t-test and pearson correlations were used. A probability value of 0.05 was chosen as the level of statistical significance.

Results and discussion

1. General Characteristics of subjects

The mean age was 55.47±10.85 years for diabetics and 49.64±6.19 years for normal controls. Among the 34 diabetics, 14 subjects(41%) were male and 20 subjects(59%) were female. BMI(body mass index) was 22.92±2.72 in diabetics and 22.95±2.29 in normal controls. As shown in table 1, there were no statistically significant differences between normal con-

Table 1. Clinical data in normal and diabetics

Variable	Normal (N=11) Mean±SD	Diabetics (N=34) Mean±SD	t-value	Prob.
Age(years)	49.64 ± 6.19	55.47 ± 10.85	-1.69	0.099
Height(cm)	160.18 ± 5.88	163.21 ± 8.23	-1.11	0.273
Weight(Kg)	59.00 ± 7.97	59.43 ± 10.22	-0.13	0.900
BMI(Kg/m^2)	22.95 ± 2.29	22.92 ± 2.72	0.04	0.968
%IBW	109.05 ± 10.73	107.99 ± 13.28	-0.24	0.813

BMI : Body mass index(kg/m^2)
%IBW : Percent ideal body weight=(current body weight(kg)/ideal body weight(kg)^2)×100

Table 2. Depression and anxiety score in normal and diabetics

Variable	Normal (N=11) Mean±SD	Diabetics (N=34) Mean±SD	t-value	prob.
Depression	13.82 ± 8.22	19.58 ± 8.53	-1.96	0.057
Anxiety	14.91 ± 5.11	23.77 ± 11.58	-3.43	0.001***

***$p \leqq 0.001$

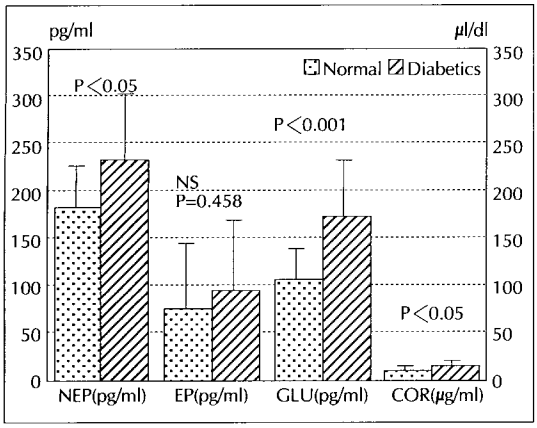

Fig. 2. Plasma stress hormone levels in normal(N=10) and Diabetics(N=33). (NEP : Norepinephrine, EP : Epinephrine, GLU : Glucagon, COR : Cortisol. Reference normal range of NEP : 100-400 pg/ml, EP : ≦120 pg/ml, GLU : 25-250pg/ml, COR : 7-24 μl/dl)

trols and diabetics.

2. Depression and Anxiety

The depression score of diabetics was 19.58±8.53 (Table 2). 36.4% of these subjects showed symptoms of the melancholia. Even though there was only a marginal significnace, depression level in diabetics was higher than that in the normal as shown in other studies[24-26,31].

The anxiety score of diabetics was 23.77±11.58 which was signigicantly higher than that of the control group. Earlier Moon and Hong[25]'s study revealed similar results.

3. Stress Hormones

The distribution of stress hormones of diabetics and normal contols was shown in table 3 and figure 2. As shown in table 3, the distribution of stress hormone in dibetics was generally in the reference normal

Table 3. Stress hormone in normal and diabetics

Variable	Normal (N=10) Mean±SD	Diabetics (N=33) Mean±SD	Reference normal range[1)]	t-value	Prob.
Total cat.(pg/ml)	255.33±55.17	329.18±111.49		-2.86	0.007**
Norepinephrine(pg/ml)	180.98±50.00	233.95± 73.99	100-400	-2.21	0.033*
Epinephrine(pg/ml)	74.35±72.92	94.03± 75.97	≦120	-0.75	0.458
Cortisol(μl/dl)	10.29± 2.88	13.18± 5.55	7- 24	-2.24	0.032*
Glucagon(pg/ml)	106.44±31.74	171.50± 62.50	25-250	-3.82	0.001***

Prob. : *≦0.05 **≦0.01 ***≦0.001 [1)]:Reference no.32
Total cat. : Total catecholamine(Norepinephrine+Epinephrine)

Table 4. Nutrients intake in normal and diabetics

Variable	Normal (N=11) Mean±SD	Diabetics (N=34) Mean±SD	%RDA	t-value	Prob.
Calorie(Kcal)	1736.0 ±301	1762.0 ±292.0	81.4	-0.26	0.779
Protein(g)	69.5 ± 15.2	72.9 ± 17.6	110.1	-0.57	0.569
animal protein(g)	30.2 ± 12.2	31.8 ±17.4		-0.28	0.779
veg. protein(g)	39.4 ± 7.7	41.1 ± 11.8		-0.45	0.656
Fat(g)	39.5 ± 16.8	42.3 ± 17.7		-0.47	0.642
animal fat(g)	13.3 ± 5.1	11.7 ± 9.7		0.70	0.490
veg. fat(g)	26.2 ± 15.3	30.6 ± 18.1		-0.73	0.490
Carbohydrate(g)	275.7 ± 59.8	272.5 ± 49.4		0.18	0.859
Fiber(g)	7.77± 2.10	9.12± 4.06		-1.42	0.166
Calcium(mg)	789.1 ±247.1	676.9 ±305.0	96.7	1.10	0.277
Iron(mg)	16.39± 2.62	17.64± 5.97	147.0	-0.95	0.346
Vitamin A(R.E.)	808.3 ±279.4	865.9 ±562.7	123.7	-0.45	0.658
Vitamin B_1(mg)	1.20± 0.35	1.20± 0.55	111.1	-0.01	0.993
Vitamin B_2(mg)	1.58± 0.42	1.43± 0.76	111.7	0.84	0.407
Niacin(mg)	19.78± 7.60	20.91± 12.68	146.9	-0.28	0.783
Vitamin C(mg)	115.0 ± 43.1	120.4 ± 60.5	218.2	-0.27	0.785
Physical activity energy expenditure(Kcal)	741 ±203	622 ±157		2.02	0.050*

*p≦0.05

Table 5. Amino acids(μmole/l) in normal and diabetics

Variable	Normal (N=10) Mean±SD	Diabetics (N=33) Mean±SD	Reference normal range[1)]	t-value	Prob.
Isoleucine	82.64± 32.10	80.02± 20.68	36 - 98	0.31	0.761
Leucine	146.01± 46.92	152.45± 35.97	75 - 175	-0.46	0.647
Lysine	220.90± 85.86	222.95± 63.58	83 - 238	-0.08	0.935
Methionine	28.77± 12.16	28.52± 11.03	6 - 40	0.06	0.951
Phenylalanine	73.26± 20.02	70.43± 16.07	37 - 88	0.46	0.647
Treonine	161.23± 101.01	133.99± 50.11	79 - 193	0.82	0.429
Tryptophan	40.20± 17.24	51.04± 13.89	20 - 95	-2.03	0.049*
Valine	274.03± 64.20	282.29± 64.04	141 - 317	-0.36	0.723
Alanine	425.26± 207.28	402.33± 86.16	210 - 661	0.34	0.740
Arginine	111.62± 37.20	95.32± 58.61	36 - 145	0.83	0.413
Asparagine	189.56± 56.67	121.54± 46.41	14 - 104	3.86	0.001***
Aspartic acid	10.68± 8.30	4.80± 1.78	0 - 24	2.22	0.052*
Cystine	57.44± 19.12	59.62± 14.87	16 - 167	-0.38	0.706
Glutamic acid	243.70± 134.10	133.57± 52.29		2.54	0.030*
Glutamine	151.88± 129.21	356.06±155.40	415 - 964	-3.77	0.001***
Glycine	284.00± 133.39	217.08± 68.45	120 - 554	1.53	0.156
Histidine	102.11± 31.04	87.87± 23.89	31 - 107	1.54	0.132
Proline	254.28± 167.35	175.33± 53.14	102 - 336	1.47	0.174
Serine	146.76± 61.17	135.58± 45.04	73 - 167	0.63	0.531
Taurine	130.31± 95.24	102.16± 38.97	27 - 168	0.91	0.383
Tyrosine	83.16± 24.07	86.00± 33.23	21 - 87	-0.25	0.803
TEAA	1027.04± 350.83	1034.01±211.49		-0.06	0.954
TNEAA	2190.76± 831.13	2023.68±421.30		0.61	0.555
BCAA	502.68± 135.24	514.77±118.31		-0.27	0.786
AMAA	196.62± 51.34	209.70± 55.02		-0.67	0.509
LNAA	699.30± 181.88	730.71±144.99		-0.56	0.577
TAA	3217.80±1155.66	3062.75±598.76		0.41	0.692

*p≦0.05, ***p≦0.001
1) : Reference no.34
TEAA : Total Essential amino acid
TNEAA : Total Nonessential amino acid
BCAA : Branced chain amino acid(isoleucine, leucine, valine)
AMAA : Aromatic amino acid(phenylalanine, tryptophan, tyrosine)
LNAA : Large neutral amino acid(isoleucine, leucine, valine, phenylalanine, tryptophan, tyrosine)
TAA : Total amino acid

range. The mean value in diabetics was 329.18±111.49pg/ml for total catecholamine(norepinephrine and epinephrine) and 233.95±73.99pg/ml for norepinephrine(reference normal range : 100-400 pg/ml), 94.03±75.97pg/ml for epinephrine(reference normal range : below 120 pg/ml), 13.18±5.55μl/dl for cortisol(reference normal range : 7-24μl/dl) and 171.50±62.50pg/ml for gulcagon(reference normal range : 25-250 pg/ml) respectively(34). The hormones of diabetics such as catecholamine, norepinephrine, cortisol and glucagon were significantly higher than those of the control group except epinephrine which showed only similar trends. Lustman's et al.[5] and Robertson's et al.[6] studies also showed that the catecholamine level in diabetics was higher than that in the normal control.

4. Nutrients Intake and physical activity energy expenditure

As shown in table 4, there was no significant difference of nutrients intake between the normal and diabetics. The calorie intake in diabetics was 1762±292kcal which is 81.4% lower than Korean recommended dietary allowances(RDA)[33]. Calcium intake was slightly low but other nutrients intakes were higher than to RDA. The proportion of calorie intake from carbohydrate, fat and protein was 62.2%, 21.3% and 16.6% respectively showing a desirable calorie construction. The level of physical energy expenditure in diabetics(622±157kcal) was significantly lower than

that in normal controls(741±203kcal).

5. FBS, Hemonglobin A_1C and Plasma Amino Acid

The value of FBS and usual FBS in diabetics was 184.18±74.22mg/dl and 177.76±42.77mg/dl respectively. The value of hemoglobin A_1C in diabetics was 8.84±2.82% which was higher than the reference normal range(4.0~6.0%)[32].

As shown in table 5, the distribution of plasma amino acids in dibetics was generally in the reference normal range[34] whereas the level of tryptophan in diabetics(40.20±17.24μmole) was significantly higher than that of the control group(51.04±13.89μmole). The level of asparagine, aspartic acid and glutamic acid in nonessential amino acid in diabetics were significantly lower than those in the control group. However, the level of glutamine(356.06±155.40μmole) in diabetics was significantly higher than that of the control group. Total essential amino acid (TEAA), total nonessential amino acid(TNEAA), branched amino acid(BCAA : isoleucine, leucine, valine), aromatic amino acid(AMAA : phenylalanine, tryptophane, tyrosine) and other amino acid patterns such as large neutral amino acid(LNAA : isoleucine, leucine, valine, phenylalanine, tryptophane, tyrosine) and total amino acid(TAA) showed no significant difference between two groups.

6. Correlations among factors

The relations among psychological stress, nutrients intakes and biochemical measures were analyzed only with diabetics. Because the control group shows just baseline for the level of psychological stress, stress hormones and amino acids.

1) According to table 6, there was no significant correlation between the depression score and hormone levels. But the level of anxiety showed significant positive correlations with the measures of total catecholamine and norepinephrine. Most importantly the level of usual FBS was positively related to the level of anxiety. But the FBS level was no relation with the level of anxiety.

This result is congruous with Peyrot and Mcmarry's study[15] which reported also a positive correlation between the depression and hemoglobin A_1C among diabetics. Also, Wing's study[1] with normal people showed that psychological stress makes blood sugar go up continuously for a extended period of time. Moon and Hong[26] in Korea reported similar results earlier.

2) As shown in table 7, the levels of depression and anxiety showed negative correlations with the levels of calorie and some other nutrients intakes and physical energy expenditure. This is consistant with Kim's[31]. Therefore psychological stability is very important for the nutrient intake.

3) There was no significant correlation between the levels of stress hormones, FBS and hemoglobin A_1C. As shown in table 8, the epinephrine showed positive correlation with the tryptophan. And glucagon showed significant positive correlation with isoleucine, leucine, phenylalanine and valine. Glucagon showed not

Table 6. Correlations between stress hormones and depression, anxiety in diabetics(N=33)

Correlations :	Depression	Anxiety
Total catecholamine	.0497	.3472*
Norepinephrine	-.0366	.3496*
Epinephrine	.1182	.1463
Cortisol	-.2121	-.1691
Glucagon	.1596	-.2889
Usual fasting blood sugar	.2126	.2994*

*p≦0.05
Total catecholamine : Norepinephrine+Epinephrine

Table 7. Correlations between nutrient intakes, physical activity energy expenditure and depression, anxiety in diabetics(N=34)

Correlations :	Depression	Anxiety
Calorie(Kcal)	-.4004**	-.3318*
Protein(g)	.0280	-.0795
animal protein(g)	.2319	-.0547
veg. protein(g)	-.3089*	-.0351
Fat(g)	-.0593	-.3219*
animal fat(g)	.0878	-.0707
veg. fat(g)	-.1017	-.2551
Carbohydrate(g)	-.5314***	-.2245
Fiber(g)	.0777	-.0133
Calcium(mg)	.2404	.0040
Iron(mg)	.1302	.0016
Vitamin A(R.E.)	.2688	.1019
Vitamin B_1(mg)	-.2418	-.1760
Vitamin B_2(mg)	.0366	-.0538
Niacin(mg)	-.1685	.1679
Vitamin C(mg)	.1986	.1976
Physcial activity energy expenditure(Kcal)	-.6602***	-.4270**

*p≦0.05, **p≦0.01, ***p≦0.001

Table 8. Correlations between amino acids and stress hormones in diabetics(N=33)

	Total cat.	NEP	EP	Cortisol	Glucagon
Isoleucine	.1786	-.0020	.2238	-.0511	.4358*
Leucine	.1666	-.0013	.2187	.0893	.3798*
Lysine	.1939	.1185	.1408	-.0466	.0784
Methionine	-.0882	-.1124	-.0320	-.0572	.1572
Phenylalanine	.0621	-.0797	.1589	-.0623	.3994*
Treonine	.0667	-.1385	.2274	-.1731	.1234
Tryptophan	.2876	.0437	.3614*	.2744	.3138
Valine	.0746	-.0936	.1864	.0966	.4544*
TEAA	.1699	-.0463	.2723	.0347	.2950
TNEAA	.2436	.0508	.2930	-.3182*	.1724
BCAA	.1213	-.0514	.2066	.0705	.4360*
AMAA	.0718	-.1204	.2181	-.0811	.3057
LNAA	.1266	-.0962	.2659	.0580	.4164*
TAA	.2472	.0303	.3136*	-.2227	.2377

*$p \leq 0.05$
Total cat. : Total catecholamine(Norepinephrine+Epinephrine)
NEP : Norepinephrine
EP : Epinephrine
TEAA : Total Essential amino acid
TNEAA : Total Nonessential amino acid
BCAA : Branced chain amino acid(isoleucine, leucine, valine)
AMAA : Aromatic amino acid(phenylalanine, tryptophan, tyrosine)
LNAA : Large neutral amino acid(isoleucine, leucine, valine, phenylalanine, tryptophan, tyrosine)
TAA : Total amino acid

Table 9. Correlations between amino acids and usual FBS,hemoglobin A_1C in diabetics(N=33)

	Usual FBS	Hemoglobin A_1C
Isoleucine	.4119**	.2315
Leucine	.3865**	.2787
Lysine	.1251	.2402
Methionine	.1480	-.1766
Phenylalanine	.2425	-.0130
Treonine	.0586	-.0368
Tryptophan	.2862	-.0238
Valine	.4376**	.3370*
TEAA	.3233*	.2519
TNEAA	.1790	.0472
BCAA	.4256**	.3078*
AMAA	.1576	-.1087
LNAA	.4023**	.2328
TAA	.2544	.1461

*$p \leq 0.05$, **$p \leq 0.01$
FBS : Fasting blood sugar
TEAA : Total Essential amino acid
TNEAA : Total Nonessential amino acid
BCAA : Branced chain amino acid(isoleucine, leucine, valine)
AMAA : Aromatic amino acid(phenylalanine, tryptophan, tyrosine)
LNAA : Large neutral amino acid(isoleucine, leucine, valine, phenylalanine, tryptophan, tyrosine)
TAA : Total amino acid

only a significant positive correlation with BCAA and LNAA but also a positive correlation coefficient with AMAA even though not significant.

4) According to table 9, usual FBS showed not only positive correlation with isoleucine, leucine and valine but also significant positive correlation with the hemoglobin A_1C which showed positive correlation with valine. And usual FBS showed significant positive correlation with TEAA, BCAA and LNAA. Hemoglobin A_1C showed positive correlation with BCAA. These results are consistant with Berger's et al.[7] study which showed a signigicant correlation between blood sugar and brancned amino acids.

Conclusion

In sum, all 3 hypotheses were accepted. In relation to hypothesis 1, it was found that the levels of depression and anxiety was positively correlated with the stress hormones(catecholamine, norepinephrine) and fasting blood sugar.

Congruent with hypothesis 2, our data showed that psychological stress was correlated with calorie and fat

intakes as well as physical activity energy expenditure. And finally hypothesis 3 was partially accepted as the levels of stress hormones were positively correlated with some amino acids. The levels of usual FBS and some amino acids were explained by the levels of stress hormones in diabetics.

We suggest a model of dynamic influential factors on diabetes as follows.

1) The psychological stress is supposed to influence the stress hormones and nutritional status of diabetics. Even though psychological stress can be caused by the diseases, stress in turn affects physiological states and treatment of the deseases.

2) Therefore diet therapy should be adjusted in consideration of psychological factors.

3) Stress management education will be crucial in diseases such as diabetes which are chronic and need multifaceted treatment(nutrition, exercise and drug). In nutrition education and counselling programs for diabetics, it is very important to emphasize psychological factors for effective blood sugar control.

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= 국문초록 =

인슐린 비의존형 당뇨병 환자의 심리적 스트레스와 스트레스호르몬 및 영양상태와의 상관관계에 관한 연구

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인슐린 비의존형 당뇨병환자의 심리적 스트레스와 스트레스호르몬 및 영양상태와의 상관관계를 알아보고자 인슐린 비의존형 당뇨병환자 34명을 대상으로 설문지를 사용하여 직접면접을 통해 심리적 스트레스로 우울, 불안을 측정하였고 24시간 회상법에 의한 영양섭취상태, 에너지 소비량 등을 조사하였고, 공복시 혈액을 채취하여 일반혈액검사와 스트레스호르몬, 아미노산 등을 분석하였다. 우울과 불안은 CED-S와 STAI-S의 방법으로 측정하였고, 영양섭취상태는 전산분석하였다. 그리고 catecholamine, hemoglobin A_1C와 아미노산은 HPLC로 분석하였으며 cortisol과 glucagon은 RIA방법으로 분석하였다.

본 연구의 결과, 당뇨병환자의 우울과 불안점수는 대조군에 비해 높았는데 특히 불안은 유의적으로 높았다. 당뇨병환자의 스트레스호르몬을 보면 총 catecholamine은 329.18±111.49pg/ml이었고 norepinephrine은 233.95±73.99pg/ml이었으며 epinephrine은 94.03±75.97pg/ml이었다. Cortisol은 13.18±5.55㎍/ml이었으며 gulcagon은171.50±62.50pg/ml이었다. 당뇨병환자의 총 catecholamine, norepinephrine, cortisol 그리고 glucagon 등은 대조군에 비해 유의적으로 높았으며 epinephrine은 높은 경향을 나타냈다. 당뇨병환자의 영양소섭취량은 대조군과는 차이가 없었다. 그러나 당뇨병환자의 경우 열량과 칼슘은 권장량보다 적었으나 다른 영양소들은 권장량보다 많이 섭취하였다. 공복혈당, 평상시 공복혈당(3개월간 평균 공복 혈당) 그리고 hemoglobin A_1C는 각각 184.18±74.22mg/dl, 177.76±42.77mg/dl와 8.84±2.82%이었다. 당뇨병환자의 혈장아미노산의 농도는 일반적으로 정상범위에 속하였다. 당뇨병환자의 불안은 norepinephrine과 평상시 공복혈당과 유의적인 양의 상관관계를 나타내었다. 또한 glucagon, 평상시 공복혈당과 hemoglobin A_1C는 분지아미노산(BCAA,leucine, isoleucine and valine)과 유의적인 양의 상관관계를 나타내었다.

핵심되는 단어 : 당뇨병환자 · 우울 · 불안 · 스트레스호르몬 · 아미노산.