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Somatotype and schizophrenia. A case-control study

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Aims. To compare somatotypes of schizophrenic patients and healthy controls and to examine some associations between somatic (joint mobility, somatotype) and psychopathological (anxiety, clinical seriousness and schizophrenic types) features.

Methods. Thirty four in-patients with DSM-IV diagnosis of schizophrenia assessed by SCID-I, aged 18 to 50 years, were recruited as cases. Thirty two subjects of a general non-clinical population were recruited as controls. Heath-Carter method and 5 questions to detect joint hypermobility were used to assess both somatotype and joint hypermobility. Trait anxiety (STAI) and BPRS were assessed at medical discharge.

Results. There were no statistically significant differences between mean somatotype groups (cases: 4½ – 5½ – 1½; controls: 5 – 5 – 1½). Schizophrenic patients showed significantly more divergence among themselves in relationship to their own common mean [t = 1.98; gl = 64; p = 0.05] and accounted for more ectomorphic categories than the control group. Somatotype means of paranoid and disorganized types were significantly more homogeneous (with greater values of ectomorphism) than undifferentiated type [χ^2 = 6.61; gl = 2; p = 0.037]. There was a tendency towards positive association between anxiety - joint hypermobility and anxiety-ectomorphism, but it did not reach a statistically significant level.

Conclusions. In spite of their limitations, the results provide suggestive data for identification of subtypes in mental illnesses that can be used as a nosologic knowledge or as potential risk markers.

Key words:
Somatotype. Joint hypermobility. Schizophrenia. Anxiety.

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Somatotipo y esquizofrenia. Un estudio caso-control

Objetivos. Comparar los somatotipos de pacientes esquizofrénicos y controles sanos y examinar algunas asociaciones entre condiciones somáticas (laxitud articular, somatotipo) y psicopatológicas (ansiedad, gravedad clínica y tipos de esquizofrenia).

Método. La muestra (n = 66) se compone de pacientes entre 18 y 50 años ingresados con el diagnóstico DSM-IV de esquizofrenia (n = 34) valorados mediante la SCID-I. Se añade otro grupo de población general no clínica (n = 32). Para el somatotipo se utiliza el método Heath-Carter y para la laxitud, las cinco preguntas para detectar hiperlaxitud articular. Se miden al alta las escalas STAI rasgo y BPRS.

Resultados. No se han hallado diferencias significativas entre las medias de los somatotipos de ambos grupos (casos: 4½ – 5½ – 1½; controles: 5 – 5 – 1½). Los pacientes esquizofrénicos resultan significativamente más divergentes entre ellos respecto a su propia media común [t = 1,98; gl = 64; p = 0,05] y llegan a representar más categorías ectomórficas que el grupo control. Los tipos paranoide y desorganizado presentan significativamente unas medias del somatotipo más homogéneas (con valores más elevados de ectomorfismo) que el tipo indiferenciado [χ^2 = 6,61; gl = 2; p = 0,037]. Existe una tendencia a favor de la asociación entre laxitud articular y ansiedad, y entre ectomorfismo y ansiedad, aunque sin llegar a la significación estadística.

Conclusiones. A pesar de sus limitaciones, estos resultados aportan datos sugerentes para la identificación de subgrupos de enfermedades psiquiátricas útiles para un avance nosológico o incluso como potenciales indicadores de riesgo.

Palabras clave:
Somatotipo. Hiperlaxitud articular. Esquizofrenia. Ansiedad.

INTRODUCTION

Studies on somatology and morphometry have been obtaining increasing interest in the recent psychiatric literature. Currently, the relationship of some somatic characteristics such as joint hypermobility, dermatoglyphics or minor

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physical anomalies and some psychopathological characteristics are well known. The interest for these relationships arose in the 5th century BC in the school of Cos of ancient Greece[1] with the initiation of body constitutionalism. Later, after 25 centuries of history on research in anthropometry and morphological taxonomy, the capacity to understand body habitus or somatotype has been improving.[2] According to Pinillos et al.,[1] the constitution is the basic organizing structure of the morphological and functional properties of a subject. The term biotype expresses the clearest manifestation of the constitution of an individual and includes the body habitus (i.e., body build) or somatotype and its morbous and temperamental predisposition.

The most emblematic typological schools arose at the beginning of the last century in Germany with Ernst Kretschmer[3] and developed more in the middle of the century in the United States with William Sheldon.[4,5] These authors largely developed constitutionalism when they described three fundamental body types: athletic or mesomorph (musculoskeletal predominance based on height, representing fat mass, organs and total fluids), pyknic or endomorph (predominance of the width in relation to height, or relative body adiposity) and leptosomatic or ectomorph (lengthening that predominates in relationship to width, or linearity and proportionality of the subject). Kretschmer related pyknic type with tendency to cyclothymic temperament (sociable, euphoric, syntonic with environment, realistic but with possibility of becoming depressed) and bipolar disorder, leptosomia with tendency to schizothymic temperament (introverted, serious, unsociable, cold on the outside but sensitive inside with motor inhibition) and schizophrenia.[3]

Currently, there are few studies on biotypology in the field of mental disease. However, these continue to provide moderately significant data. Specifically. Pivnicki and Christie[6] concluded in 1968, following the classical hypothesis, that the body habitus of the schizophrenic patients and of the patients with affective disorder are opposite or have different dominances. Along this line, Singer et al., in 1972[7] and in 1976,[8] studied a sample of Chinese nationality subjects formed by schizophrenic patients with affective disorders, with neurotic disorders and healthy subjects to compare their body habitus. In spite of the low methodological rigor used, the authors found a tendency to corpulence in bipolar disorder patients and a tendency to linearity in schizophrenic and anxious patients compared to healthy subjects. In 1987 and 1991, Kornetov[9,10] compared the body habitus of schizophrenic patients with healthy subjects without finding significant differences, although he associated pyknic body habitus with the course of recurrent and abrupt shift-like forms with abrupt circular onset forms of schizophrenia and asthenic habit with a continuous and progressive course of insidious onset with more negative symptoms. The intermediate body habitus would include those cases with a progressive course, but with psychotic episodes and productive symptoms.

In 1999, Sivkov and Akabaliev[11] compared the somatotypes of schizophrenic and bipolar patients using the Heath-Carter method, both somatotypes being of the mesomorph-endomorph spectrum, but with significant differences in relationship to the relative composition of the three components. In the year 2003, Toth et al.[12] studied the somatotype of a sample of patients with bipolar disorder, confirming the kretschmer hypothesis of predominance of endomorphism between these patients. Finally, in the year 2005,[13] Sivkov et al., when he compared the somatotypes of a sample of schizophrenic patients and healthy controls, found differences in the relative composition of the components only among the men. Equally, they found greater representation of somatotypic categories between the case group and thus, with more frequent representation of ectomorphic categories than in the control group. The associations of early onset schizophrenia with body linearity or ectomorphism both in men and women also stand out[7,8,11]. In this sense, there are currently cohort studies that associate low weight and/or height at birth with a subsequent risk of developing schizophrenia.[14-16]

Furthermore, the relationship of asthenic build with hereditary disorders of the connective tissue and especially with joint hypermobility is known.[17] In this sense, several authors have also related joint hypermobility or ligamentous laxity with panic anxiety disorders and/or agoraphobia.[18-22] In this way, it has also been possible to confirm this association among schizophrenic patients with comorbid panic and/or agoraphobia (with a similar prevalence to that of patients with anxiety disorder without schizophrenia.[23] Finally, in 1996, an association was found between panic and/or agoraphobia and asthenic or ectomorph habitus.[24]

This work attempts to respond to the following objectives: 1) Primary aim: compare the somatotypes of a group of schizophrenic patients with a group of non-clinical general population and 2) Secondary aim: analyze the associations of some somatic and psychopathological characteristics.

MATERIAL AND METHODS

Subjects

A case-control study was conducted in a psychiatric hospital of approximately 550 beds (Centres Assistencials Dr. Emili Mira i López, Sta. Coloma of Gramenet, Barcelona) that covered the mental health needs of approximately 700,000 inhabitants in the Barcelona province. The patients chosen to take part in the study came from the acute, subacute and day care hospital units in in-hospital regime. A sample of nonclinical subjects from the general population formed by volunteers chosen at random among the workers of the same hospital center was also added.

The case sample was formed by patients with schizophrenia (schizoaffective, schizophreniform, and patients with schizoid or schizotypal personality have been excluded) between 18 and 25 years who fulfilled the diagnostic criteria of the DSM-IV-TR.[25] Among these ages, joint mobility and somatotype remain as stable body characteristics.

The exclusion criteria were: 1) subjects with psychoactive substance dependence (sufficiently severe as to alter the body habitus composition) or brain organic syndromes, 2) subjects with problems to understand the self-applied questionnaires (condition of acute severe psychoses, illiterates, moderate or severe mental retardation), 3) subjects with somatic conditions that prevent extrapyramidal rigidity, walking problems, significant changes in body weight in the last six months, deformities in the spine or limbs, and amputations) and 4) subjects with some degree of family relationship with other son subjects previously chosen or non Caucasian subjects.

The healthy subjects from the control group were not undergoing any psychiatric follow-up for treatment at the time of the study. In the hospitalized cases with acute psychiatric condition, all the variables and measurements were performed close to the hospital discharge as far as possible, after a reasonable stabilization of the psychiatric disease. All the patients were taking antipsychotic medication at the time of the study. Before initiating the study, all the subjects received an oral and written explanation of this study as well as of the informed consent. The study was approved previously by the ethics committee of the Hospital Germans Trias i Pujol of Badalona.

Study variables and instruments

In the first place, sociodemographic data was collected (age, gender, civil status, educational level, work status, and cohabitation) as well as onset age of the disease, number of previous hospitalizations and psychiatric treatment received by the patient. To confirm the psychiatric diagnoses of schizophrenia, the structured clinical interview of the DSM-IV (Structured Clinical Interview for DSM-IV; SCID-I) was used.[26] Examination of the anxiety was conducted using the Spanish validated version of the State-Trait Anxiety Inventory (STAI).[27] The syndromic subtyping of schizophrenia was evaluated using the 18-item Spanish validated Brief Psychiatric Rating Scale (BPRS).[28] Three schizophrenic patients could not be evaluated with the BPRS scale because it was not possible to administer it before their hospital discharge.

Examination of hypermobility was conducted using the hetero-applied questionnaire of five questions to detect hypermobility of Hakim and Grahame 2003 (*A simple questionnaire to detect Hypermobility*).[29] In order to rule out signs of extrapyramidal rigidity secondary to treatment with neuroleptics that could hinder the physical examination of joint mobility, the brief version of the Simpson-Angus Scale, (SAS) was used.[30] Those patients who scored 1, 2, or 3 on the rigidity items and 2 or 3 on the rest of the items (facial expression, tremor akinesia, akatisia and dystony) were discarded.

Examination of the somatotype was conducted using the Heath-Carter Somatotype Method.[31] This method provides three-number rating representing endomorphism, mesomorphism and ectomorphism, respectively. Values between 0.5 and 2.5 are considered low, between 3 and 5 moderate, between 5.5 and 7 high and above 7.5 very high. The tridimensionality of the somatotype may be represented in a somatochart in order to determined the spectrum or somatotype category (this includes 13 categories according to Heath-Carter: 1) endomorph-ectomorph, 2) ectomorphic endomorph, 3) balanced endomorph, 4) mesomorphic endomorph, 5) mesomorph-endomorph, 6) endomorphic mesomorph, 7) balanced mesomorph, 8) ectomorphic mesomorph, 9) mesomorph-ectomorph, 10) mesomorphic ectomorph, 11) balanced ectomorph, 12) endomorphic ectomorph and 13) central).

For the evaluation of the somatotype, in addition to age, 10 anthropometric measurements were also considered: weight, height, upper arm and calf girths, triceps, subscapular, spraspinale and medial calf skindfolds, and biepicondylar diameters of the humerus and femur. The material used for the physical examination included: bone caliper to measure bone diameters, metric tape measure for muscular mass and a skindfold caliper. The physical measurements were performed twice in the right hemibody. In case of discrepancy in the measurement, the median was calculated.

Computing and statistical analysis

Data collection for the evaluation of the somatotype was conducted with the Somatotype (calculation and analysis) program of Sweat Technologies. Statistical processing was performed with a PC Pentium IV with the SPSS version 11.0 program. Descriptive data are presented in frequencies for the qualitative variables and with the mean and standard deviation for the quantitative ones. The quantitative variables that do not follow a normal distribution are presented with a median and range. The Chi-square test was used to compare cases and controls in the categorical and qualitative variables. In 2 x 2 tables, the Yates correction is provided. When > 20% of the boxes had values of expected frequency below 5, the Fisher exact test was used. To compare quantitative variables, the Student's T test or Mann-Whitney non-parametric test was used. Correlation techniques were also used (parametric when the distribution allowed it) and cluster analysis.

RESULTS

Description and comparison of the sociodemographic and pharmacological variables

The data of 66 subjects were analyzed: 34 cases with schizophrenia (SCH) and 32 healthy controls (CON). The origin of the patients enrolled was the following: 16 patients from acute unit (47.05%), 16 patients from subacute/high dependence unit (47.05%) and 2 from day hospital (5.90%). The case group had the following subtypes of schizophrenia: 26 paranoid schizophrenia (76.5%), 4 undifferentiated schizophrenia (11.8%) and 4 disorganized schizophrenia (11.8%).

In table 1, the social demographic and pharmacological characteristics for both groups can be seen. When compared, significant differences were found in relationship to gender [$\chi^2 = 6.16$; gl = 1; p = 0.013], educational level [$\chi^2 = 30.16$; gl = 2; p = 0.000], civil status [$\chi^2 = 6.36$; gl = 2; p = 0.042] and cohabitation situation [$\chi^2 = 20.64$; gl = 2; p = 0.000]. No significant difference was found regarding age.

Description and comparison of somatic and psychopathological variables

The mean and standard deviation in the total of the BPRS scale and on the positive and negative subscales were, respectively, 26.48 (8.62), indicating severe mental disorder, 9.16 (4.02) and 6 (2.6). According to the schizophrenia type, the medians and ranges of the total score on the BPRS and the positive and negative subscales were the following: undifferentiated: 33 (13), 9 (6) and 6 (2), paranoid: 24 (38), 11 (15) and 5 (9), and disorganized: 32 (10), 11 (7) and 9 (4).

The mean and standard deviation of the STAI trait scores for the complete sample was 19.45 (8.7) for the men and 21.4 (10.2) for the women and higher in the schizophrenic patients 25 (9.1) then in the controls 15.7 (7.52). When scores of the variable was examined using the variance method, it was observed that in the control group, there were 3 outlier values, only in the lower extreme, equal or below 1% of the standardized population means, both in men and in women (27), that were eliminated by subsequent analyses (scores of 2 and 7 in women and of 3 in one man). The medians and ranges of

Table 1 Sociodemographic and pharmacological variables. It includes a comparison between groups with χ^2 or the Student' T test

	SCH (n = 34) Mean (SD)	CON (n = 32) Mean (SD)	t / χ^2	gl	p
Age	34.1 (6.57)	35.23 (7.56)	- 0.65	64	0.52
Age on onset of SCH	20.62 (4.35)				
Number of admissions[1]	4(9.5)				
% Antidepressants	14.7				
% Benzodiazepines	35.3				
% Anticholinergics	35.3				
% Men	61.8	31.3			
% Women	38.2	68.8	6.16	1	0.013[2]
% Single	85.3	68.8			
% Married	5.9	28.1			
% Separated	8.8	3.1	6.36	2	0.042[2]
% < 8 year of studies	26.5	0			
% 8-12 year of studies	70.6	62.5			
% > 12 years of studies	2.9	37.5	30.16	2	0.000[2]
% Active workers	14.7				
% Unemployed	55.9				
% Pensioners	29.4				
% Live with origin family	82.4	28.1			
% Live with own family	5.9	43.8	20.64	2	0.000[2]
% Live alone	11.8	28.1			

[1]Data presented in: Median (Interquartile range).
[2]Significant difference (p < 0.05).

the new truncated variable (n = 63) were 19 (29) for men and 21 (36) for women without significant differences [Z = -0.85; p = 0.397], and equally higher in the cases 25 (38) than in the controls 14 (25) with significant differences [Z = -3.6; p = 0.000].

In all, the medians and ranges of the scores on the joint hypermobility scale were greater for women than for men [men: 0 (3); women: 1 (5)], with statistically significant differences [Z = -3.25; p = 0.001]. The medians and ranges for cases and controls were respectively from 1 (3) and 1 (5), without significant differences [Z = -0.75; p = 0.455].

Figure 1 shows the STAI trait scores in form of Box-and-Whisker plot according to joint mobility variable. A weak positive correlation between joint hypermobility and anxiety level was observed, without reaching statistical significance [rho = 0.171; p = 0.18]. This association was slightly significant in the case group [rho = 0.31; p = 0.07], but not in the control group [rho = 0.11; p = 0.57]. The results when comparing the medians of the STAI trait variable after grouping the subjects in no case/case according to the cutoff on the joint hypermobility scale were the following: level 0/1 (no case/case) [Z = -1.56; p = 0.119], level 1/2 [Z = -0.41; p = 0.683] and level 2/3 [Z = -1.76; p = 0.078].

The mean of the somatotype of the schizophrenic patients (fig. 2) fitted to the «endomorphic mesomorph» spectrum and presented a moderate endomorphism, elevated mesomorphism and low ectomorphism (4 1/2 - 5 1/2 - 1 1/2) while the mean of the control group (fig. 3) adapted to the «mesomorph-endomorph» spectrum and presented a moderate value in endomorphism and mesomorphism and low one in ectomorphism (5 - 5 - 1 1/2).

There are two different statistical approaches to compare the global one of the somatotype between independent groups. In the first one, the differences are analyzed between the means of the somatotypes of each group and in the sec-

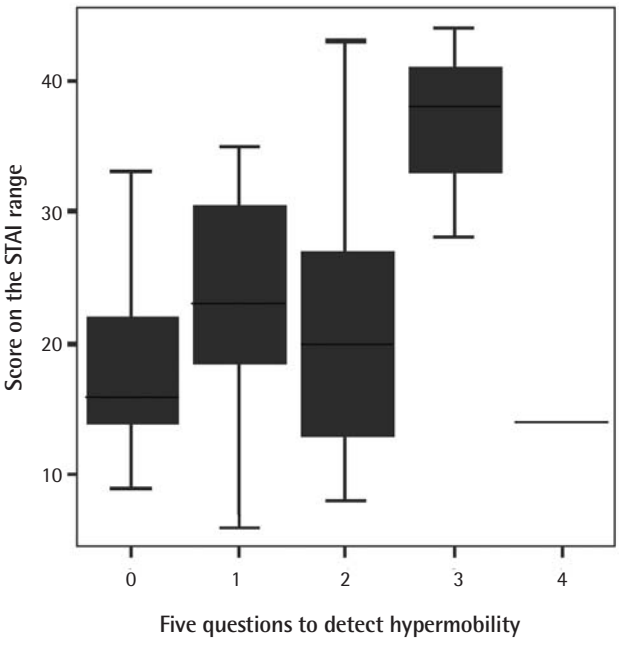

Figure 1 *Box plot of the scores in STAI trait according to the grade of joint hypermobility.*

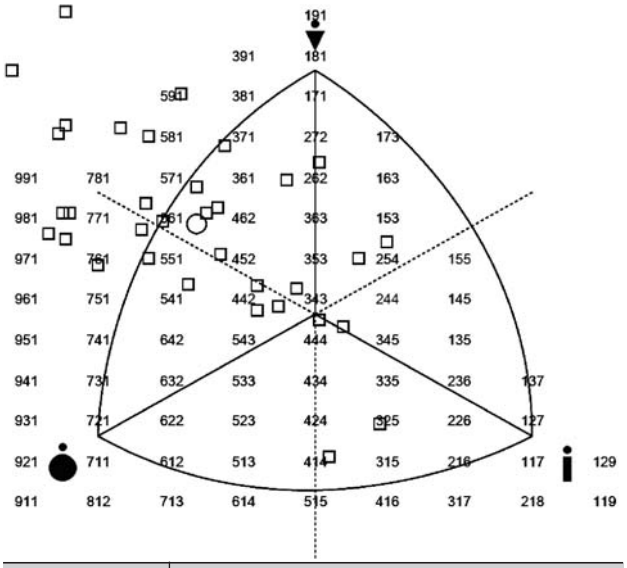

Figure 2 *Somatochart of the group of schizophrenic patients. The boxes indicate the position of each patient. The circles indicate the mean of the somatotypes.*

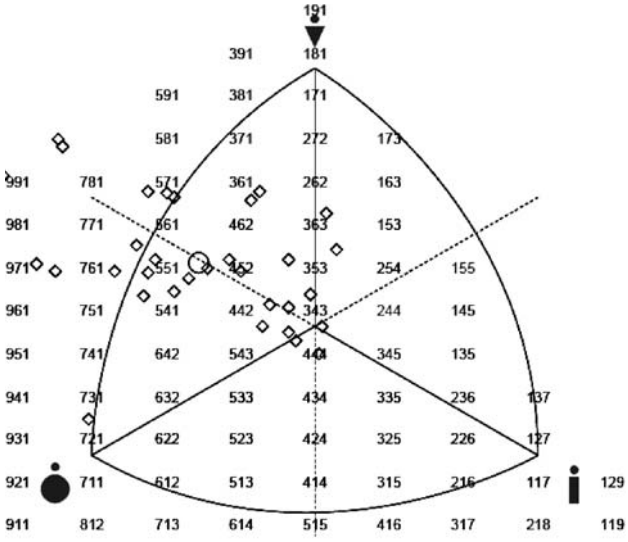

Figure 3 *Somatochart of the control group. The rhombuses indicate the positions of the patients. The circle indicates the mean of the somatotypes.*

ond one, the differences are analyzed between the distances of the somatotypes regarding their own means (by the *Somatotype Attitudinal Distance Value (SAD)*). Table 2 shows, respectively, for the case and control group, the descriptive statistics of the body measurements and of the variables used to compare the somatotypes. No significant differences were found in the comparison of the means of the somatotype between both groups [t = 1.98; gl = 64; p = 0.33], but there was one in the dispersion of the different somatotypes regarding the means themselves of the group (t=1.98; gl=65; p = 0.05): that is, the schizophrenic patients are more divergent between themselves as a group and finally represent more categories or spectrums than the control group. Equally, a tendency towards having a greater representation of ectomorphic categories has been observed among the cases than among the controls (cases: «ectomorphic mesomorph» 6%, «endomorph-ectomorph» 3% and «balanced ectomorph» 3%; controls: «ectomorphic mesomorph» 3%).

No statistically significant differences were found in the comparison of the means of the components separately: endomorphism [t = 0.24; gl = 64; p = 0.81], mesomorphism [t = 1.25; gl = 64; p = 0.21] and ectomorphism [t = 0.82; gl = 64; p = 0.42]. There were also no significant differences found for the components between men [endomorphism: Z = -0.23; p = 0.82; mesomorphism: Z0= -0.23; p = 0.82; ectomorphism: Z = -0.89; p = 0.39], or women except mildly significant differences for ectmorphism [endomorphism: Z = -1.26; p = 0.22; mesomorphism: Z = -1.54; p = 0.13; ectomorphism: Z = -1.95; p = 0.057]. Furthermore, the significant differences in the comparison of weight between groups stand out [t = 2.11; gl = 64; p = 0.038], there being no significant differences in height [t = 0.60; gl = 64; p = 0.55].

Table 3 Initial and final sites of the cluster analysis of the somatotype of the patients

Initial sites	Group 1 (n = 20)	Group 2 (n = 14)
Endomorphism	3.1	8.5
Mesomorphism	1.3	10.3
Ectomorphism	4.9	0.1
Final sites	**Group 1 (n = 20)**	**Group 2 (n = 14)**
Endomorphism	3.5	6.5
Mesomorphism	4.1	7.1
Ectomorphism	2.3	0.3

The cluster analysis of the components of the somatotype provided two differentiated groups of schizophrenic patients according to the initial and final values of the centers (table 3). Both groups fit into the group or spectrum «mesomorph-endomorph», however the first one with moderate values of endo- and mesomorphism and low ones of ectomorphism, and the second one with elevated values of endo- and mesomorphism very low ones of ectomorphism.

Analysis by chi square between type of schizophrenia and the two clusters provided significant differences (table 4),

Table 2 Mean, median, range and standard deviation of the somatic variables used for the calculation of the somatotype for both groups.

	SCH (n = 34)				CON (n = 32)			
	Median	Mean	SD	Range	Median	Mean	SD	Range
Endomorphism	4.4	4.7	1.82	1.1 – 8.5	4.6	4.8	1.63	2.1 – 8.5
Mesomorphism	5.0	5.3	2.13	1.1 - 11	4.8	4.8	1.38	2 – 7.9
Ectomorphism	0.8	1.4	1.48	0.1 – 4.9	1.5	1.7	1.11	0.1 – 3.6
SAD	2.55	2.77	1.47	0.7 – 6.4	1.83	2.13	1.08	0.7 – 4.9
Height	169.55	168.96	9.72	154 – 196	166.5	167.59	8.73	154 - 189
Weight	77.55	77.34	17.09	50 – 125	67.0	69.45	12.78	52 - 100
Triceps skinfolds	14.25	17.0	8.88	5 – 39	16.25	18.63	7.68	9 - 35
Subscapular skinfolds	15.65	18.36	8.04	5 – 38	16.75	16.66	6.64	7 - 33
Supraliac skinfolds	12.25	13.99	7.38	3 – 36	12.5	14.73	7.47	5 - 37
Calf skinfolds	15.25	16.51	8.99	4 – 39	10.75	12.64	7.38	4.5 - 44
Arm girth	31.9	32.14	4.55	22.5 – 42.5	30.05	30.18	2.96	25.2 – 35.2
Calf girth	37.25	37.81	3.75	31.8 – 45.7	37.3	37.09	3.32	26.5 - 44
Humerus diameter	6.6	6.59	0.7	5.3 - 8	6.0	6.26	0.6	5 – 7.4
Femur diameter	9.75	9.58	0.72	8.26 – 11.3	9.55	9.57	0.74	8.4 - 12

SAD (*Somatotype Attitudinal Distance*): Exact distance between the tridimensional points of two somatotypes. Calculated by the endomorphism, mesomorphism and ectomorphism components.

Table 4 Number of cases, percentage and chi square test according to type of schizophrenia and cluster analysis

	Paranoid S.		Undifferentiated S.		Disorganized S.		Statistical significance		
	N	%	N	%	N	%	χ^2	gl	p
Cluster 1	17	65.4	0	0	3	75	6.61	2	0.037
Cluster 2	9	34.6	4	100	1	25			

indicating that the clusters distinguished the types of schizophrenia. Most of the paranoid patients (17 vs. 9) and disorganized ones (3 vs. 1) presented moderate values of endo- and mesomorphism with a higher ectomorphism than the patients with undifferentiated schizophrenia (4 vs. 0), which had very low values of ectomorphism.

A possible way to approach separately the components of somatotype and other psychopathological or somatic variables is by partial correlations. In the case group, controlling for endomorphism and ectomorphism, mesomorphism had a significantly positive correlation with the total score on the BPRS scale [r = 0.31; p = 0.09]. Equally, among the group of patients, although a tendency towards association between greater ectomorphism, controlled by endo- and mesomorphism, and lower onset age of schizophrenia was found, this was not significant [r = -0.14; p = 0.46]. Finally, for the total of the sample, a tendency for a positive direction between ectomorphism, controlled by endo- and mesomorphism and the STAI trait scores was observed, however, this did not reach statistical significance [r = 0.21; p = 0.111].

DISCUSSION

This study compares the somatotypes of schizophrenic patients and healthy controls and examines the possible associations between somatic and psychopathological features. As in the Kornetov study,[9] the results indicate that there are no significant differences between both somatotypes. The somatotype of the schizophrenic patients fit into the «endomorphic mesomorph» spectrum of the somatochart (4½ - 5½ - 1½) and that of the controls in the «mesomorph-endomorph» (5 - 5 - 1½). In the controls, this spectrum indicates a balance between endomorphism and mesomorphism, while in the schizophrenic patients, there is a mild disproportion (they diverge in one unit) towards a lower endomorphism and a higher mesomorphism.

As in the study of Sivkov et al. of the year 2005, with schizophrenic patients and healthy controls,[13] schizophrenic patients are more divergent among themselves as a group and represent more categories than the control group, with greater representation of ectomorphic categories. Although there is a tendency to find more ectomorphic subjects among the case group, it is more likely that these results have been reduced due to weight gain that is mostly produced by antipsychotic drugs,[32] although their effect on the somatic variables and on the calculation of the global somatotype is little known.

It is difficult to compare the biotypological results with other authors since the methods used over the years have varied considerably. In 1999, Sivkov and Akabaliev[11] studied the somatotype of 68 patients with affective disorder (6 - 5½ - ½) and 54 schizophrenic patients (4½ - 4½ - 2) using the same method of Heath-Carter, and they placed both groups in the mesomorph-endomorph spectrum, finding significant differences between the somatotype of both groups. In comparison with the Sivkov and Akabaliev study, in the sample of patients of this study, there is a mild predominance of mesomorphism, but with similar values of endomorphism and ectomorphism. It is likely that the differences in the mesomorphism, that are usually higher in men,[2] are due to the different proportion of men among our samples (56.7% in Sivkov et al. vs. 61.8%), which has also hindered the analysis of the somatotype by gender, although no differences have been found.

The appearance of three outlier values below 1% population in the STAI trait scale scores of the control group may be due to a possible bias when choosing voluntary workers of the hospital. Measurement of the subjective anxiety level using self applied scales may be a difficult task to predict since the subject may tend to minimize his/her symptoms, especially in the context of a work relationship. In this sense, it should be remembered that in spite of the elevated prevalence, the anxiety disorder is, for example, a condition with great demand for somatic care and relatively low demand for specialized care.[33] Among the control group, there were no other outlier values with elevated scores on the scale among the case group.

The association between joint hypermobility and anxiety has been recently studied in schizophrenic patients with comorbid anxiety disorders, with similar results to the patients with anxiety disorders without schizophrenia.[23,34] In our study, there is a tendency towards the association be-

tween joint hypermobility and anxiety, especially in the case group, although without reaching statistical significance. The approach to joint hypermobility by correlational analysis may not be the most satisfactory.[20] That is why categorial analyses of «no case/case» have been made. In these, a higher score on the STAI trait according to the grade of joint hypermobility has also been observed, but probably with weak significance due to the difference of gender and small sample size.

Previously, several authors had also described the association between ectomorphism and anxiety disorders,[7,8,24] although with different anthropometric variables and without considering the global concept of the somatotype in three components. In our study, a tendency towards this association was observed, although it did not reach statistical significance. The genetic flexibility of the connective tissue, increased in joint hypermobility, may also intervene in the formation of the body habitus, result of a lengthening of the longitudinal axis of the embryo in the growth process.

Kornetov,[9,10] using different methods, has described associations between clinical manifestations and course in schizophrenia, and the different body habitus. In this sense, an interesting positive association of this study is that of the mesomorphism with clinical severity measured with the BPRS scale, that has not been described up to now in the psychiatric literature. Although other associations of great nosological interest appear in the cluster analysis (moderate values of endo-, meso- and ectomorphism with paranoid and disorganized schizophrenia and more disharmonic values with the undifferentiated schizophrenia), the low number of cases prevents more reliable conclusions from being obtained.

It is clear that this study has important limitations in the analysis of the results. In the first place, the low number of cases and controls and the fact of not using diagnostic criteria to evaluate joint hypermobility has made it difficult to draw more valid conclusions for the secondary aim. Clearly, the quality of the study would have improved with investigators blind to the somatic and psychopathological measurements. Finally, several genetic variables or neuroimaging variables have also not been studied. These would have provided a greater reliability to the results. However, this study has made it possible to confirm the hypothesis of other authors and to observe tendencies for future studies in the field of morphometry. Future studies will be necessary with larger samples to be able to replicate the results of the present work.

The somatic measurements such as body habitus, joint hypermobility or minor physical anomalies may be useful to the nosology to identify disease subgroups such as schizophrenia, or as potential indicators of mental disease risk. In addition, they are very simple measurements that can be examine, some times even *de visu*, with the patient standing, sitting on a chair or lying in a bed. Even though these measurements require preparation, some training can be achieved in a few weeks. Recently, in our setting, other research lines have tried to associate the emotional response using the IAPS (International Affective Picture System) with certain types of mental disorders.[35] These techniques suppose a benefit compared to other more technological, invasive and expensive techniques. Thus, they open the way towards this type of examination in the field of psychiatry.

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