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DISTINCTIVE PARAMETERS DURING GROWTH PROCESS IN THREE SPANISH RURAL POPULATIONS

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Abstract: *In this study we deal with principal components analysis the variability which has been detected in the anthropometric and physiologic parameters in the population of Cuenca (Spain) at three stages of development. The socioeconomic environment of the sample and the nutritional norms belonged to a dietetic study which was done during a week to every single person studied, have been taken into account. The sample includes 3600 people, both sexes. One group of 7 year old children, another one of 17 year old young people and three other groups of children approaching puberty. Three rural areas have been considered: Alcarria, Sierra and Mancha. A "short up" happens between 13 and 14–15 year old boys and between 11 and 12–13 year old girls. It has been demonstrated that rural population in different geographical areas have analogos behaviour to the contributions of the different variables with respect of the first factor of variability. The rural population shows a deviation between the variables of size and build.*

Key words: *Principal Components Analysis; Rural populations; Anthropometry; Growth.*

Introduction

The complexity of the growth process is evident. The analysis of the dynamics in several characters during growth process shows a simple idea of this process. In order to have a better knowledge of the growth process it's interesting to analyse the interactions which were found between all parametres and the multidimensional relations between these ones and the variables which affect them.

In last years, the Principal Component Analysis was used in growth studies of the human populations (Mueller and Reid 1979, Bernis and Sandín 1979, Sandín 1981, Mueller and Stallone 1981, Prado 1981, 1982, Prado, Martínez and Nielsen 1983, 1986a, 1986b, Neves, Salzano and Da Rocha 1985).

In this study the variability observed in the anthropometric, physiological, nutritional, paragenetic and socio-professional parametres of rural population in the province of Cuenca was analyzed with Principal Component Analysis.

Material and Methods

The sample analyzed includes 3600 boys and girls. Their age varied from 7 to 17 years both including a young adult (18–30 year old) group. The population studied corresponds to the province of Cuenca in its rural ambit, being differentiated the natural regions: Alcarria, Sierra, and Mancha.

Cuenca is a province, situated in the outh subtable land, being the fifth province in extension and presenting one of the lower activity of Spain. It has suffered a strong rural exodus and its rural population has been reducing to almost half in this century. The Mancha zone, situated in the south of the province is the least depressed demographic

and economically (it represents aproximatly the 71% of the rural population in the whole province). This three natural regions (Alcarria, Sierra and Mancha) differ geographically, demographically and economically (Altitude: Sierra 1105 m., Alcarria 885 m. and Mancha 709 m.).

Data were collected according to the IBP norms (Weiner and Lourie 1969). Statistical analysis were carried out in the Computer Centre of the Autonoma University of Madrid using the 4M (Principal Component Analysis) BMDP statistical package. The following variables were registe red:

Anthropometry: Stature (EST), Sitting height (SIT), Biacromial diameter (DBA), Biiliocristal diameter (DBI), Total length of the arm (LTB), Total length of the leg (LTP), Head circumference (CCC), Arm circumference (CCB), Thigh circumference (CCM), Leg circumference (CCP), Abdomen circumference (PEA), Weight (PES), Subcutaneous fat: Skinfolds Triceps (GRT), Subscapular (GRE), Suprailiac (GRS); Bizigomatic width (ABZ), Head width (ACE), Head length (LCE), Morphological face height (AMC).

Physiology: Left hand (DII) and Right hand (DID) grip (Dynamometer), Difference of the two grips (DIF), Systolic Blood pressure (PRS), Diastolic Blood pressure (PRD), Difference of Blood pressure (DPR), Vital Capacity (ESP), Menarche (MEN).

Sociodemography: Father's and mother's age (EDP; EDM), Educational level of the father and the mother (ETP; ETM), Father's and mother's profession (PRP, PRM), Endogamy (END), Family size (TAF), Parity (PAR), Viability (VIA), Tobacco comsumption (FUM).

Nutrition: Number of meals in a day (NCD), Number of meals with Carbohydrates (NCF), Calcium NCC), Proteins (NCP) and Vegetables (NCV).

Calculated indexes: Cormico Index (ICO), Quetelet Index (IQE), Robusticity (Rohrer Index, IRO), Cephalic Index (ICE), Facial Index (IFA). (These abbreviations are used in Table 1.)

The CCPP analysis were carried out in each age, sex and region group. In this short study only three groups are presented: preadolescents (8.5 year old), adolescents (in girls: 12.5, 13.5, 14.5 year old, and in boys: 13.5, 14.5, 15.5 year old groups), adults (17.5 year old group and young adults) of each region and both sexes.

Results

Preadolescent girls: The first factor in all the three regions was distinguished by morphophysiological variables against paragenetic variables. The second factor was distinguished by the opposition between the paternal ages and their socioprofessional variables (Table 1 and Fig. 1).

Preadolescent boys: The first factor keeps characterized the women's scheme (morphophysiological variables against paragenetic variables) although in the Mancha group the morphophysiological variables were opposed to the endogamy. The second factor in the Mancha group was distinguished by the opposition amongst the vital capacity, hand grip (dinamometer), blood pressure and skinfold fat. In the Sierra group, the socioprofessional variables distinguished this factor where as the feminine scheme stands in the Alcarria group.

Table 1. **Unrotated factor loadings (pattern) for principal components (VP is variance explained by the factor)**

Char-actor-istics*	Mancha: females 14 Factor 1	Factor 2	Factor 3	Alcarria: males 8 Factor 1	Factor- 2	Factor 3	Sierra: males 17 Factor 1	Factor 2	Factor 3	
SIT	0.900	0.322	0.141	0.812	-0.243	-0.284	-0.244	0.414	-0.196	SIT
EST	0.746	0.500	0.187	0.773	-0.392	-0.296	-0.419	0.581	-0.203	EST
PES	0.943	0.078	0.188	0.905	0.109	0.164	0.751	0.224	0.164	PES
DBA	0.652	0.341	-0.543	0.574	-0.246	-0.373	0.243	0.353	0.309	DBA
DBI	0.283	-0.250	-0.538	0.751	-0.228	-0.262	-0.142	0.408	-0.067	DBI
GRT	0.235	-0.499	0.544	0.808	0.349	0.219	0.850	-0.232	0.017	GRT
GRE	0.372	-0.440	0.050	0.648	0.497	0.424	0.753	-0.501	0.047	GRE
GRS	0.425	-0.479	-0.057	0.638	0.447	0.443	0.718	-0.524	-0.039	GRS
PAS	0.484	-0.099	0.440	0.668	0.146	-0.183	0.519	0.365	0.105	PAS
PAD	0.158	0.617	0.134	0.570	0.343	-0.098	0.358	0.112	0.407	PAD
DPR	0.295	-0.495	0.499	0.349	0.252	-0.184	0.359	0.411	-0.305	DPR
DID	0.316	-0.387	-0.500	0.542	0.040	-0.002	0.270	0.690	0.215	DID
DII	0.371	-0.351	-0.489	0.397	0.109	0.104	0.084	0.433	0.462	DII
ESP	0.151	0.175	-0.243	0.571	-0.447	0.078	-0.319	-0.119	0.106	ESP
DIF	0.055	-0.152	0.152	0.146	-0.161	-0.209	0.210	0.147	-0.511	DIF
LTB	0.782	0.497	0.044	0.563	-0.533	-0.150	-0.492	0.395	0.101	LTB
LTP	0.906	0.080	-0.031	0.701	-0.324	-0.175	-0.299	-0.494	0.187	LTP
CCC	-0.020	0.412	0.643	0.642	-0.040	-0.098	-0.232	0.469	0.037	CCC
CCB	0.555	-0.335	0.305	0.833	0.255	0.269	0.727	0.270	0.082	CCB
CCM	0.363	-0.224	0.670	0.771	0.064	-0.083	0.920	0.069	-0.076	CCM
CCP	-0.124	0.372	0.111	0.879	0.175	0.106	0.326	0.276	-0.320	CCP
PEA	0.371	-0.193	0.307	0.797	0.278	0.187	0.815	-0.265	0.167	PEA
MEN	0.118	0.551	0.382	0.790	0.084	-0.122	0.331	0.294	0.145	ABZ
ABZ	0.815	-0.003	-0.296	0.598	0.196	-0.416	0.377	0.406	0.125	ACE
ACE	0.639	0.194	-0.202	0.657	-0.065	-0.473	0.469	0.461	-0.040	LCE
LCE	0.281	0.807	-0.098	0.586	-0.064	0.173	0.071	0.461	-0.280	AMC
AMC	0.863	0.230	-0.176	0.256	0.174	-0.154	0.454	-0.175	0.006	ICO
ICO	0.631	-0.350	-0.067	0.638	0.485	0.476	0.908	-0.137	0.242	IQE
IQE	0.658	-0.392	0.415	0.285	0.649	0.600	0.888	-0.263	0.247	IRO
IRO	-0.006	-0.584	0.200	0.169	0.365	-0.102	0.076	0.414	0.220	ICE
ICE	0.405	-0.588	-0.263	-0.300	-0.148	0.341	0.094	0.497	-0.014	IFA
IFA	-0.257	0.311	0.269	0.122	-0.491	0.459	-0.192	-0.405	-0.325	PRP
PRP	0.053	0.355	-0.190	0.112	-0.061	-0.259	-0.243	-0.151	-0.030	PRM
PRM	-0.174	0.799	0.271	0.142	-0.411	0.579	-0.339	-0.341	-0.201	ETP
ETP	-0.174	0.799	0.271	0.029	-0.397	0.654	-0.018	-0.129	-0.034	ETM
ETM	-0.127	0.787	0.178	-0.239	-0.446	-0.387	-0.311	-0.193	0.608	TAF
TAF	0.397	0.148	0.505	-0.305	0.627	-0.356	-0.352	-0.131	0.696	PAR
PAR	-0.423	-0.313	0.557	0.285	-0.412	0.074	-0.155	-0.299	0.097	END
END	0.018	0.823	0.063	0.101	0.680	-0.287	-0.316	-0.368	0.611	EDP
EDP	0.261	-0.582	0.457	-0.191	0.627	-0.325	-0.269	-0.416	0.601	EDM
EDM	-0.028	-0.423	0.671	-0.106	0.513	-0.097	-0.017	0.201	0.749	VIA
VIA	0.229	0.127	-0.352	0.000	0.000	0.000	-0.264	0.004	0.418	FUM
FUM	-0.336	-0.273	0.021	-0.029	-0.350	-0.087	-0.107	-0.280	-0.220	NCD
NCD	0.151	0.211	0.466	0.134	-0.187	0.085	-0.387	-0.373	0.202	NCP
NCP	0.551	0.306	0.570	0.399	0.176	0.243	0.231	-0.428	0.017	NCF
NCF	0.016	-0.168	0.616	0.319	-0.450	-0.188	-0.117	-0.019	-0.434	NCC
NCC	0.195	0.149	-0.599	0.060	-0.291	0.525	0.108	-0.472	-0.044	NCV
NCV	0.435	0.240	0.349							
VP	25%	15%	11%	23%	17%	9%	24%	16%	9%	

*Abbreviations used in this table are explained in text, see: Material and Methods

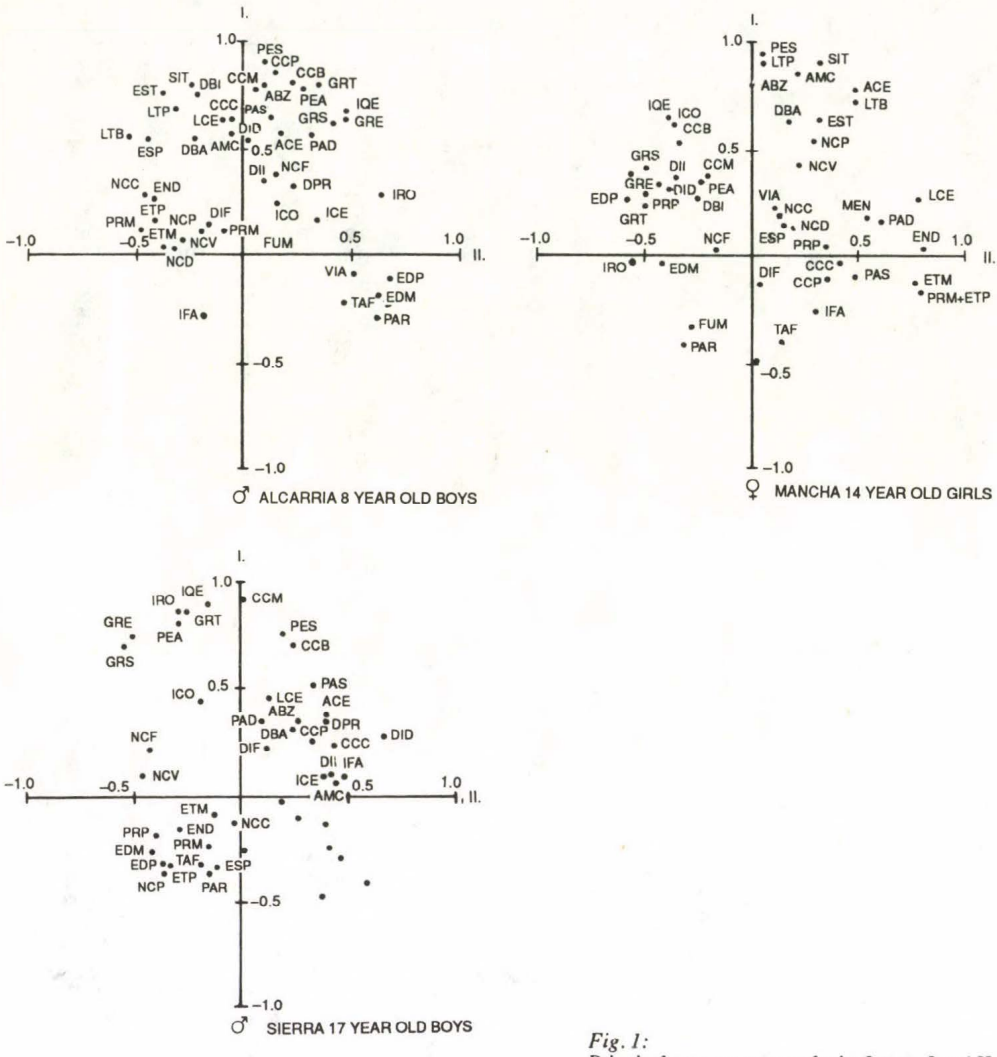

Fig. 1:
Principal components analysis, factors I and II

Adolescent girls: A dissociation between height and weight was observed in the 13.5 year old Mancha girls, and in the Sierra and Alcarria girls a year later. The first factor, however, continuously were defined by morphophysiological variables in opposition to the paragenetic variables. In the second factor an opposition between socioprofessional and paragenetic variables was observed. In 14.5 year old group, the second factor was defined by the the height in the Sierra and Alcarria groups, and by the endogamy in the Mancha group.

Adolescent men: In the three age groups the first factor was distinguished by the morphophysiological variables, against the paragenetic variables. In the Mancha group endogamy existed against the morphophysiological variables. In the second factor

heights, lengths diameters and vital capacity were against the skinfold fat and Cormico, Robusticity of Rohrer and Quetelet Indices, being less marked in the Mancha group where the second factor was distinguished by paternal socioprofessional variables.

Adult women: There was a tendency to dissociation size – shape and height – weight in the three regions, although the first factor continuously were defined by the morphophysiological variables which were against to the nutritional variables in the Sierra group, to the paragenetilc, socioprofessional variables, endogamy, vital capacity and hand grip (dynamometer), in the Alcarria group and to the paragenetic variables in the Mancha group. The second factor in the Mancha group was distinguished by the endogamy and socioprofessional variables which were against the paragenetic variables. In the Sierra group it was distinguished by height, cephalic variables, vital capacity and blood pressure, against the skinfold fat and menarche. In the Alcarria group it was distinguished by the opposition among the circumferences, indices and weight against lengths, height and menarche.

Adult men: The first factor was distinguished by the morphophysiological variables which were against the height in the Sierra and Alcarria groups. In the Sierra men the size variables were associated with the socioprofessional variables. The nutritional variables were against the shape variables in the Alcarria and Mancha groups. The second factor was distinguished by the paragenetic variables which were against the height in the Sierra and Alcarria groups.

Conclusions

Based on these results one can see that it isn't easy to synthesize all the relations observed among the variables.

In growth process in both sexes there was observed an opposition between morphophysiological and paragenetic variables. These results show like family size and high parities have negatives repercussions on the individual growth. In the most age groups studied, the profession and educational level of the father was against the parameters which define the development of the subcutaneous adipose tissue. This is understandable because a high economical and cultural status allows the access to a more balanced nutrition while the most unfavourable status have diets rich in carbohydrates. In both sexes of the Mancha population during the puberty there was an opposition between the endogamy level and body size. This implies that a bigger heterosis helps the somatic development of the individual, in a favourable environment.

Out of the three regions, the Mancha group shows a bigger heterosis and socioeconomical development. In general, during the preadolescent and postadolescent periods the size and shape variables (height and weight) were associated, becoming independent in the adolescent and adult periods. This would show that the tallest individuals aren't always who have the bigger weight.

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