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Somatotype in spondyloarthritis: a prevalence study in a Brazilian tertiary hospital

Somatotipo em espondiloartrite: estudo de prevalência em hospital terciário brasileiro

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ABSTRACT

Objective: This study assessed the prevalence of somatotypes in different types and subtypes of spondyloarthritis based on the anthropometric, demographic, and phenotypic data. **Method:** The Heath and Carter method was used to determine the somatotype in 61 patients with spondyloarthritis who were being treated at a teaching hospital in Brazil. Analysis of variance and Fisher's exact tests were used to statistically analyze the results. **Results:** The sample included individuals who were predominantly male (68.9%), Caucasian (63.9%), age [54.8 ±13.68 years], height [1.68 ± 0.1 meters], total body mass [81.64 ± 12.59 Kg], body mass index [29.06 kg/m 2 ± 4.23], fat percentage [28.94 ± 5.25], disease time [20.38 ± 10.44 years], and diagnosis time [16.6 ± 10.3 years]. In the types of spondyloarthritis, meso-endomorph was more prevalent [axial= 39 [16 (41%)] and peripheral= 22 [10 (45,5%)], with no direct relationship between the subtypes, but with meso-endomorph tendency, in the enthesopathic [6 (45.5%)] and intestinal phenotypes [2 (7.7%)]. Ankylosing spondylitis was characterized by hypertrophy and thinness, with the absence of cutaneous phenotype (p< 0.05), psoriatic spondyloarthritis due to hypotrophy and thinness with the presence of the cutaneous phenotype (p < 0.05), Meso-endomorph and mesomorph endomorph aggregate three phenotypes, whereas endo-mesomorph and endomorph mesomorph two. **Conclusion:** The study highlights to a heterogeneous spectrum on anthropometric distribution of spondyloarthritis, which can be considered for guidelines and individual treatment decisions.

Keywords: Axial Spondyloarthritis, Body Composition, Somatotypes

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RESUMO

Objetivo: Este estudo avaliou a prevalência do somatotipo em diferentes tipos e subtipos de espondiloartrite com base em dados antropométricos, demográficos e fenotípicos. **Método:** O método de Heath e Carter foi utilizado para determinar o somatotipo em 61 pacientes com espondiloartrite em tratamento em um hospital universitário no Brasil. Análise de variância e testes exatos de Fisher foram utilizados para análise estatística dos resultados. **Resultados:** A amostra incluiu indivíduos predominantemente do sexo masculino (68,9%), brancos (63,9%), idade [54,8 ±13,68 anos], altura [1,68 ± 0,1 metros], massa corporal total [81,64 ± 12,59 Kg], índice de massa corporal [29,06 kg/m 2 ± 4,23], percentual de gordura [28,94 ± 5,25], tempo de doença [20,38 ± 10,44 anos] e tempo de diagnóstico [16,6 ± 10,3 anos]. Nos tipos de espondiloartrite, o mesoendomorfo foi mais prevalente [axial= 39 [16 (41%)] e periférico= 22 [10 (45,5%)], sem relação direta entre os subtipos, mas com tendência mesoendomorfo, na entesopática [6 (45,5%)] e fenótipos intestinais [2 (7,7%)]. A espondilite anquilosante foi caracterizada por hipertrofia e magreza, com ausência de fenótipo cutâneo (p< 0,05), espondiloartrite psoriática por hipotrofia e magreza com presença do fenótipo cutâneo (p< 0,05), Mesoendomorfo e mesomorfo endomorfo agregam três fenótipos, enquanto endo-mesomorfo e endomorfo mesomorfo dois. **Conclusão:** O estudo destaca um espectro heterogêneo na distribuição antropométrica da espondiloartrite, que pode ser considerado para diretrizes e decisões individuais de tratamento.

Palavras-chave: Espondiloartrite Axial, Composição Corporal, Somatotipos

INTRODUCTION

Somatotype is defined as the quantification of body composition and structure, where endomorphy represents relative fat, mesomorphy, relative musculoskeletal robustness and ectomorphy is related to relative linearity or physical thinness.[1] The initial proposal by Sheldon et al.[2] and Parnell analysis[3] in 1954 was revised and modified by Heath and Carter (H&C) in 1967 and certified by the International Standards for Anthropometric Assessment (ISAK).[4] It is rare to have a single component defining the somatotype, but rather somatotype categories[4,5] allowing 13 combinations: endomorph, meso-endomorph, endomorph mesomorph, endo-mesomorph, balanced mesomorph, ecto-mesomorph, mesomorph-ectomorph, meso-ectomorph, balanced ectomorph, endo-ectomorph, endomorph-ectomorph, central, or balanced.[4,5]

There is no somatotype pattern considered normal, its variations throughout life are related to different social factors[5-7] and to different variables involving its relationship with athletes, non-athletes, genders, age, ethnicities, genetic, and environmental influences.[5-8] However, it was noticed that the somatotype and its main components should be considered not only in physically fit and active individuals but also in the sick[7-10] sedentary ones[7-10] and in the prevalence of several chronic diseases.[9-10] Alternatively, it should be considered the possibility of somatotype becoming the phenotypic trait of what is conventionally called biological individuality[11,12] a term used to express, in clinical practice, dissimilarities in clinical evolution and in therapeutic response among patients with the same disease and identical treatments.[12]

Studies involving the somatotype importance in medical practice are not recent[13-16] but uncommon in musculoskeletal diseases[17-18] Parhami[19] in 1976, sought common physical similarities in subjects with ankylosing spondylitis, suggesting an ectomorphas prevalent somatotype. This statement was argued, in 1977 by Calabro et al.[20] who identified the dominance of the mesomorph, followed by endomorph and a smaller number of ectomorph somatotypes. Except for Plasqui's[21] description of the connection between physical activity and body composition in ankylosing spondylitis, this topic has not yet been studied since then.

This study describes an investigation on the relationship between somatotype and its components with the prevalence of spondyloarthritis (SA). The motivation for this investigation has different reasons, primarily because it is a preliminary study, which seeks a rereading of the studies of Parhami and Calabro[19,20] but within the current diagnostic criteria of SA[22,23] and contemporary anthropometric techniques.[3,4] Thus, it describes the relationship between somatotype and body composition with the prevalence of SA in a group of patients with spondyloarthritis treated in a Brazilian tertiary hospital.

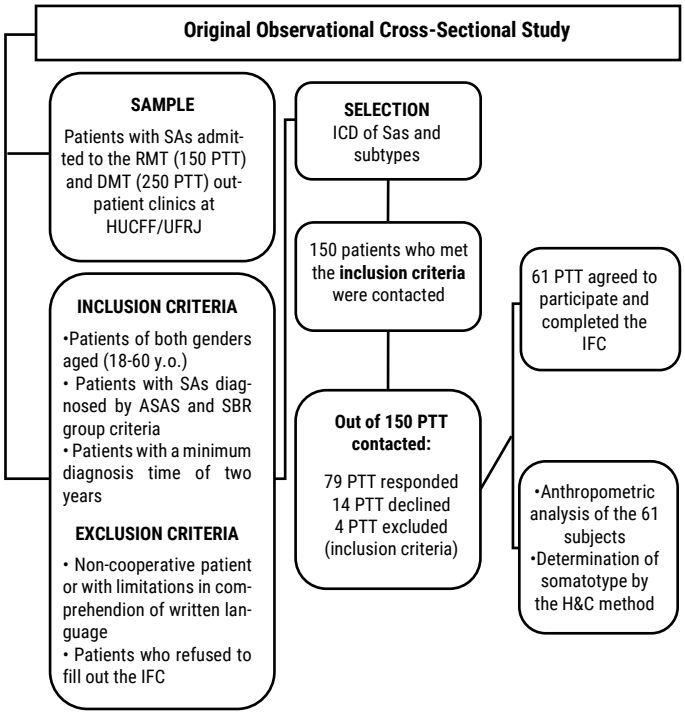
METHOD

Original cross-sectional observational study. Outpatients were diagnosed with SA and treated at the Rheumatology (150 patients) and Dermatology (250 patients) Services at the HUCFF/UFRJ. A total of 190 patients with the International Classification of Diseases of SA and subtypes (H20.0, M07.0, M07.2, M07.6, M45, M46, M46, M46.1) were selected from the administrative database of HUCFF/UFRJ.

The inclusion criteria adopted were: patients of both sexes aged 18–60 years, diagnosed with SA according to the Assessment on SpondyloArthritis International Society (ASAS) and Brazilian Society of Rheumatology (SBR) group criteria, and with a minimum disease diagnosis time of two years.

The exclusion criteria adopted were: noncooperative patients or those with limitations in understanding written language and those who refused to complete the free and informed consent form (FICF).

We contacted 150 patients of both sexes, aged between 25 and 77 years with an average age of 54.9 years, diagnosed with the disease for at least 2 years, and met the criteria for the diagnosis of SA.[22,23] Seventy-nine patients answered the initial contact, of which 14 did not want to participate, four were excluded (two for being wheelchair users and two for not fulfilling the diagnostic criteria). We included 61 subjects who agreed to participate in the study and signed the FICF. Then, the patients were identified and submitted to a routine of anthropometric measurements by the H&C method[4] (Figure 1).



***PTT**: patient; **SAs**: SpondyloArthritis; **ICD**: International Disease Code; **HUCFF/UFRJ**: Clementino Fraga Filho University Hospital of the Federal University of Rio de Janeiro; **RMT**: rheumatology; **DMT**: dermatology; **ASAS**: Assessment on SpondyloArthritis International Society; **SBR**: Brazilian Society of Rheumatology; **IFC**: free and informed consent form; **H&C**: Heath & Carter method*

Figure 1. Schematic design of the methodology

Measure

A single evaluator, certified by ISAK[5] performed anthropometric measurements by the H&C method[4] and estimated the following parameters in the group of 61 subjects: height (H) with the compact Trena Type Sanny® stadiometer-ES 2040; bone diameter (BD) in right dimidia of the evaluated patients, the following measurements were obtained: biepicondylar diameter of the humerus (BDU) and biepicondylar diameter of the femur (BDF) using a small anthropometric caliper Sanny®; segmental perimeter of the body seeking the maximum perimeter of a body segment being measured: contracted arm perimeter and calf perimeter, for this, a flexible metal anthropometric trena of Sanny brand was used; skinfolds (SF): triceps (TR); subscapular (SB); supraspinatus (SS)

and medial calf (MC) using a calibrated scientific skinfold compass; total body mass (TBM); a digital platform scale (GLAM) was used, with accuracy of 100g, barefoot patient, using as little clothing as possible, positioning itself on top of the scale, with its back to the scale, with feet in the given location, legs extended, arms positioned along the body and head positioned parallel to the ground, oriented in the Frankfurt plan and, finally, to measure the somatotype, the H&C method[4] was applied, according to ISAK standards 5 using ten measures: height; body weight; four skinfolds (TR, SB, SS, and MC); two bone diameters (BDU and BDF); two perimeters of body segment (flexed arm in maximum contraction and calf) seeking the determination of the three components: endomorphy, mesomorphy, and ectomorphy (Figure 1).

Statistical analysis

For the quantitative variables, measures of tendency and variability were calculated: mean and standard deviation, while for the qualitative variables there were absolute (n) and relative (%) frequency distributions. Mean comparisons were made using analysis of variance and cross tables with Fisher's exact test. The significance level of the study was set at 5% ($p < 0.05$) in statistical software R version 4.0.2.

Ethical approval

The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review committee: ethics committee of the Hospital Univeristario Clemetino Fraga Filho of the Universidade Federal do Rio de Janeiro (CEP-HUCFFF/UFRJ); Certificate of Presentation of Ethical Appreciation (CAAE) number: 83384818.2.0000.5257.

RESULTS

Anthropometric, demographic, and phenotypic data are in Table 1. The result characterizes the socio-demographic distribution of our sample, containing 61 subjects with the majority living in the city of Rio de Janeiro; males, caucasian, idade media 54.8 years disease time 20.8 years and diagnosis time 16.6 years, com body mass index of (BMI = 29.06) falling within the overweight range.

In the prevalence of the type of SAs, there was an axial domain over the peripheral type. In the subtypes, the predominant distribution was ankylosing spondylitis, then, psoriatic SA, nonradiographic Axial SA, Enthesopathic SA, and an equivalence between Undifferentiated SA and Inflammatory Bowel Disease SA. Among the clinical phenotypes, there was a domain of the articular and, subsequently, cutaneous, enthesopathic, ocular, and intestinal.

The "n" of patients with two phenotypes was more dominant, followed by one phenotype and, finally, three phenotypes. As for the somatotype, there is a greater dominance of meso-endomorph, followed by endo-mesomorph, mesomorph endomorph, endomorph mesomorph, and only one balanced mesomorph subject.

The prevalence of somatotype in SA and its subtypes, with distributions of possible somatotype types to subjects who have and do not have the respective type of spondyloarthritis (Table 2).

Table 1. Sample characterization

Characteristics	Variable	Total (n= 61)
City (%)	Belford Roxo	2 (3.3)
	Mesquita	1 (1.6)
	Niterói	1 (1.6)
	New Iguaçu	5 (8.2)
	Rio das Ostras	1 (1.6)
	Rio de Janeiro	42 (68.9)
	Seropédica	1 (1.6)
	Sao Gonçalo	3 (4.9)
	São João do Meriti	5 (8.2)
Rio de Janeiro (%)	No	19 (31.1)
	Yes	42 (68.9)
Ethnicity (%)	Caucasian	39 (63.9)
	Afro-descendant	4 (6.6)
	Mixed	18 (29.5)
Age (mean (SD)) - years		54.87 (13.68)
Gender (%)	Female	19 (31.1)
	Male	42 (68.9)
Disease time (mean (SD)) - years		20.38 (10.44)
Diagnosis time (mean (SD)) - years		16.16 (10.30)
Height (average (SD)) - meters		1.68 (0.10)
Total body mass (mean (SD)) - kg		81.64 (12.59)
Somatotype (%)	Endo-mesomorph	19 (31.1)
	Mesomorph endomorph	6 (9.8)
	Meso-endomorph	26 (42.6)
	Balanced mesomorph	1 (1.6)
	Endomorph mesomorph	9 (14.8)
Bone diameters - cm	Wrist (mean (SD))	5.57 (0.40)
	Elbow (mean (SD))	7.21 (0.59)
	Knee (mean (SD)0	10.06 (0.68)
Fat percentage (%)	F% - Faulkner (mean (SD))	20.20 (3.63)
	F% - Pollock 7 SF (mean (SD))	28.94 (5.25)
	F% - Pollock 3 SF (mean (SD))	22.44 (4.53)
Distribution of body fat	Body mass index (mean (SD)) - kg/m2	29.06 (4.23)
	Conicity index (mean (SD))	1.25 (0.18)
	Waist to Hip ratio index (mean (SD))	0.91 (0.14)
Body composition distribution - kg	Fat mass (mean (SD))	23.96 (7.03)
	Bone mass (mean (SD))	6.75 (0.56)
	Residual mass (mean (SD))	19.68 (3.03)
	Muscle mass (mean (SD))	31.26 (4.57)
	Lean body mass (mean (SD))	57.68 (7.42)
	% muscle mass (mean (SD))	38.57 (4.63)
Spondyloarthritis	Axial (%)	39 (63.9)
	Peripheral (%)	22 (36.1)
Subtype (%)	AS	29 (47.5)
	NrAxSA	4 (6.6)
	EtsSA	2 (3.3)
	USA	1 (1.6)
	IBD	1 (1.6)
	PSA or PA	24 (39.3)
Clinical phenotype		
Articular (%)	No	3 (4.9)
	Yes	58 (95.1)
Enthesopathic (%)	No	53 (86.9)
	Yes	8 (13.1)
Intestinal/IBD (%)	No	57 (93.4)
	Yes	4 (6.6)
Ocular/Uveitis (%)	No	53 (86.9)
	Yes	8 (13.1)
Skinfold/Cutaneous Psoriasis (%)	No	39 (63.9)
	Yes	22 (36.1)
Number of phenotypes	1	27 (44.3)
	2	29 (47.5)
	3	5 (8.2)

***F%**: fat percentage; **7SF**: seven skinfolds; **3SF**: three skinfolds; **AS**: ankylosing spondylitis; **NrAxSA**: non-radiographic axial spondyloarthritis; **EtsSA**: enthesopathic spondyloarthritis; **USA**: undifferentiated spondyloarthritis; **PSA or PA**: psoriatic spondyloarthritis or psoriatic arthritis; **IBD**: spondyloarthritis of inflammatory bowel or enteropathic disease*

Table 2. Prevalence of somatotype in spondyloarthritis types and subtypes

Spondyloarthritis	n	Endo-mesomorph	Endomorph mesomorph	Meso-Endomorph	Balaced Mesomorph	Mesomorph endomorph	p
Types							
Axial	39	13 (33.3)	2 (5.1)	16 (41.0)	1 (2.6)	7 (17.9)	0.055
Peripheral	22	6 (27.3)	4 (18.2)	10 (45.5)	0 (0.0)	2 (9.1)	
Subtypes							
AS	29	11 (37.9)	0 (0.0)	12 (41.4)	0 (0.0)	6 (20.7)	0.138
NrAxSA	4	0 (0.0)	1 (25.0)	2 (50.0)	1 (25.0)	0 (0.0)	
EtsSA	2	0 (0.0)	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	
USA	1	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	
PSA or PA	24	8 (33.3)	4 (16.7)	9 (37.5)	0 (0.0)	3 (12.5)	
IBD	1	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	

***AS**: ankylosing spondylitis; **NrAxSA**: non-radiographic axial spondyloarthritis; **EtsSA**: enthesopathic spondyloarthritis; **USA**: undifferentiated spondyloarthritis; **PSA or PA**: psoriatic spondyloarthritis or psoriatic arthritis; **IBD**: spondyloarthritis of inflammatory bowel or enteropathic disease*

There is a dominance of the somatotype meso-endomorph in axial and peripheral SAs, followed by endo-mesomorph. However, from this point on, the dominant sequences diverge being in the axial type: mesomorph endomorph; endomorph mesomorph, and balanced mesomorph, in the peripheral type: endomorph mesomorph and mesomorph endomorph. Here, it is worth mentioning that when comparing somatotype, within type, the p-value= 0.055, which is very close to the level of significance adopted in the study. Emphasis is given to the mesomorph endomorph in the axial type, and endo-mesomorph in the peripheral type.

Among the subtypes, there is a dominance of ankylosing spondylitis (AS) in relation to the other subtypes being the psoriatic sequence as follows: nonradiographic axial; enthesopathic, undifferentiated, and enteropathic disease or inflammatory bowel disease. Thus, identified as follows: AS - meso-endomorph, endomesomorph and mesomorph endomorph; psoriatic spondyloarthritis/psoriatic arthritis (PSA/PA) - meso-endomorph, endo-mesomorph, endomorph mesomorph and mesomorph endomorph; NrAxSA-meso-endomorph, endomorph mesomorph and balanced mesomorph; EtsSA-meso-endomorph; USA-meso-endomorph, inflammatory bowel or enteropathic disease (IBD) endomorph mesomorph endomorph.

However, there was no direct relationship between the somatotype and subtypes of SA. The somatotype description considers ethnicity, gender, disease time, diagnosis time, and phenotype clinical variables (Table 3).

Table 3. Description of the somatotype with variables of interest

Characteristics	Variables	Endo-mesomorph	Endomorph mesomorph	Meso-endomorph	Balanced Mesomorph	Mesomorph endomorph	P *
n		19	6	26	1	9	
Ethnicity (%)	Caucasian	12 (63.2)	4 (66.7)	18 (69.2)	0 (0.0)	5 (55.6)	0.448
	Afro-desdant	3 (15.8)	0 (0.0)	0 (0.0)	0 (0.0)	1 (11.1)	
	Mixed	4 (21.1)	2 (33.3)	8 (30.8)	1 (100.0)	3 (33.3)	
Age (average (SD))		54.68 (14.57)	59.24 (10.51)	57.02 (14.17)	42.87 (-)	47.47 (10.93)	0.280
Gender (%)	Female	8 (42.1)	4 (66.7)	5 (19.2)	0 (0.0)	2 (22.2)	0.089
	Male	11 (57.9)	2 (33.3)	21 (80.8)	1 (100.0)	7 (77.8)	
Disease time (mean (SD))		23.00 (11.65)	15.67 (6.77)	19.77 (8.94)	6.00 (-)	21.33 (13.12)	0.468
Diagnosis time (mean (SD))		16.58 (11.33)	12.33 (7.17)	15.92 (9.24)	2.00 (-)	20.11 (12.38)	0.542
Clinical phenotype							
Articular (%)	No	0 (0.0)	0 (0.0)	3 (11.5)	0 (0.0)	0 (0.0)	0.388
	Yes	19 (100.0)	6 (100.0)	23 (88.5)	1 (100.0)	9 (100.0)	
Enthesopathic (%)	No	19 (100.0)	6 (100.0)	20 (76.9)	1 (100.0)	7 (77.8)	0.065
	Yes	0 (0.0)	0 (0.0)	6 (23.1)	0 (0.0)	2 (22.2)	
Intestinal/IBD (%)	No	19 (100.0)	4 (66.7)	24 (92.3)	1 (100.0)	9 (100.0)	0.056
	Yes	0 (0.0)	2 (33.3)	2 (7.7)	0 (0.0)	0 (0.0)	
Ocular/Uveitis (%)	No	16 (84.2)	5 (83.3)	22 (84.6)	1 (100.0)	9 (100.0)	0.658
	Yes	3 (15.8)	1 (16.7)	4 (15.4)	0 (0.0)	0 (0.0)	
Skinfold/Cutaneous Psoriasis (%)	No	11 (57.9)	2 (33.3)	19 (73.1)	1 (100.0)	6 (66.7)	0.306
	Yes	8 (42.1)	4 (66.7)	7 (26.9)	0 (0.0)	3 (33.3)	
Number of phenotypes	1	8 (42.1)	0 (0.0)	13 (50.0)	1 (100.0)	5 (55.6)	0.105
	2	11 (57.9)	5 (83.3)	10 (38.5)	0 (0.0)	3 (33.3)	
	3	0 (0.0)	1 (16.7)	3 (11.5)	0 (0.0)	1(11.1)	

***Tests that did not consider balanced mesomorph*

Only one patient had a balanced mesomorph somatotype, so he was excluded in the comparative tests because he was not representative of an entire group. The characterization of the somatotype with the clinical variables was as follows: predominance of the caucasian race - endo-mesomorph , endomorph mesomorph, meso-endomorph and mesomorph endomorph but without direct relation with somatotype (p= 0.448); in all somatotypes the age group is between 40 and 60 years, with a higher mean for the endomorph mesomorph, and lower for the mesomorph endomorph; there is male dominance, with the meso-endomorph somatotype being the most prevalent, while in females it is the endo-mesomorph; there is a longer mean disease time for the endo-mesomorph somatotype, with the following decreasing sequence - mesomorph endomorph, meso-endomorphand endomorph mesomorph; there is longer time of diagnosis for the mesomorph endomorph somatotype, with the following decreasing sequence– endo-mesomorph; meso-endomorph and endomorph mesomorph.

Regarding clinical phenotypes, in all components there is a predominance of articular phenotype, the enthesopathic phenotype tends to the meso-endomorph and mesomorph endomorph components. The intestinal phenotype tends to the endomorph mesomorph and meso-endomorph components, the ocular phenotype appears in the meso-endomorph, endo-mesomorph, and endomorph mesomorph, finally, in the cutaneous phenotype higher rates of occurrence in the endo-mesomorph, meso- endomorph, and endomorph mesomorph components are noted. In relation to the number of phenotypes, meso-endomorph and mesomorph endomorph aggregate three phenotypes; endo-mesomorph and endomorph mesomorph, two phenotypes.

There was no significant or even trending difference between height, TBM, BD, fat percentage, and total body fat distribution. In the axial type, there is a tendency to greater muscle mass, and in the peripheral type, the smallest muscle mass (p= 0.061). There was a tendency of higher lean body mass, in the axial type and lower lean body mass, in the peripheral type (p= 0.067), with a percentage distribution among those who do not have the type.

The articular phenotype is present in all types; however, it is more evident in the axial type (p< 0.001) and the cutaneous phenotype stands out in the peripheral type (p< 0.001). Regarding the number of phenotypes, both types' aggregate three phenotypes, but with greater emphasis on the axial group (p< 0.001). The distribution was as follows: axial (greater emphasis on articular and ocular phenotypes and proportional between the enthesopathic, intestinal, and cutaneous phenotypes.) and peripheral (with greater emphasis on phenotypes: cutaneous and, followed by articular, and enthesopathic phenotypes). Table 4 shows the overview of the correlation analysis between the most frequent subtypes of spondyloarthritis with body composition and clinical phenotypes.

There was no significant or even trending difference between height, TBM, BD, and fat percentage. In the subtype of Type AS, there is a tendency to greater muscle mass (p= 0.065) and significance for greater lean body mass (p= 0.115). In the peripheral type, there is a tendency to lower muscle mass (p= 0.011) and significance for lower lean body mass (p= 0.032). The articular phenotype is present in the mentioned subtypes, the cutaneous phenotype is absent in the subtype of AS (p< 0.001) and adding two phenotypes: articular and ocular (p< 0.001). In the PSA/PA subtype, the cutaneous phenotype is present (p< 0.001), the ocular phenotype is absent (p< 0.001), the ocular phenotype is absent (p< 0.001) and aggregating three phenotypes: cutaneous, articular, and enthesopathic (p< 0.001). The tables, with complete analyses and descriptions, among the prevalence of somatotype in SAs, correlation with body composition and clinical phenotypes.

DISCUSSION

The study describes an investigation of the relationship between somatotype and its components and the prevalence of SAs in a group of patients treated in a Brazilian tertiary hospital. There is great interest recently in studies that correlate physical characteristics and chronic diseases.[24] Anthropometric methods emerge as a low-cost, non-invasive and easy-to-apply alternative in clinical medicine.[4,7-9,13,14,24] The choice of investigation was essentially based on a preliminary study that seeks a rereading of Parhami and Calabro studies.[19,20] However, within the current diagnostic criteria of SAs[22,23] and current anthropometric techniques6. We discuss here the analysis of the relationship between a somatotype and its components and body composition with SAs, and its prevalence in this group of diseases.

Most patients are from the city of Rio de Janeiro; males, caucasian, overweight but not atrophic. The ideal would be to follow them prospectively, because there are biomechanical and anthropometric aspects, which deteriorate by different variables, namely advancing age, difference between genders, disease progression, postural pattern, postural stability, body shape, body composition, heritability, sedentary lifestyle habits, being physically active, and/or being an athlete,[5-10] although ideal is unfeasible.

The focus was to describe the somatotype of the sample as a first step toward a subsequent retrospective analysis of clinical and social variables, which may show a possible relationship with SAs prognosis and provide future proposals for pharmacological and non-pharmacological interventions. Therefore, it is important to know who our patient is, especially in a disease in which exercise is a factor of improvement and sedentary lifestyle is a worsening factor, with both influencing somatotypes. It should be highlighted that the somatotype is something individual, and cannot be compared to a normality pattern, healthy or not, suffering prospective changes due to diseases, as described by Koleva.[14]

The study described results not yet contemplated in the literature, although it should be emphasized that they reflect the sample, however, without failing to be a representative hypothesis among the SAs. When developing this study, at first, we thought about the gap that existed for five decades, in the relationship between somatotype and SAs. In fact, it brought robust results and, obviously different from the findings of Parhami,[19] who described ectomorph type as a prevalent somatotype in AS, and Calabro et al.[20] who also identified the dominance of the mesomorphic somatotype in AS, followed by endomorphic and lower ectomorphic spondylitis, and analyzed the type and subtypes of SAs, within its current diagnostic criteria[22,23] and within the current anthropometric criteria.[5] There is a dominance of the endomorph and endo-mesomorph in the axial and peripheral spondyloarthritis regardless of the type, there is a sample with alternating dominance between muscle mass and body fat.

This result confirms the description by Marques et al.[24] who related endomorph to the elderly and chronic diseases. In the dominant sequences, there is divergence in the axial type: mesomorph endomorph and endomorph mesomorph and in the peripheral type: endomorph mesomorph and mesomorph endomorph.

Table 4. Overview of the correlation analysis between types and subtypes of spondyloarthritis with body composition and clinical pheno types

Types of SAs	Without ≠ significance	Tendency	With ≠ significance	Comments
Body Composition				
Axial	H–TBM–BD–F% - DCC	TBM: ↑MM (p = 0.061)	DCC: ↑ LBM (p= 0.067)	In the axial type there is a tendency to higher MM and higher LBMM
Peripheral	H - TBM - BD - G%	TBM: 「MM (p = 0.061)	DCC: • LBM (p= 0.067)	In the peripheral type there is a tendency to lower MM and lower LBM
Clinical Phenotypes				
Axial	Articular; Ocular; Enthesopathic and Intestinal	No description	Articular present (p < 0,001); Aggregates three phenotypes (p < 0,001)	The articular phenotype is present and highlighted. The axial type includes three phenotypes, with greater emphasis on articular and ocular phenotypes and proportionally between the enthesopathic, intestinal, and cutaneous phenotypes
Peripheral	Articulatar; Ocular; Enthesopathic and Intestinal	No description	Articular present Cutaneous present (p < 0,001); Ocular absent (p < 0,001); Aggregates three phenotypes (p < 0,001)	The articular phenotype is present, in a minor emphasis. The cutaneous phenotype is present and highlighted. The peripheral type aggregates three phenotypes, with greater emphasis on phenotypes: cutaneous, followed by articular, and enthesopathic phenotypes
Subtypes of SAs	**Without ≠ significance**	**Tendency**	**With ≠ significance**	**Comments**
Body Composition				
SA	H - MCT - DO - G%	DCC: ↑MM (p = 0.065)	DCC: ↑MCM (p= 0.115)	There is a tendency to higher MM and higher significance for LBM
PSA /PA	H - MCT - DO - G%	DCC: 「MM (p = 0.011)	DCC: 「MCM (p= 0.032)	There is a tendency to lower MM and higher significance for LBM
Clinical Phenotypes				
AS	Articular; Ocular; Enthesopathic and Intestinal	No description	Cutaneous absent (p < 0,001); Aggregates two phenotypes (p < 0,001)	The cutaneous phenotype is absent and aggregates two phenotypes: articular and ocular
PSA/PA	Articular; Enthesopathic and Intestinal	No description	Cutaneous present (p < 0,001); Ocular absent (p < 0,001); Aggregates three phenotypes (p < 0,001)	The cutaneous phenotype is present; the ocular and intestinal are absent and aggregates three phenotypes: cutaneous; articular; enthesopathic

***SAs**: spondyloarthritis; **AS**: ankylosing spondylitis; **PSA or PA**: Psoriatic spondyloarthritis or Psoriatic arthritis; **H**: height; **TBM**: total body mass; **BD**: bone diameter; **F%**: percentage of fat; **TBFD**: total body fat distribution; **MM**: muscle mass; **LBM**: lean body mass*

This suggests more muscle and less adiposity in the axial type than in the peripheral type. Note here the importance of somatotype, the MYOSPA study[25] describes that in axial SAs there is muscle dysfunction and increased body fat. However, when identifying the somatotype, we observed the opposite: more muscle and less adiposity. In AS there is dominance of meso-endomorph; endo-mesomorph and mesomorph endomorph, presenting muscle predominance over adiposity or of adiposity over muscle predominance, but with minimal trace of linearity. In the other subtypes, the sequence was as follows: in nonradiographic axial spondyloarthritis: meso-endomorph, endomorph mesomorph, in enthesopathic spondyloarthritis: meso-endomorph, in undifferentiated spondyloarthritis: meso-endomorph; in PSA or PA, meso-endomorph, endo-mesomorph, endomorph mesomorph, and mesomorph endomorph. Finally, in enteropathic or inflammatory bowel spondyloarthritis, there is a predominance of the endomorph mesomorph. The result of the subtype analyses confirms the muscle predominance over adiposity, followed by inversion and balance between muscularity and adiposity.

Reinforcing what was previously reported, in the sample, the mesomorph and endomorph components prevail confirming the balance, even if alternating, between adiposity and muscularity, with a small trait of ectomorph. At this point, some similarity is admitted to the dominant results of Calabro et al.[20] however, there is an alternation in the study under discussion. This similarity can be explained by the greater presence of the AS subtype and the alternation by the second largest presence of the PSA subtype.

Demographically, a profile similar to the studies by Skare et al.[26,27] and Galinaro et al.[28] was found: caucasian ethnicity, the age of onset of the disease between 40 and 60 years, and the male sex. This sex issue will be better discussed when describing the relationship between sex, somatotype, and therapeutic clinical profile. However, studies showed a more homogeneous prevalence between genders in AS;[29,30] nevertheless, female patients with Axial SpA without radiographic sacroiliitis, present distinct clinical manifestations due to different immune, hormonal, and genetic responses.

Additionally, female patients experience a longer delay in diagnosis than males. However, these studies did not consider the somatotype, different from this study, which, in addition to the similarity described, identified higher mean age in the endomorph mesomorph component, predominance of meso-endomorph in males and endomorph mesomorph in females, longer disease in endo-mesomorph, longer diagnosis time in mesomorph endomorph. These elements will be the basis of a further analysis involving the clinical, laboratory, and therapeutic profiles, which is expected to uncover these patients' clinical evolution and prognosis through the somatotype.

Body shape evaluation showed that thinness is a trait in both types of SA: axial hypertrophic and peripheral hypotrophic. In the subtypes, subjects with AS tend to be hypertrophic and thin, and with PSA, the subjects are hypotrophic and thin. The result confirms the somatotypic characterization of the sample, which showed more muscularity and less adiposity in the axial type than in the peripheral type, and both with some linearity. Here, the importance of determining the somatotype is evident. The study generated results that will certainly contribute to the rehabilitation of patients with spondyloarthritis. The prescription of strength training is essential in its management, particularly in PSA, which presents hypotrophy and thinness. Within this reasoning, it is possible to establish a line of research that identifies the best non-pharmacological approaches in spondyloarthritis not only based on the somatotype's identification but also on their correlation with biomechanical variables; personalized training protocols; disease activity; phenotypic predominace; comorbidities and individual tolerability.[31,32]

We must highlight that higher body mass indexes (BMI) are associated with greater disease activity in axial SpA, impacting on pharmacological and non-pharmacological therapeutic responses and certainly, also on the somatotype, which has not yet been studied.[33-35]

The articular phenotype is present in all types and subtypes, but it is more evident in the axial type; the cutaneous phenotype is more evident in the peripheral type and, both types aggregate three phenotypes, especially the axial group; the cutaneous phenotype is absent in AS, which combines two phenotypes, and present in PSA, which combines three phenotypes and with absence of an ocular phenotype.

The articular phenotype predominates in all somatotype components, and among the other phenotypes, the distribution was as follows: cutaneous phenotype: endo-mesomorph, meso-endomorph, and endomorph mesomorph; enthesopathic phenotype: meso-endomorph and mesomorph endomorph; intestinal phenotype: endomorph mesomorph and meso-endomorph, and ocular phenotype: meso-endomorph, endo-mesomorph and endomorph mesomorph. Meso-endomorphs and mesomorph endomorphs combine three phenotypes, while endo-mesomorphs and endomorph mesomorphs add two phenotypes. Keeping in mind that the somatotype is also a phenotype, there is a chance that it will complement the findings of Baeten et al.[33] who proposed that SAs is a single disease with heterogeneous phenotypes without identifying the precise phenotype, and Brophy et al.[36] who intended the synergistic interrelationship between articular, ocular, cutaneous, and intestinal phenotypes, in the clinical course of the disease.

In addition to the previously known axial and peripheral SA types, this study showed a heterogeneous spectrum in the distribution of somatotype and body composition related to phenotypes and may suggest a possibility of being close to a new concept of SA type.

D'Agostino et al.[37] and Constantine et al.[38] concluded that there were two clinical phenotypes for inflammatory low back pain, one with axial predominance and the other with peripheral predominance and, later, rewrote that there were three different groups of phenotypes, involving demographic, clinical, and laboratory variables, but without considering the somatotype. Thus, it is possible that later when analyzing the laboratory and therapeutic clinical profile of the sample, the findings are more relevant to the identified somatotype.

The result of this study points to directions for further research, either to confirm the most notable findings or more specialized designs, seeking a deeper understanding of the less emphasized or null. It is possible that the somatotype can help clarify biological individuality through retrospective analysis of the clinical, laboratory and therapeutic profile, as well as understand its possible variations influenced by social determinants of health.

The possible relationship between somatotype and changes in clinical evolution and therapeutic protocol; different responses to non-pharmacological interventions; biomechanical variables of the disease; metrics of the activity and remission of the disease, and the relationship of the disease with the individual and his/her socio-economic, cultural, environmental, family, and lifestyle profile can be further explored. These responses may influence the

rehabilitation and change in the patient's prognosis, besides allowing an analysis, which will ratify or not, a new type of SA based on phenotypic variations.

CONCLUSION

The somatotype meso-endomorph was the most common in SA, followed by endo-mesomorph in a non-atrophic sample with overweight, but hypertrophic and lean in ankylosing and hypotrophic spondylitis, and lean in PSA. Meso-endomorph predominate in males while endomorph mesomorph in females. Endo-mesomorph presents long-lived disease and mesomorph endomorph presents longer diagnosis time. Meso-endomorph and mesomorph endomorphs aggregate three phenotypes whereas endo-mesomorph and endomorph mesomorph aggregate two phenotypes, and balanced mesomorph one phenotypes. Future studies, including somatotype, spondyloarthritis, and their clinical and social profiles, may reveal a potential correlation with SA prognosis and offer crucial information for therapeutic decisions.

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