Flexibility Assessment: Normative Values for Flexitest from 5 to 91 Years of Age

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Summary

Background: Physical exercise plays a role in health-promotion policies and its prescription should be scientifically based. Flexibility is one of the major components of health-related and performance-related physical fitness, and is defined as the maximum physiological passive range of motion of a given joint movement. According to its specificity, the assessment of flexibility should, ideally, incorporate multiple movements. Introduced in 1980 and with redesigned evaluation maps published in 1986, Flexitest consists of the assessment of mobility with the use of a scale from 0 to 4. By adding the individual results of the 20 joint movements assessed, it is possible to obtain a global score called Flexindex.

Objective: To present Flexitest updated normative values.

Methods: Data were obtained from 4711 non-athlete subjects (2943 men and 1768 women) with age ranging from 5 to 91 years, and were collected by experienced raters. Approximately 70% of the data were collected by the author of the method himself.

Results: Considering the data heteroscedasticity and non-parametric distribution, we chose to use age and gender-percentile tables. Flexindex decreases with age and the median results for females are higher than for males of the same age since childhood. This trend becomes stronger with physical development and, later, with the aging process.

Conclusion: These normative data contribute to a better knowledge of the flexibility behavior with age and gender and will be useful for professionals who assess flexibility in their professional practice. (Arq Bras Cardiol 2008; 90(4): 257-263)

Key words: Flexibility; joints; motor activity; range of motion articular; exercise.

Introduction

There is a consensus among clinical cardiologists that physical exercise is one of the main tools to improve and maintain health[1]. Although cardiologists commonly encourage and recommend the practice of exercises, this activity is most often limited to predominantly aerobic exercises. As has been emphasized in recent institutional recommendations[2,3], a well-prescribed exercise plan should include flexibility exercises, in addition to the aerobic and muscle-strengthening activities. Flexibility, one of the main health-related and performance-related variables of physical fitness, is defined by Araújo[4] as the maximum physiological passive range of motion of a given joint movement. Body flexibility varies with age, gender and a regular pattern of physical exercises[5-12]. Flexibility is not uniform in the different joints and body movements, and it is common that, in a given individual, their maximal range of motion is good for certain movements and limited for others, thus representing what has been conventionally called specificity of flexibility[13]. Additionally, genetic characteristics seem to play an important role, especially in the cases of hyperlaxity[14,15].

Unlike other physical fitness-related variables such as maximal aerobic power and muscle strength, very high levels of flexibility do not always seem to be associated with a better physical performance or health condition[4]. Despite these considerations, exercises targeted at improving flexibility are usually included in any exercise plan, both for athletes and for individuals with a sedentary lifestyle and even for those with several diseases and particularly for individuals older than 65 years of age, according to recent institutional recommendations of the American Heart Association and of the American College of Sports Medicine[2,3], and they may result in improved quality of life[16]. On the other hand, there is a consensus that a well-prescribed and customized exercise plan should be based on data from a judicious, reliable and valid evaluation. This being considered, it seems appropriate, in this setting, to provide methods of flexibility measurement and the respective criteria for evaluation.

By the end of the 1970's, Pável and Araújo[17] started to develop a method for the measurement and evaluation of flexibility-Flexitest-, which is based on the comparative analysis between the mobility actually obtained and that recorded in standardized evaluation maps for 20 joint movements. The

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maps were later redesigned[18] and a series of studies were conducted[19-21], culminating in a doctoral thesis[22] in which a preliminary database with approximately 500 cases was presented. However, it was only in September 2003, with the publication of a specific book on Flexitest in the United States[4] and of its Portuguese[23] and Spanish[24] versions, both in 2005, that the first normative patterns for the evaluation of the measurements taken with Flexitest considering age and gender, and including slightly more than 3000 cases, were formally presented. Thus, the routine use of Flexitest for flexibility assessment in different situations became even more feasible. However, with the continued use of Flexitest in the past years, the database could be further improved, not only with a larger number of individuals but also with a broader age range considered.

In the past years, we have observed an increasing utilization of Flexitest in Brazil. For instance, the Air Force incorporated part of the method in the physical evaluation of their staff, which culminated in the proposition of specific normative values for this military force (REF). This also reflects in the scientific sphere, because in addition to Exercise Medicine[25], other fields of Medicine, such as Nephrology[26], Geriatrics[27], and Physical Medicine[28] have also published original articles in which Flexitest was used for the assessment of flexibility; this also occurs in the field of Physical Education[29].

Within this context, the objective of this article is to present an update on the normative data regarding Flexitest, originally published in 2003 for individuals between five and 91 years of age, and which had its assessment process improved with the use of the method.

Methods

Sample

Among all Flexitest data made available to the author, only the measurements taken by raters experienced in the technique, all of them trained directly by the author of the method, were considered to set the normative values. After careful selection, a total of 4711 non-athlete individuals, of whom 2943 were males and 1768 were females, with ages ranging from five to 91 years, were included to comprise the sample used to set up the database. In approximately 70% of the cases, Flexitest was administered by the study author himself. Although a specific ethnical evaluation had not been made, the great majority of individuals were primarily of Caucasian origin. Approximately 85% of the individuals of the sample were evaluated in the Exercise Medicine Clinic – CLINIMEX, Rio de Janeiro, RJ. As recommended in scientific practice, a written informed consent was obtained from all participants or their legal representatives, in the case of underage individuals, before Flexitest was administered.

Flexitest

Briefly, the method consists of measuring and evaluating the maximum passive range of motion of 20 body joint movements (36 if considered bilaterally), including the ankles, knees, hips, "trunk", wrists, elbows and shoulders. Eight movements are performed in the lower limbs, three in the trunk and the remaining nine in the upper limbs. The movements are numbered in a distal-proximal direction. Each one of the movements is measured in a growing discontinuous scale of whole numbers from zero to four, thus comprising a total of five possible values (see example in Figure 1). The measurement is taken with the movement being slowly performed until the point of maximum range of motion is reached; this measurement is further compared with the evaluation maps. In general, the point of maximum range of motion is easily detected because of the great mechanical resistance against the continuation of the movement and/or because of the local discomfort experienced by the individual being assessed. The usual time spent to take the 20 measurements is of approximately three minutes for a rater experienced in the method. A detailed description, evaluation maps and strategies for rater training are available in another reference[23].

Because of the nature of the scale and the way the evaluation maps were purposely designed, a Gaussian data distribution is observed, so that the central trend is two, the one and three values are less frequent, and the extreme values, that is, 0 and 4 are very uncommon. Thus, although the analysis of Flexitest can and should be performed for each movement and/or joint, it is valid to add the results obtained in the 20 individual movements to obtain a global index of flexibility or joint mobility called Flexindex[4]. Additionally, with

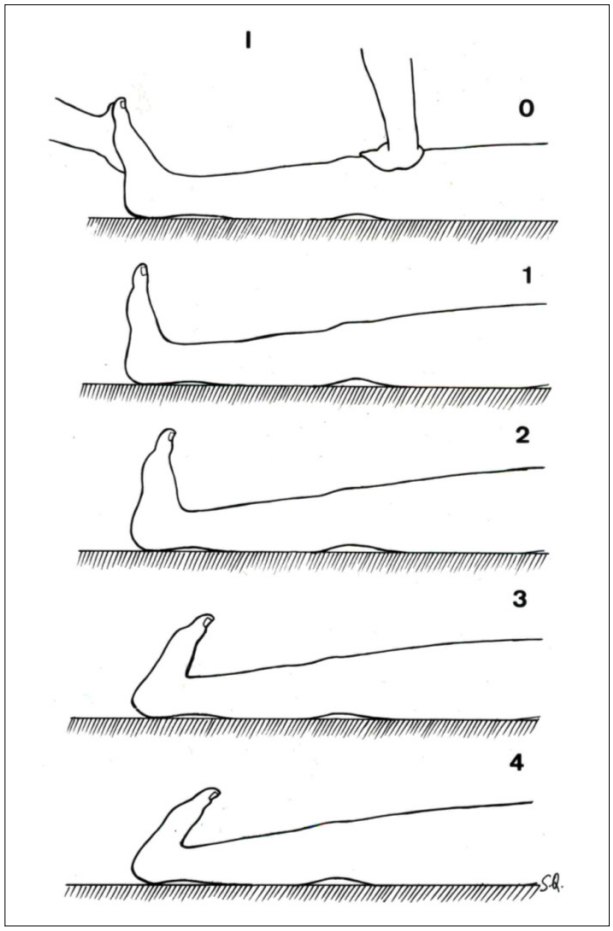

Figure 1 - Flexitest chart with figures representing the 0 to 4 scores for movement I - ankle dorsiflexion.

the Gaussian nature of the scale for each movement and of the global scale, it is possible to study the entire mobility spectrum, since the extreme values – 0 and 80 points – have never been obtained in practice. Accordingly, the so-called ceiling and/or floor effects, which significantly impair the clinical utilization of certain simpler tests, did not occur. Several studies on intra and interobserver reliability conducted with pictures of models or with real measurements in individuals showed systematically high intraclass correlation coefficients for Flexitest measurements and, in particular, for Flexindex[4,30-32].

Statistical Analysis

The individuals were initially stratified by gender – male and female – and then by age – in a total of 22 different ages or age ranges – for determination of the respective values and percentile curves of Flexindex. For inferential analyses, the t-test for dependent samples and the Pearson product-moment correlation were used. The statistical significance level was set at 5%.

Results

Flexindex values for 23 different percentiles for each one of the 22 age ranges or ages with respective sample sizes are shown in Tables 1 – males, and 2 – females. Median values tend to be systematically higher in women than in men, even at younger ages. For better visualization, a summary of these data is presented in Figures 2 and 3, illustrating the main percentiles for the male and female genders, respectively, thus permitting the identification of a similar and progressive, but not linear, reduction with age.

There is a direct relationship between age and the interquartile differences, ranging from 5 to 13 points in the male and female samples for Flexindex, going from a plateau at approximately 10% of the median value in childhood to approximately 40 to 50% in the higher age ranges. The correlation coefficients were 0.69 and 0.59 ($p < 0.001$) for the male and female genders, respectively (Figure 4).

Statistically, Flexindex results for men and women differ as of 10 years of age ($p < 0.05$). In practical terms, women tend to be more flexible than men as of five years of age – approximately 5%; this difference is intensified after puberty – 10 to 15% - and even more in the third decade of life – 20%. After 60 years of age, the differences tend to be even greater in women, reaching between 20 and 40% more than the value obtained for Flexindex in men, even though this corresponds

Table 1 - Flexindex percentiles for males – 5 to 91 years of age (n = 2943)

	N	1	3	5	10	15	17	25	30	35	40	45	50	55	60	65	70	75	83	85	90	95	97	99
Age		0.01	0.03	0.05	0.1	0.15	0.17	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.83	0.85	0.9	0.95	0.97	0.99
MALE	2943																							
5	30	52.3	52.9	53.0	53.9	56.0	56.0	57.0	57.0	58.0	58.6	59.0	60.0	61.0	61.0	61.0	62.0	62.8	63.1	63.7	64.2	66.6	67.0	67.0
6	48	51.5	52.0	52.4	53.0	54.0	54.0	56.0	56.1	57.0	57.0	58.0	58.5	59.0	59.2	60.0	60.0	61.5	64.0	65.0	66.6	68.7	69.0	70.1
7	66	48.4	49.6	51.2	52.0	53.0	54.0	56.0	56.0	57.0	57.0	57.0	58.0	59.0	59.8	60.0	61.0	62.0	64.0	64.0	65.0	66.9	67.7	69.0
8	81	38.6	44.2	48.0	49.0	50.0	51.6	53.0	53.0	54.0	55.0	56.0	56.0	57.0	57.0	58.0	59.0	59.0	61.4	62.0	63.0	63.0	64.6	65.4
9	66	40.8	45.4	47.0	48.0	49.9	50.0	52.0	53.0	53.0	54.0	54.0	55.0	56.0	57.0	57.0	58.2	59.0	60.0	61.0	62.0	63.0	63.6	66.1
10-11	114	39.1	41.2	43.7	45.0	45.0	45.2	47.0	47.0	48.0	49.0	50.0	50.0	51.0	52.0	53.0	53.0	54.0	57.0	58.0	58.7	61.0	64.1	68.9
12-13	85	35.0	37.0	37.2	40.0	41.0	41.3	45.0	46.2	47.4	48.0	48.0	49.0	50.0	50.0	51.0	52.8	53.0	54.0	54.0	55.0	57.0	60.9	66.5
.14-15	88	34.7	35.0	36.0	37.7	39.0	39.0	40.0	41.1	42.5	43.0	44.2	45.0	45.0	46.0	47.0	47.0	48.3	51.0	51.0	52.3	55.7	58.4	63.0
.16-20	140	32.6	35.2	36.0	37.9	38.9	39.0	41.0	41.0	42.0	43.0	43.6	44.0	45.0	46.0	46.0	48.0	48.0	51.0	53.0	53.1	55.1	56.8	63.3
.21-25	107	30.0	30.0	31.0	34.0	36.0	36.0	39.0	40.0	42.0	42.0	42.7	44.0	44.0	45.0	46.0	47.0	48.0	49.0	50.1	52.0	56.0	57.6	58.9
.26-30	98	22.9	24.9	29.4	34.7	36.6	37.5	40.3	41.0	42.0	42.0	43.0	44.0	44.0	45.4	47.1	48.0	49.8	51.0	52.0	56.0	60.2	62.0	62.2
.31-35	159	23.6	27.0	28.0	32.8	34.0	35.0	37.5	39.0	40.0	41.0	42.0	43.0	44.0	45.8	46.0	47.0	48.5	50.0	51.0	52.2	55.0	56.3	60.9
.36-40	194	19.8	24.0	28.0	30.0	31.0	32.0	34.0	35.0	36.0	38.0	39.0	40.5	41.2	43.0	43.0	44.0	46.0	48.0	48.0	51.0	55.0	56.2	61.1
.41-45	219	22.2	25.0	25.9	28.8	30.0	30.0	32.5	34.0	35.0	36.0	36.1	37.0	38.0	39.0	41.0	42.0	43.0	44.0	45.0	47.2	50.0	53.9	58.6
.46-50	233	17.0	21.9	24.0	27.0	28.0	29.0	31.0	32.0	33.0	34.0	35.0	36.0	37.0	38.2	39.8	41.0	42.0	43.6	44.0	45.8	48.0	49.0	51.0
.51-55	271	15.7	19.0	20.0	23.0	25.0	25.9	28.0	30.0	31.0	32.0	34.0	35.0	36.0	37.0	38.0	39.0	40.0	42.0	43.0	44.0	46.0	47.0	49.0
.56-60	269	10.4	15.0	18.4	22.0	24.0	25.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0	36.0	37.0	39.4	40.8	44.0	46.0	48.0	50.3
.61-65	212	11.1	14.0	15.0	18.0	20.0	20.0	23.0	24.3	26.0	27.0	28.0	29.0	30.0	32.0	33.0	34.0	35.0	38.0	38.0	39.0	41.0	42.0	47.9
.66-70	175	9.7	11.4	13.0	15.4	17.0	17.6	20.0	22.0	23.0	25.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0	33.0	33.9	36.0	41.3	43.0	45.5
.71-75	147	8.5	10.8	12.0	14.0	15.0	16.0	18.0	18.8	19.1	21.0	23.0	24.0	25.0	27.0	27.0	28.0	29.5	32.0	33.0	34.0	37.0	40.2	51.7
.76-80	84	8.0	10.5	11.2	13.3	15.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	21.0	22.0	23.0	24.1	27.0	28.0	28.6	30.0	35.9	39.0	44.0
.81-91	57	6.6	7.0	7.8	10.6	12.0	12.0	14.0	15.0	15.6	16.0	17.0	18.0	19.0	20.0	21.0	22.0	22.0	24.9	27.0	27.4	30.2	32.3	35.9

Table 2 - **Flexindex percentiles for females – 5 to 91 years of age (n = 1768)**

	N	1	3	5	10	15	17	25	30	35	40	45	50	55	60	65	70	75	83	85	90	95	97	99
Age		0.01	0.03	0.05	0.1	0.15	0.17	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.83	0.85	0.9	0.95	0.97	0.99
Female	1768																							
5	33	55.3	56.0	56.6	58.0	58.0	58.4	60.0	60.0	61.2	62.0	63.0	63.0	64.0	64.2	65.0	66.4	67.0	67.6	68.0	68.8	71.0	71.2	73.7
6	40	53.0	53.2	54.0	56.9	57.0	57.6	59.0	59.0	60.0	60.0	60.0	61.0	61.0	61.0	62.0	63.0	64.3	65.4	66.3	70.0	70.2	72.5	73.6
7	70	47.8	51.3	53.0	54.2	57.0	57.0	59.0	59.0	60.0	60.0	61.0	61.0	62.0	63.0	64.0	64.4	65.5	68.0	68.0	69.0	71.9	73.0	75.0
8	71	45.0	46.2	48.5	51.0	54.0	54.0	56.0	57.0	57.0	58.0	59.0	59.0	60.0	60.0	60.5	61.0	62.0	63.0	63.5	66.0	66.5	67.9	69.3
9	61	43.6	44.8	45.0	46.0	49.0	50.2	51.0	53.0	54.0	55.0	55.0	56.0	57.0	58.0	59.0	59.0	60.0	62.0	62.0	63.0	65.0	66.6	69.4
.10-11	88	39.7	42.0	43.4	46.0	47.0	47.8	48.0	49.0	50.0	50.8	52.0	52.5	53.0	54.0	54.0	57.0	58.0	60.2	61.0	62.6	64.7	66.0	70.1
12-13	81	42.6	45.8	47.0	48.0	49.0	50.0	51.0	51.0	52.0	52.0	52.0	54.0	54.0	55.0	55.0	56.0	56.0	58.4	60.0	64.0	66.0	66.6	70.4
.14-15	68	34.4	41.0	43.0	44.0	46.0	46.0	46.8	47.0	48.0	48.8	49.0	50.5	51.0	53.0	54.0	54.0	55.3	58.6	59.0	61.0	65.3	68.0	70.0
.16-20	113	37.0	39.4	40.6	43.0	44.0	44.0	46.0	47.0	48.0	49.0	50.0	51.0	52.0	52.2	53.0	53.0	54.0	56.0	56.0	57.8	59.0	60.3	64.6
.21-25	96	35.7	38.7	41.8	43.5	45.0	45.2	47.0	48.0	49.0	50.0	51.0	51.5	52.3	53.0	54.0	55.0	56.0	57.0	57.0	59.0	61.3	64.2	66.0
.26-30	71	41.7	42.0	42.5	45.0	47.0	47.9	49.0	50.0	51.0	53.0	53.0	54.0	55.5	56.0	58.0	59.0	60.0	63.1	64.0	65.0	67.0	67.0	68.3
.31-35	84	34.7	35.5	36.2	39.3	40.5	41.1	44.0	45.0	47.0	48.2	49.0	50.5	52.0	53.8	54.0	55.0	57.0	59.9	60.6	62.7	64.0	65.5	69.2
.36-40	115	34.1	36.4	38.0	40.8	43.0	43.0	45.5	46.0	47.0	48.0	49.0	49.0	50.0	51.0	52.0	54.0	56.0	58.6	59.0	60.0	62.0	63.6	66.9
.41-45	106	23.3	29.2	31.0	35.0	37.0	38.0	40.0	42.5	44.0	46.0	47.0	48.0	49.0	50.0	51.3	52.0	53.0	55.0	56.0	58.0	59.8	61.0	63.0
.46-50	120	20.2	27.7	31.0	34.0	36.0	37.0	39.0	41.0	43.0	44.0	45.0	46.0	47.0	48.0	48.4	50.0	51.0	51.0	52.2	54.1	60.0	60.9	62.8
.51-55	134	19.3	22.0	24.7	30.0	32.0	33.0	35.0	37.9	39.0	40.0	41.9	43.0	43.0	45.0	45.0	47.0	47.8	50.4	51.0	52.0	54.7	57.0	62.3
.56-60	107	25.1	27.2	28.7	31.0	32.0	32.0	34.8	36.1	38.5	39.8	41.0	41.0	42.0	44.0	45.0	46.0	47.0	49.0	49.0	52.0	55.7	56.0	58.9
.61-65	86	19.9	25.1	26.3	28.5	29.8	30.5	34.0	35.0	36.0	37.0	40.0	41.0	41.8	44.0	45.0	45.5	46.8	48.0	49.0	51.0	52.0	54.0	59.2
.66-70	76	15.8	17.5	19.8	27.5	30.0	30.0	31.8	32.0	34.0	35.0	36.0	37.0	38.0	39.0	40.0	41.5	43.0	44.0	44.8	45.5	47.3	48.8	54.8
.71-75	62	15.1	17.8	19.0	20.2	24.0	24.0	26.3	27.0	28.0	30.0	30.0	31.5	32.6	33.0	33.0	35.7	37.0	39.6	40.9	42.9	44.9	45.3	47.8
.76-80	59	11.0	13.5	16.0	17.0	18.0	20.0	21.0	22.0	22.4	23.0	24.0	25.0	27.0	28.0	30.0	31.0	32.0	34.0	36.4	38.0	40.8	45.4	49.2
.81-90	27	11.8	13.3	14.6	16.6	17.0	17.4	19.5	20.0	20.1	21.4	22.0	23.0	23.3	24.6	25.0	26.0	27.0	31.6	32.0	32.0	32.7	34.1	36.7

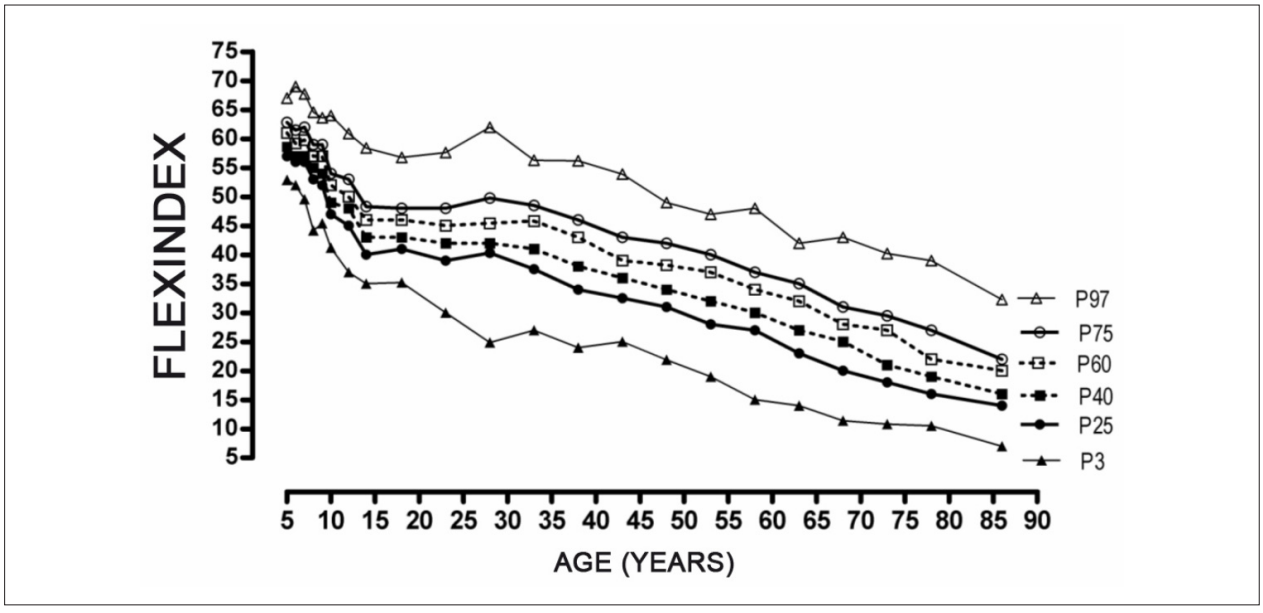

Figure 2 - Percentile curves for Flexindex in 2943 male individuals between 5 and 91 years of age.

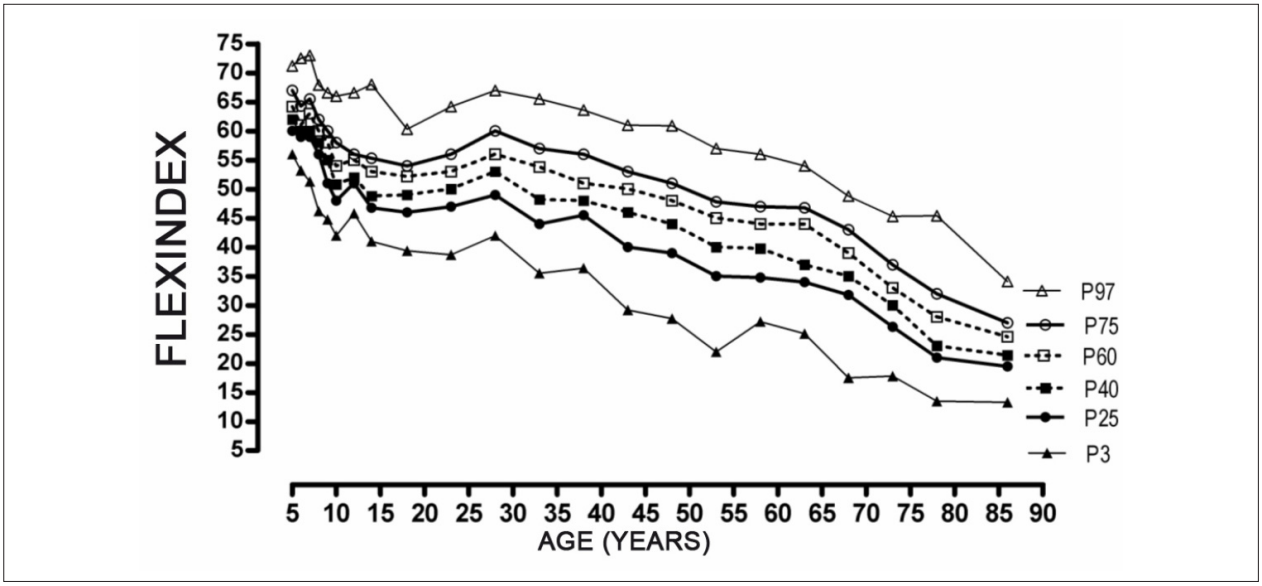

Figure 3 - Percentile curves for Flexindex in 1768 female individuals between 5 and 91 years of age.

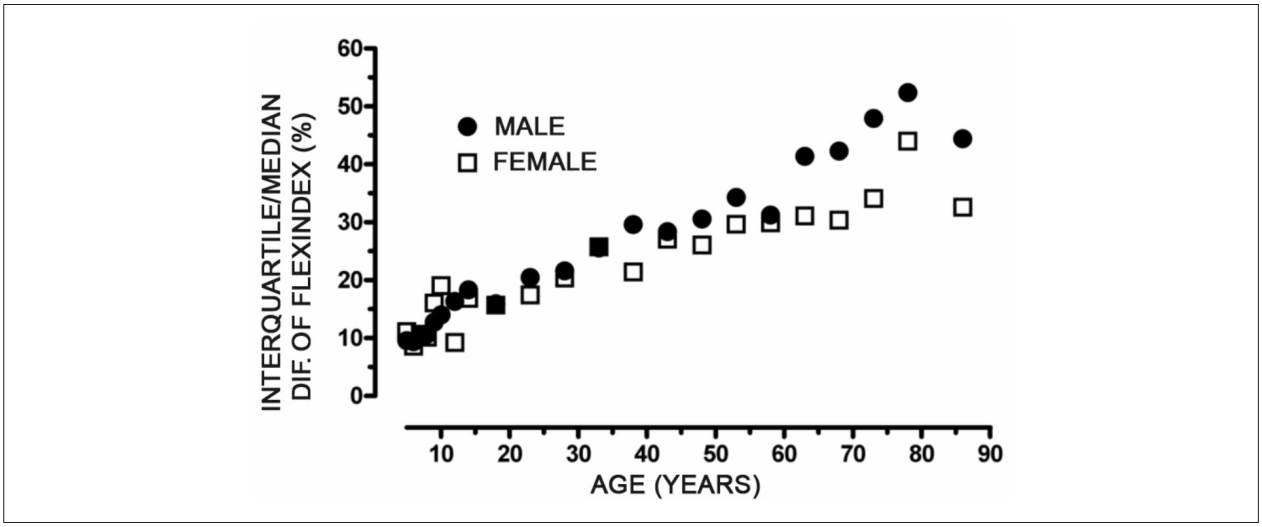

Figure 4 - Relationship between the interquartile/median differences of the Flexindex results and age for men and women.

to only 4 to 10 points in the absolute result of the sum of mobility scores measured for each of the 20 movements.

Discussion

Created and developed more than 25 years ago, Flexitest has been largely used in Brazil for the assessment of flexibility. Initially, by means of several university extensions and of the inclusion of the topic in several lists of disciplines of graduation and post graduation in Physical Education throughout the country, Flexitest became more widely known and used. Later, with the publication of several scientific studies and several postgraduate dissertation and theses defenses using Flexitest, the method became increasingly more widely known. Nonetheless, it was mainly with the publication of the Flexitest book by Human Kinetics and with its subsequent Portuguese and Spanish versions that the number of professionals knowing and using the method in several countries worldwide significantly increased. The original book is available in more than 160 university libraries of English-speaking countries, and both the English and Spanish versions are available in the National Library of Medicine in Bethesda.

As thoroughly discussed in another publication[4], when compared with other methods available for the assessment of flexibility, such as the sit-and-reach test[33], Leighton flexometer[11], goniometry[34] and the Beighton-Hóran assessment[5] – all of them proposed within the 1950's and 1970's, Flexitest offers innumerous advantages (see Box 1). We can point out: a) the possibility of a specific and individual analysis for 20 joint movements, b) the possibility of obtaining a global

Box 1 - Comparison between the Main Flexibility Assessment Methods

Item	Criterion	Flexitest	Leighton	Goniometry	Beighton-Hóran	Sit-and-Reach
1	Mode of performance	Passive	Active	Active	Active	Active
2	No. of movements	20	Up to 30	> 30	9	1
3	No. of joints per test item	Single	Single	Single	Single	Multiple
4	No. of movements per test items	Single	Compound	Single/ Compound	Single	Compound
5	Total no. of joint movements	Large	Large	Large	Large	Small
6	Possibility of global score	Yes	No	No	Yes	No
7	Measurement unit	Points	Degrees	Degrees	Points	Centimeters
8	Equipment required	None	Flexometer	Goniometer	None	Bench
9	Reliability	High	High	High	Intermediate	High
10	Clinical and sports applicability	Very high	Very high	Very high	Low	Intermediate
11	Ease to perform	Great	Intermediate	Little	Great	Great
12	Characteristics of results distribution	Parametric	Parametric	Parametric	Non-parametric	Parametric

score – Flexindex, c) the analysis of variability components, d) absence of a ceiling and floor effect (in practice, no minimum and maximum limits were ever found), and e) availability of a large normative database (Tables 1 and 2).

In order to prepare these normative data, we purposely chose to exclude all individuals engaged in regular competitive sports activity regardless of modality, since athletes tend to present distinct flexibility levels as compared to those of the general population. Normative values can be expressed in different manners. In the setting of laboratory tests, the tendency is to present a range of reference values considered statistically normal, probably obtained from the determination of mean values plus or minus two standard deviations in an enough large sample of healthy individuals. Depending on the nature of the variable, genders are occasionally discriminated and, less frequently, age groups, such as children, premenopausal and postmenopausal women. However, this strategy has several limitations. First, it assumes that the variables have a Gaussian distribution (which hardly ever occurs with the majority of the variables, such as hematocrit, blood glucose, etc); and, second, it does not allow a reliable detection of the impact of subtle changes that may occur within a given normal range.

Another quite common form of representing the relationship of a determined variable with age is to express it in simple (linear, exponential, polynomial, etc), multiple (ideally stepwise), or logistic regression models. Almost all these models assume that data distribution presents homoscedasticity and generates some estimate error value at the end. By analyzing the association between the 22 interquartile (P_{75}-P_{25}) variability measurements and respective ages (mean values for the age ranges), we obtained significant correlation coefficients for both genders, which clearly indicates that flexibility variability increases with age despite the absolute Flexindex reduction, thus going against the basic premise for the use of regression models. Actually, when there is reason to suspect heteroscedasticity or a non-parametric data distribution and, on the other hand, when the sample size is large enough, the most suitable analysis alternative is likely the definition of percentile curves to establish normative values. This usually occurs with growth and development charts for height and body weight. Taking these issues into consideration, this was precisely the choice we made to analyze Flexindex.

Data regarding normative values of Flexindex presented in this article significantly contribute to a more detailed interpretation of results obtained in the flexibility assessment performed with Flexitest. In comparison with the data made available in 2003, data from the present study represent an increase by approximately 50% in the sample size, with wider and more subdivided age ranges. Additionally, the great majority of the sample distortions could be corrected, thus enabling all age ranges of both genders to include at least 30 cases, except for the female 81+ group (with 27 cases). Determination of the different percentiles was thus made easier.

An interesting aspect is that there is a greater tendency of variation of Flexindex values over the years, so that the interquartile differences tend to increase both in males and females. Like for other variables of the human performance, this is probably due to the progressively greater differences in relation to the regular physical activity pattern of individuals when they reach adulthood and in subsequent years. Further longitudinal studies should contribute to explain whether the loss of flexibility over the years bears any relation to the degree of global flexibility observed in childhood.

In terms of direct cardiologic application, Flexitest was more recently used in the assessment of adult women with mitral prolapse[14], and approximately 15% higher values of Flexindex were observed when compared to adult women not diagnosed with mitral prolapse, with 77% of them exceeding the levels expected for the 75th percentiles of the respective ages. Additionally, none of the 31 adult women with mitral prolapse scored 0 or 1 for elbow extension and for lateral shoulder rotation, thus establishing objective criteria for differentiation.

Finally, we conclude that this new strategy of age range subdivision, year by year for younger children and at five-year intervals for adults up to the third age, will allow a better assessment of the differences inherent to the growth and

development and aging processes as regards flexibility, as well as the chronic effects of physical training or detraining. Additionally, it will represent a useful tool for professionals adopting the recommendation for the inclusion of flexibility exercises in the broader scope of exercise prescription.

Potential Conflict of Interest

Copyright is received on the sale of books published in Brazil (Editora Manole), in the United States (Human Kinetics) and Spain (Paidotribo), as well as on commercial softwares developed in Brazil (Micromed) which include or deal with Flexitest.

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Study Association

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