IMMUNOLOGICAL AND VIROLOGICAL CHARACTERISTICS AND PERFORMANCE IN THE VARIABLES FLEXIBILITY AND ABDOMINAL RESISTENCE STRENGTH OF HIV/AIDS ADOLESCENTS UNDER HIGHLY ACTIVE ANTIRRETROVIRAL THERAPY

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ABSTRACT

Introduction: In the context of chronicity of AIDS, few studies have evaluated variables of physical fitness in children and adolescents; however, with adults the importance of adherence to HAART associated with physical exercise to improve these variables has been reported. Objective: To identify the immunological and virological characteristics and flexibility (FLEX) and abdominal resistance strength (ARS) variables of children and HIV / AIDS adolescents using HAART. Methods: This cross-sectional study took place at the HIV/AIDS Pediatric Clinic of the University Hospital ("Hospital de Clínicas") in the city of Porto Alegre. The sample was obtained consecutively by 63 patients (10 children and 53 adolescents) of both sexes, between ages 07 and 17 years. Data analysis was performed with SPSS, version 18.0 (p ≤ 0.05). To compare the means, paired Student's t test was used. Results: The mean diagnosis time of HIV and HAART was, respectively, 11 ± 3.42 years and 40 ± 32.78 months. The prevalent form of transmission was vertical transmission (98.42%). The undetectable viral load was identified in 73.1%. The count of CD4 + and CD8 + T cells as well as their relationship, presented averages of 932.25 ± 445.53 cells/ml, 1018 ± 671.23 cells/ml and 0.90 ± 0.41, respectively. Concerning the variables FLEX and ARS, regardless of sex, there was a higher proportion of children and adolescents classified below the cutoff points. Significant difference was observed between AE and their respective cutoff points in the HIV diagnosis (p = 0.032); CD4 + (p = 0.008) and viral load (p = 0.030). There were significant differences between FLEX and its respective cutoffs in variables CD4 + / CD8 + (p = 0.022) and in the viral load (p= 0.040). Conclusion: The results demonstrate that immunological and virological characteristics are stable; however, undesirable levels of fitness are observed in FLEX and ARS variables.

Keywords: HIV/AIDS, physical fitness, children, adolescents.

INTRODUCTION

The acquired immunodeficiency syndrome (SIDA, AIDS) is the advanced clinical manifestation derived from an immunodeficiency scenario caused by the human immunodeficiency virus (VIH, HIV)[1]. The disease is characterized by the continued suppression of the cells of the immune system infected by the HIV, which will make the body prone to the infections known as opportunistic such as tuberculosis, toxoplasmosis and pneumonia (by *pneumocystis jirovecii*)[2].

In Brazil, the cases of vertical transmission have proportionally increased to the incidence of AIDS, and from 2000 to June, 2011, 61,789 new cases in pregnant women were reported[3]. In children and adolescents younger than 13 years, vertical transmission appears as the predominant exposure category, with percentage above 85% from 2006[4].

The Highly Active Antirretroviral Therapy (HAART), from the introduction of the protease inhibitors (PI) in 1996, have provided the sustained suppression of viral load and, consequently, the immunological reconstitution, decreasing the incidence of opportunistic infections and increasing life expectancy of patients, characterizing hence AIDS as a chronic disease[5].

In that chronicity context, few studies have evaluated variables of physical fitness in children and adolescents; however, the research with adults has recorded the importance of engagement in physical exercises aassociated with HAART in order to improve physical fitness and consequently, functional independence[6-8]. From these premises, the need for parameters for the variables which compose physical fitness related to health of children and adolescents with HIV/AIDS becomes evident, and, provides hence qualification in prescription and monitoring of physical training. Thus, a study was designed with the aim to identify the immunological and virological characteristics as well as flexibility (FLEX) and abdominal resistance strength (ARS) variables of children and adolescents with HIV/AIDS undergoing ART.

METHOD

It is a cross-sectional study held in the HIV/AIDS Unit in Pediatrics of the Clinics Hospital of Porto Alegre - Brazil. The sample was

consecutively obtained by 63 children and adolescents with HIV/AIDS undergoing ART, of both sexes, aged between seven and 17 years and clinically, qualified for practice of physical exercises. The patients who were practicing regular physical exercises in the three months previous to the study were not included in it. The project was approved by the Ethics in Research Committee of the Clinics Hospital of Porto Alegre (CEP/HCPA). Data from the medical record of the patients concerning their clinical profile were collected (sex, age, transmission manner, HIV diagnosis period and current time of HAAR Tuse), immunological parameters (T CD4+ – auxiliary lymphocytes, T CD8+ – cytotoxic lymphocytes and T CD4+/T CD8+ ratio) and virological parameters (viral load and log- scientific note which uses the 10 potency to describe number alterations in the viral load). The current HAART time was considered, the most recent therapeutic scheme prescribed by the doctor responsible for the patient.

The T lymphocytes are cells responsible for the cellular immunity of the individuals and are classified in three large groups T CD4+, T CD8+ the *natural killer* lymphocytes, natural killers (NK). The T CD4+ or auxiliary lymphocytes (also known as *helper*) are the first lymphocytes to enter in contact with the HIV for expressing on their surface a phenotype marker named CD4, which presents high affinity with the virus. The T CD8+ are cytotoxic lymphocytes which act in the immunological surveillance, being responsible for the release of cells infected by the HIV. The NK lymphocytes are associated with the surveillance skill in certain tumors and viral infections; however, they did not participate in the HIV replication process[9].

The FLEX variable was evaluated through the "sit and reach" test and the ARS through the abdominal test in one minute, whose reference protocols compose the Test Battery of the Brazil Sports Project (PROESP-BR)[10].

FLEX is defined as the maximum skill to move an articulation in a range of motion, while ARS is the ability of a muscular group to perform repeated contractions for a period of time sufficient to cause muscle fatigue or keep specific percentage of an isometric voluntary contraction for a prolonged period of time through tension[11].

The tests and reference values of the PROESP-BR are valid, reliable, of low cost and easy application, accessible to physical education teachers in order to establish the follow-up of children and adolescents aged between seven and 17 years. Among its aims, we can mention the performance of interventions in the promotion of health markers field through the proposition of a measurement system which enable the evaluation of the health indicators associated with sex, chronological age concerning body growth, nutritional status and physical fitness (figure 1).

Regarding FLEX, the values above the cutoff points are considered with expected levels of physical fitness related to health, while for ARS, the values equal and above the cutoff points suggest expected levels for this aptitude[10].

Data analysis was performed in the statistical *software Package for the Social Sciences* (SPSS), version 18.0, (p ≤ 0.05). The descriptive variables were analyzed through measures of central tendency (mean) and dispersion (standard deviation) and the categories were described by the frequency. The means were compared using the paired *Student's t test*.

Figure 1. Defines the cut-off points used for the FLEX and ARS variables according to sex and age of the children and adolescents[10].

Age	FLEX* (cm)		ARS (number of flexions)	
	Male	Female	Male	Female
7	29.3	21.4	20	20
8	29.3	21.4	20	20
9	29.3	21.4	22	20
10	29.4	23.5	22	20
11	27.8	23.5	25	20
12	24.7	23.5	30	20
13	23.1	23.5	35	23
14	22.9	24.3	35	23
15	24.3	24.3	35	23
16	25.7	24.3	40	23
17	25.7	24.3	45	23

*Without Wells bench.
Source: Brazil Sport Project Manual (2009)[10].

RESULTS

The general characteristics of the participants are presented in table 1. Considering the 63 patients, 10 were children (seven to nine years old) and 53 were adolescents (ten to 17 years old), with 58.7% of the individuals being female. The mean HIV diagnosis time was of 11 ± 3.42 years, and the mean current time of HAART use was of 40 ± 32.78 months. The most prevalent transmission manner was vertical transmission (98.42%). Undetectable viral load (< 50 copies/ml) was identified in 73.1%, and the logarithm mean was of 0.90 ± 1.53. The T CD4+ and T CD8+ count, as well as their ratio, presented, respectively mean of 932.25 ± 445.53 cells/ml, 1,018 ± 671.23 cells/ml and 0.90 ± 0.41.

Table 1. Clinical characteristics of the participants in the study.

Variables	Total (n = 63)
Age (years) n (%)	
7 to 9	10 (15.9)
10 to 17	53 (84.1)
Sex	
Male	26 (41.3)
Female	37 (58.7)
Diagnosis period (years)	11 ± 3.42
Time of ART use (months)	40 ± 32.78
Transmission manner n (%)	
Vertical transmission	62 (98.52)
Others	1 (1.58)
Viral load	
< 50 copies/ml	46 (73.1)
≥ 50 copies/ml	17 (26.9)
Log	0.90 ± 1.53
T CD4+*	932.25 ± 445.53
T CD8+*	1018 ± 671.23
Relação T CD4+/ T CD8+	0.90 ± 0.41

cART = combined antiretroviral therapy; *values expressed in cells/ml.

Table 2. Results of the FLEX and ARS of the participants in the study.

Variables	Male	n (%)	Female	n (%)
FLEX	Below c.o.p.	15 (57.69%)	Below c.o.p.	19 (51.35%)
	Above c.o.p.Acima p.c	11 (42.31%)	Above c.o.p.	18 (48.65%)
ARS	Below c.o.p.	21 (80.76%)	Below c.o.p.	27 (72.97%)
	Above c.o.p.	5 (19.24%)	Above c.o.p.	10 (27.03%)

FLEX = flexibility; ARS = abdominal resistance strength; c.o.p.= cutoff point; FLEX: from seven to nine years male = 29.3cm; tem years male = 29.4cm; 11 years male = 27.8cm; 12 years male = 24.7cm; 13 years male = 23.1cm; 14 years male = 22.9cm; 15 years male = 24.3cm; 16 and 17 years male = 25.7cm; seven to nine years female = 21.4cm; tem to 13 years female = 23.5cm; 14 to 17 years female = 24.3cm. Cutoff point ARS: seven to eight years male = 20 flexions; nine to tem years male = 22 flexions; 11 years male = 25 flexions; 12 years male = 30 flexions; 13 to 15 years male= 35 flexions; 16 years male = 40 flexions; 17 years male = 45 flexions; seven to 12 years female = 20 flexions; 13 to 17 years female = 23 flexions.
Source: Brazil Sport Project Manual (2009)[20].

The FLEX and ARS variables are described in table 2. Higher proportion of children and adolescents classified below the cutoff point was observed, regardless of sex.

Significant difference was observed between ARS and its respective cutoff points in the period of HIV diagnosis (p = 0.032), T CD4+ (p = 0.008) and viral load (p = 0.030). Children and adolescents with ARS above the cutoff point presented higher T CD4+ than those below the cutoff point. Significant difference was observed between FLEX and its respective cutoff points in the T CD4+/T CD8+ (p = 0.022) and viral load (p = 0.040) variables. Children and adolescents with FLEX above the cutoff point presented higher T CD4+/T CD8+ ratio than those below this point (table 3).

DISCUSSION

The results of this study demonstrated that there is stability in the immunological and virological characteristics of the participants; however, they presented undesirable levels of physical fitness in the FLEX and ARS variables.

The participants presented mean of 11 years of HIV infection diagnosis and of three years and four months of HAART use. Undetectable viral load was evidenced (< 50 copies/ml) in 73.1% of the participants and T CD4+ count > 500 cells/ml in all of them. T CD4+ count > 500 cells/ml classifies them in the "absent immunological category" concerning the HIV infection[12] and demonstrates positive activity of HAART in its clinical stability, since the natural history of the infection is immunosuppression.

The SRT contribution to the stability of virological and immunological parameters is crucial to hold the progression of morbidity in children and adolescents vertically infected. This premise may be corroborated by other studies, as by Mc Con-

nell et al.[13] and Judd et al.[14], in which the use of HAART caused decline (81-93%) in mortality in children and adolescents in the USA and UK between 1994 and 2006. In Brazil, Romanelli et al.[15] cite the triple scheme as the most recommended treatment due to its lower viral replication. Matida et al.[16] consider the HAART use as the predictor which significantly influences on the survival increase of children exposed to the HIV by vertical transmission (p < 0.001). According to Miller[17], the suppressed viral replication consequent of the HAART engagement characterizes AIDS as a chronic and controllable disease with low mortality rate when compared with other pathologies.

The HIV transmission manner in 98.5% of the participants was vertical, a result which agrees with the Brazilian epidemiological data in which 85.8% (13,540) of the cases of AIDS in individuals younger than 13 years old occur by this transmission manner[3]. Another relevant result is that 58.7% of the patients were female. The sex ratio in Brazil is 1.7 men for each case in women[3]; however, the percentage of this study in the female sex is worrisome, since many of these children and adolescents will reach adulthood, that is to say, sexual and reproductive life; therefore, they will be able to increase the cases of HIV infection if prophylactic strategies to the HIV infection are not implemented.

The FLEX and ARS variables were able to evidence that HIV/AIDS children and adolescents do not present desirable levels of physical fitness, corroborating hence the study by Somarriba et al.[18], which identified that children and adolescents with HIV/AIDS (± 16.1 years) presented lower measurements of physical fitness when compared with the non-infected ones in the FLEX (23.71% vs. 46.09%, p = 0.0003), VO$_2$ peak (25.92 vs. 30.90 ml/kg/min, p < 0.0001) and strength/weight ratio of lower extremities (0.79 vs. 1.10 kg lifted/kg of body weight, p = 0.002) variables. Thus, the physical compromising caused by the HIV aassociated with the HAART may cause negative alterations in strength, muscular mass and physical endurance[19,20].

The prospective investigation performed by Mikkelsson et al.[21] mentions that low physical fitness in childhood and adolescence negatively reflects in adulthood. The physical fitness components are influenced by sex, maturational status and health conditions of the individuals[22].

Fortunately, the FLEX and ARS variables may be modified with interventions, as demonstrated by Miller et al.[23], where after 24 physical exercise sessions aimed at HIV/AIDS children, the most

Table 3. Comparison of the clinical characteristics with the FLEX and ARS variables

Clinical variables	FLEX Below cutoff point	Above cutoff point	p	ARS Below cutoff point	Above cutoff point	p
Diagnosis period (years)	12.0 ± 3.2	10.7 ± 3.6	0.138	11.9 ± 3.5	9.8 ± 2.6	0.032
Time of ART use (months)	42.85 ± 37.85	38.76 ± 26.10	0.989	42.02 ± 35.93	37.60 ± 20.23	0.949
T CD4+	912 ± 445.69	955 ± 452.05	0.659	858.92 ± 430.12	1166.93 ± 424.87	0.008
T CD8+	1.294 ± 766.57	1.073 ± 527.04	0.190	1.200.37 ± 738.57	1.168.60 ± 404.01	0.651
T CD4+/T CD8+	0.78 ± 0.33	1.04 ± 0.46	0.022	0.84 ± 0.40	1.07 ± 0.42	0.086
Viral load (log)	1.27 ± 1.75	0.47 ± 1.11	0.040	1.14 ± 1.66	0.15 ± 0.60	0.030

FLEX = flexibility; ARS = abdominal resistance strength; Paired *Student's t test*.

remarkable alterations were verified in endurance *(p* = 0.006), flexibility *(p* = 0.001) and cardiorespiratory fitness (VO$_2$ peak – *p* = 0.001). The authors also mention that interventions with physical exercises in HIV/AIDS children are efficient for lower cardiovascular risk. Continuous administration of HAART is characterized as a risk factor for development of cardiovascular diseases[24], which can appear in childhood or adolescence, justifying hence the practice of guided physical exercises for prevention or attenuation of the adverse effects of the medication (especially the protease inhibitors), for maintenance of clinical stability and development of physical fitness related to health.

The use of the cutoff points for FLEX and ARS of this study are sued in the clinical practice for non-infected children and adolescents, and this limitation may be important, since HIV/AIDS patients present distinct characteristics due to the infection process and use of ART. Specific studies with children and adolescents with HIV/AIDS are suggested in order to verify the suitability of the cutoff points currently recommended on health-related physical fitness and outlining able to evaluate the physical training efficiency.

CONCLUSION

As crianças e adolescentes apresentaram estabilidade clínica, porém, necessitam melhorar a aptidão física relacionada à saúde nas variáveis flexibilidade e força de resistência abdominal.

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