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Original Article

The influence of fat mass percentage, EK functional motor scale and age in children with duchenne muscular dystrophy

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ABSTRACT

Honório S, Batista M, Martins J. The influence of fat mass percentage, EK functional motor scale and age in children with duchenne muscular dystrophy. *J. Hum. Sport Exerc.* Vol. 7, No. 2, pp. 573-580, 2012. The purpose of this study is to determine the influence of the fat mass percentage and age on the mobility of these children. It was used the EK functional motor scale to determine their movement capacity. It was also used skinfolds measures and anthropometric formulas to calculate fat mass percentage, as well as calculated age means. The EK scale was also applied, by a total of five evaluations in six boys with ages from seven to eleven years. All values demonstrated that, as the age value gets higher, the fat mass and EK scale points were higher either, meaning that these individuals have bigger motor limitations. After the application of the Rho Spearman test the correlations values between the variables of fat mass and EK scale, the correlations results showed "Very Good" values, meaning that one gets higher as the other one gets higher too, with a 0.006 significant statistical value, and was also obtained "Very Good" correlation results between age and EK scale (0.000). We didn't found any significant statistical values, and all variables increase from the first to the fifth evaluation. This study has reveal that fat mass percentage and age affect EK scale, which leads to higher motor limitations. Key words: AGE, FAT MASS PERCENTAGE, EK MOTOR FUNCTIONAL SCALE, DUCHENNE MUSCULAR DYSTROPHY

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INTRODUCTION

The Duchenne Muscular Dystrophy (DMD) is a genetic disease and its main characteristic is the muscle weakness and progressive atrophy of these ones. This fact comes from the absence of the distrophyne protein production, which brings implications to the normal functionality of the muscles (Dubowitz, 1989).

The DMD is the most common and severe dystrophy within an incidence of 1 to 3,500 male bourns that leads to a physical disability by muscular weakness. The first symptoms are the volume increase of gastrocnemius muscles, frequent falls and the difficulty in climbing stairs. It's caused by a defective gene that suffers a genetic mutation, in the short arm of the X chromosome, more exactly in the xp21 region. A women has got two X chromosomes and men have only got one, meaning that, if a woman has one defective X chromosome, the other one will protect her from developing this disease. That's why only male gender is affected. In 65% of these cases, when the mother is a gene carrier, we have 50% chances that her child will be affected. However, when the mother isn't a gene carrier, there's also a 35% possibilities that the children will born with the disease, and when that happens it's called a new mutation or punctual mutation (Abreu,1999; Marques, 2007).

The most common symptoms are progressive muscle weakness, frequent falls, daily difficulties like climbing stairs, frequent stages of quick fatigue, lost of intellectual ability, scoliosis and muscles deformities. According to Zanardi et al. (2002), there is an increasing obesity tendency in these individuals by movement limitations, so that we proceeded to the body mass index (BMI) evaluation and fat mass measures, which influences the mobility degree in daily activities of our study individuals that we classify in the EK motor functional scale. This scale submits a certain value to each individual that quantifies a lower or bigger limitation in their abilities. This scale adopts numbers from 0 (zero) to 30 (thirty), and as higher the scale value is the bigger will be their motor limitations. By this, we are trying to establish a relationship between fat mass percentage and its effect on this scale and number decoded, along with their age development.

MATERIAL AND METHODS

Participants and data collection

Our sample was a group of six individuals, all of them of male gender and white (race) with ages between seven and eleven years old. All individuals were submitted to five evaluations where the variables analyzed were the age, fat mass percentage and EK functional motor scale. These children were recruited from a Portuguese hospital, where they are following by a specialist in neuropediatrics. All children's and their parents were informed and an authorization was made by the responsible doctor to the hospital committee.

Anthropometric measures

In order to evaluate the fat mass percentage, we applied the anthropometric techniques of skinfold measures described by Vieira and Fragoso (2005). For this purpose we used a skinfold plastic instrument (Fat Mass II) with digital reading that provides more precision. Afterwards, we measured this skinfolds we calculated the fat mass percentages taking in consideration the body composition protocols that are used to evaluate children from six to seventeen years of age. We must have in consideration certain values regarding if the children are white or black.

The formula used on this protocol to calculate the fat mass percentage only measures two skinfolds, the triceps and the scapular skinfolds (Filho & Reis, 2006). The equation to determine this variable is the one we present next:

$$\% FM = 1.35 (TR + SB) - 0.012 (TR + SB)^2 - C \text{ (C = constant, see Table 1).}$$

Table 1. Constant values by age, gender and race from Lohman (1986), Pires and Petroski (1996).

Sex/Race	Ages											
	6	7	8	9	10	11	12	13	14	15	16	17
Male												
White	3.1	3.4	3.7	4.1	4.4	4.7	5.0	5.4	5.7	6.1	6.4	6.7
Black	3.7	4.0	4.3	4.7	5.0	5.3	5.6	6.0	6.3	6.7	7.0	7.3
Female												
White	1.2	1.4	1.7	2.0	2.4	2.7	3.0	3.4	3.6	3.8	4.0	4.4
Black	1.4	1.7	2.0	2.3	2.6	3.0	3.3	3.6	3.9	4.1	4.4	4.7

EK Functional Motor Scale

The EK functional motor scale is also an instrument of evaluation. It was validated by Baddini et al. (2006), also in children's with DMD. With this scale we can quantify the functional limitation degree of each individual. This scale presents a group of ten questions and each question has three items, and makes a maximal total of thirty points. This means that the higher the total of points is the bigger will the limitation of the individual be.

Statistical analysis

The values acquired were exported to computing applications. The statistical treatment of the data was in charge of the SPSS 17 program (Statistical Program for Social Sciences), with a significance level of 0.05. The descriptive analysis (means and station deviations) was calculated to all variables, on every evaluation. We also applied the Rho Spearman test to verify the type of correlations between variables and analyze the statistical relevance.

RESULTS

In the tables below we present the established data from the evaluations that take place with the individuals that constitute the study sample, regarding the values of age, fat mass percentage and EK scale.

Table 2. Values obtained from the five evaluations regarding each and every one of the individuals.

Individual	Evaluation	Age	% FM	EK
	1	7	16.09	3
	2	7	16.40	5
1	3	8	16.72	6
	4	8	17.31	8
	5	9	17.91	10
	1	7	18.89	3
	2	7	19.48	6
2	3	8	20.8	8
	4	8	21.04	10
	5	9	22	12
	1	6	17.68	2
	2	6	18.49	3
3	3	7	19.30	4
	4	7	20.08	6
	5	8	22.3	7
	1	8	18.5	9
	2	8	18.95	10
4	3	9	19.4	11
	4	9	23.3	14
	5	10	25.1	17
	1	9	20.22	9
	2	10	21.51	12
5	3	10	24.10	15
	4	11	25.4	18
	5	11	27.4	21
	1	9	21.93	8
	2	10	22.26	11
6	3	10	22.6	14
	4	11	23.43	16
	5	11	24.8	20

The Table 2 indicates that all individuals increase their fat mass percentage and EK scale from the first to the fifth evaluation, as the age values get higher. The individual's one, two, three and four, present in the beginning of this study normal fat percentage. In the end of all evaluations each of these individuals presents high levels of fat mass percentages.

Table 3. General mean values of all samples, regarding the age, fat mass percentage and EK scale variables.

Group		Age Mean	FM Mean	EK Mean
Evaluated group	Mean	9.33	20.5247	9.93333
	N	6	6	6
	Std Deviation	1.89	2.23905	4.56596

Table 3 presents the variables means values of Age, %FM and EK. The %FM is considered "High moderated", Pires and Petroski (1996) and EK scale is considered a lower value, because it is diminished by the younger individuals.

After the analysis of the correlations between variables, presented in Tables 4 and 5, we find that as age gets higher, fat mass and EK scale values are as well higher. All variables increase from de first to the fifth evaluation, which also increase the EK scale values, meaning that there are more motor limitations by these individuals. We can see in Table 4 that fat mass percentage presents significant statistical references regarding the EK scale. We can find that the correlation factor between EK scale and BMI variables becomes a positive association, though lower and less relevant, and doesn't have a significant statistical value (0.229), meaning a very humble interference in functional mobility.

Table 4. Correlation values between EK scale and Fat mass variables.

Test	Mean and Coefficient		EK mean	FM mean
Rho Spearman's	EK mean	Correlation Coefficient	1.000	0.901
		Significance	--	0.006
		N	6	6
	FM mean	Correlation Coefficient	0.901	1.000
		Significance	0.006	--
		N	6	6

We can find that the correlation factor between EK scale and Fat Mass variables becomes very high in statistical terms (0.006). This represents a very positive association "Very good", between 0.90 and 1. It's the second most influent value into EK scale.

Table 5. Correlation values between EK scale and Age variables.

Test		Mean and Coefficient	EK Mean	Age Mean
Rho Spearman's	EK mean	Correlation Coefficient	1.000	0.982
		Significance	--	0.000
		N	6	6
	Age mean	Correlation Coefficient	0.982	1.000
		Significance	0.000	--
		N	6	6

DISCUSSION

According to literature researched, obesity leads to a bigger muscular erosion and stresses a higher skeletal deformity (Ledoux, 1995). Our study sample presents distinct fat mass values, knowing that a bigger percentage of that same mass has a derivation of bigger limitations in EK scale (Caromano et al., 2010). A higher weight makes them more dependent and alters their body composition decreasing the thin mass which, at the same time, degenerates with the disease progression (Mok, 2006). Our fat mass percentages (20.52%) are inferior once compared to Zanardi et al. (2002) which are of 32%, and our age means they are also inferior when compared with Mok (2006) that is 10.4%.

We found that the correlation factor between EK scale and Age variables is the highest one of all (0.000). This represents a "very good" and positive association between the variables between 0.90 e 1. It's the most influent value in the EK scale.

After analyzing all the tables, we found that Fat Mass and Age variables are the most influent ones in the EK scale values. However, the age factor is not reversible and by the time these individuals grow older they are gradually increasing their functional limitations. We verified the same situation in Ramacciotti and Nascimento (2009) where the individual, with six years didn't have significant limitations, was able to walk and capable of doing several activities with a little help. On the other hand, fat mass percentage can be controlled and attenuated with a guided diet and a very moderated exercise practice, considering the mobility capacity of each person.

As the age factor increases, their moving abilities will be bigger, meaning higher EK scale values (Dubowitz, 1989). We are able to verify that the facts in Table 5 where the correlation value is highly significant. Younger children that can fulfil several tasks by themselves are the ones that have lower EK scale values (Okama et al., 2010). Leroy-Willig (1997) have made a brief evaluation on their eight patients with DMD with ages between nine and twelve years old and an age mean of 11.1 years old. The fat mass percentage mean was 11.4%. This value indicates that these individuals were not obese, with a lower value regarding our study. We also comply with the study of Okama et al. (2010) where the older individuals are more dependent in their daily activities. The major benefit of EK scale is that it can be applied in any stage of this disease, because it is practical, non-invasive and doesn't cause any kind of pain or discomfort to the patient. By this, it becomes a useful tool, to intervene in earlier stage of this condition and to try to permit, at least, a more tranquilizing quality of life. This study reveals that fat mass percentage and age affetc EK scale values, meaning that this variables are leading to higher/bigger motor limitations to DMD children´s, in their movement capacities, and daily activities.

CONCLUSIONS

We have concluded that as higher are the BMI values and fat mass percentages, the EK scale values are higher either, despite we didn't found any statistical significant values. BMI values increase from the first to the fifth evaluation as well as the fat mass percentage and EK scale values, reveled by the Rho Spearman test.

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