

Original article (short paper)

Effect of a physical activity program on sport enjoyment, physical activity participation, physical self-concept and quality of life in children with asthma

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Abstract—This study aims to analyse the effects of indoor physical training program on the enjoyment and the willingness to participate in sports activities, physical self-concept and the quality of life in children with asthma. Participants were randomized in an experimental group (EG) ($n=58$, age= 11.55 ± 1.01 years old) and, a control group (CG) ($n=47$, age= 11.51 ± 1.42 years old). An indoor training program was executed for 12-week, with each week containing three sessions of 60 minutes. Enjoyment in physical activity questionnaire, participation in physical activities, physical self-concept questionnaire, 6 minute walking test, and paediatric asthma quality of life questionnaire were employed. After the intervention, EG showed a significant reduction in the body mass index as well as a significant improvement in physical fitness test and the score obtained in questionnaires compared to the CG. A 12-week indoor training program targeted towards asthmatic children improved the sport enjoyment, physical activity participation, physical self-concept, and quality of life.

Keywords: asthma, children, physical exercise, quality of life

Resumo—“Efeito de um programa de atividade física no gozo esporte, a participação da atividade física, auto-conceito físico e qualidade de vida em crianças com asma.” O objetivo estudo foi analisar o efeito de um programa de treinamento *indoor* no prazer e na intenção de prática de esportes, no autoconceito físico e na qualidade de vida em crianças com asma. Participantes foram divididos aleatoriamente em grupo experimental (GE) ($n=58$, idade = $11,55 \pm 1,01$ anos), e grupo de controle (GC) ($n=47$, idade= $11,51 \pm 1,42$ anos). Foi ministrado um programa de treinamento indoor de 12-semanas, com 3 sessões semanais de 60-minutos de duração. Foram utilizados os questionários autoconceito físico, *6-Minutes Walk Test* (6MWT) e questionário de qualidade de vida de asma pediátrico. O programa de treinamento GE reduziu o IMC, além de melhorar as pontuações nos vários testes e questionários preenchidos, contrário do GC. O programa de treinamento *indoor* de 12-semanas aumentou o prazer da prática da atividade física, a participação da atividade física, o autoconceito físico e a qualidade de vida em crianças com asma.

Palavras-chave: asma, crianças, exercício, qualidade de vida

Resumen—“Efecto de un programa de actividad física en el disfrute de deportes, la participación en la actividad física, el autoconceito físico y la calidad de vida en niños con asma.” El objetivo del estudio fue analizar el efecto de un programa de entrenamiento *indoor* en el disfrute e intención de participar en actividades deportivas, autoconceito físico y calidad de vida en niños con asma. Participantes fueron randomizados en grupo experimental (GE) ($n=58$, edad= $11,55 \pm 1,01$ años), y grupo control (GC) ($n=47$, edad= $11,51 \pm 1,42$ años). Se llevó a cabo un programa de entrenamiento *indoor* de 12-semanas, con 3 sesiones semanales de 60-minutos. El cuestionario de disfrute en actividades físicas, participación en actividades físicas, autoconceito físico, *6-minute walking test* y cuestionario de calidad de vida de asma pediátrico fueron empleados. A diferencia del GC, para el GE el programa de entrenamiento provocó una reducción en IMC, además de una mejora en las puntuaciones obtenidas en el test de condición física y la puntuación de los cuestionarios cumplimentados. Un programa de entrenamiento *indoor* de 12-semanas mejoró el disfrute de la actividad física, la participación en actividades físicas, el auto-concepto físico y calidad de vida en niños con asma.

Palabras claves: asma, niños, ejercicio físico, calidad de vida

Introduction

Physical activity may be useful in the management of asthma (Verlaet *et al.*, 1976) and in improving the management of asthma symptoms (Eijkemans, Mommers, Draaisma, Thijs, & Prins,

2012; Van der Horst, Twisk, & Van Mechelen, 2007), pulmonary function, mental health (Avallone & McLeish, 2013), and quality of life (Wirrell, Cheung, & Spier, 2006). High physical fitness seems to be associated with risk reduction of developing asthma (Rasmussen, Lambrechtsen, Siersted, Hansen, & Hansen, 2000).

Nevertheless, children with asthma, especially those with a more severe clinical disease, tend to have a sedentary lifestyle and therefore a lower aerobic capacity than in healthy children (Kathiresan & Paulraj, 2010). Fear of breathlessness and induced asthma attacks inhibits participation in physical activity and sport in many patients (Welsh, Kemp, & Roberts, 2005).

Certain psychological factors such as self-identity, self-efficacy, perceived competence, enjoyment of physical activity and motivation influence the individual's attitude and therefore, their participation in the physical activity (Kohl & Hobbs, 1998). Previous research has revealed that a positive perception of physical competence is linked to enjoyment in physical exercise (Fairclough, 2003) and that a positive association exists between self-efficacy and physical activity (Van der Horst, Twisk, & Van Mechelen, 2007). Children who are more active, enjoy sport, have confidence in their capability to be physically active, feel competent, will perceive fewer barriers to physical activity in the future, and will be more likely to enjoy physical exercise throughout their lives (Biddle, Gorely, & Stensel, 2004; Dishman *et al.*, 2005). Enjoyment is often cited as an important correlate or predictor of physical activity participation and it is included in many health promotion models and behaviour motivation theories (Dacey, Baltzell, & Zaichkowsky, 2008).

Negative past experiences with exercise may result in unpleasant perceptions of physical activity involvement, leading to a vicious cycle of sedentary habits (Pianosi & Davis, 2004; Welsh *et al.*, 2004). Asthmatic children who experience the benefits of exercise are more likely to be active throughout their lives. However, there is limited research focusing on attitudes toward exercise from the perspective of school-aged children with asthma (Dimitrakaki *et al.*, 2013). More research focusing on the connection between asthmatic children to sport is needed. It is necessary to exam the correlation between insufficient physical activity and sedentary behaviours in order to develop effective interventions that may help children and adolescents with asthma reduce the time it takes to develop inactive behaviours. It is therefore important to progress in the investigation that will ultimately acquire a clearer understanding of the motivational mechanisms that underlie the positive or negative outcomes of physical education, such as enjoyment in children with asthma.

Considering the benefits of physical activity for health of children with asthma, it was hypothesized that indoor exercise training improving sport enjoyment, physical activity participation and quality of life in children with asthma. Therefore, the aim of this study is to analyse the effects of physical activity program on sport enjoyment, physical activity participation, physical self-concept, and quality of life in children with asthma.

Methods

Participants

This study included 118 students (age=11.53 ± 1.20 years; age range: 10-14 years) diagnosed with asthma by the allergy specialists in hospitals in Ubeda and in Jaen (Andalusia, Spain). All children were deemed eligible by the following criteria: diagnosis of asthma severity according to the Global Initiative for Asthma (GINA, 2011), have undergone treatment for at least

6 months before the study and were in a stable phase of the disease. This stable phase means that the children's disease was not exacerbated during that time, no recent changes in drug use were made, nor did they suffer from other cardiopulmonary diseases, musculoskeletal problems or mental disabilities. All parents of students completed an informed consent form which met the ethical standards of the World Medical Association Declaration of Helsinki. The study was approved by the Bioethics Committee of the University of Jaen. Finally, 105 children were randomized into experimental group (EG; $n= 58$; age=11.55±1.01 years; 51.7% boys and 48.3% girls) and control group (CG; $n= 47$; age= 11.51±1.42 years; 70.2% boys and 29.8% girls). Figure 1 shows the flowchart of participants during the study.

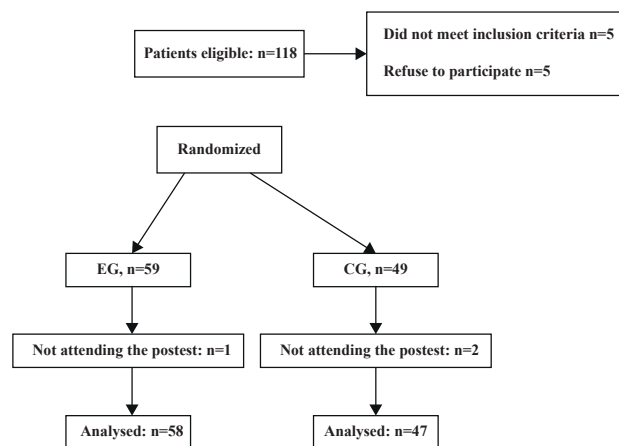


Figure 1. Flowchart progress through the study's participants.

Instruments and testing

The anthropometric parameters analysed included height (m), measured with a stadiometer (Seca 222, Hamburg, Germany), body mass (kg), recorded with a Seca 634 (Hamburg, Germany), and the body mass index (BMI)= body mass (kg) / height (m²). Aerobic endurance was measured through a six minute walk test (6MWT) (American Thoracic Society; American College of Chest Physicians, 2003), which is a sub-maximal test useful to examine the functional capacity in individuals with moderate to severe asthma. It looks carefully at the distance that an individual can walk quickly in a rectangle of 45.57 metres during 6 minutes (Rikli & Jones, 1999). For the assessment of perceived exertion (RPE) after the completion of 6MWT, the Borg scale (Borg, 1982) was used to established items from 0-10 (low intensity to high intensity). To test the enjoyment of the physical activity, Physical Activity Enjoyment Scale (Motl *et al.*, 2001), Spanish version (Moreno, González-Cutre, Martínez, Nestor, & López, 2008) was used. This scale consists of 16 items, preceded by the sentence "When I am active...", and evaluates the enjoyment from the highest level (e.g., "I enjoy," "It is very exciting," "I find it enjoyable") to the lowest (e.g. "I am bored," "I do not like it," "It frustrates me"). The answers were collected in a Likert scale whose punctuation ranks oscillate from 1 (totally disagree) to 5 (totally agree). Cronbach's alpha in this study was .907. The physical activity was calculated with the

Physical Activity Questionnaire for Children (PAQ-C) (Kowalski, Crocker, & Kowalski, 1997). The PAQ-C, which is appropriate for school children (8-14 years old), registers the physical activity performed 7 days prior its administration. We used the teenager version of Martínez-Gómez *et al.* (2009) translated into Spanish and updated from its children's version. Cronbach's alpha in this study was .726. To analyse the quality of life of asthmatic children PAQLQ (Paediatric Asthma Quality of Life Questionnaire) was used in its Spanish version (Tauler *et al.*, 2001). This questionnaire was developed for asthmatic children from 7 to 17 years of age to evaluate the quality of life. It is composed of 23 questions (items) distributed into three fields: symptoms, limitation in activities and emotional function. Their answers are coded in a Likert scale with options from 1 (lowest quality of life) to 7 (highest quality of life). Cronbach's alpha in this study was .958. To test the physical self-concept, CAF questionnaire was used (Goñi, Azúa, & Liberal, 2004) it is composed of 36 items divided into four scales of physical self-concept (physical attractiveness, physical ability, fitness and strength) and two for the physical self-general and general self-concept. Cronbach's alpha in this study was .922.

Intervention

The intervention consisted of three 60-minute sessions of physical indoor exercise training per week for 12 weeks, with meetings on Monday, Wednesday and Friday. The structure of the session consisted of a 10 minute warm-up, a 35 minute program of activities and a 10 minute cool down. The type of physical sports program was in accordance with the criteria of the American College of Sports Medicine (ACSM, 1999), which recommended that the exercise program designed for people with asthma ensure that they develop tolerance to cardio respiratory activities as these specific activities use large aerobic muscles. It is recommended that these people do indoor sports, meaning that most of the sessions were conducted in indoor sports facilities away from pollution and allergens (ACSM, 1999). The intensity of the exercises was self-administered by the participants. Cardiovascular exercises included walking at different speeds, running, aerobic dance and other continuous and rhythmic activities that involved great muscle groups, self-loading exercise, loading exercises with a companion, flexibility, relaxation and team sports. Exercise intensity was increased during the whole program, by modifying the number of reps per set, by increasing movement speed and by reducing rest time between exercises. The goal given to the tasks was control of skills rather than competition.

Statistical analysis

Data were analysed using SPSS., V.19.0 for Windows (SPSS Inc, Chicago, USA) and the significance level was set at $p < .05$. The data are shown in descriptive statistics for mean and standard deviation. Analysis of covariance (ANCOVA) with the analysis was performed on pre- and pos-test using sex as a covariate and ANCOVA with post-pre-test differences, taking the pre-test and sex as covariates. We performed Spearman correlation between the enjoyment and the rest of the variables analysed.

Results

Table 1 shows results of BMI, enjoyment of physical activity, physical activity participation and quality of life in asthmatic children. Table 2 shows the results of physical self-concept and 6MWT. After the intervention, a significant reduction of BMI ($p < .001$), were produced in EG, while CG remained unchanged. Likewise, a significant increase ($p < .001$) in sport enjoyment, physical activity participation, quality of life in children with asthma, physical self-concept and walk distance in 6MWT, were produced in EG in relation to CG. This improvement in 6MWT performance was accompanied by a significant reduction in RPE posttest ($p < .001$) in EG. It should be highlighted the significant increase ($p < .001$) in the participation of physical activities in EG's school (items 2 and 3) in relation to that same participation in CG.

Table 1. Anthropometric variables, enjoyment of physical activity questionnaire (PACES), physical activity questionnaire (PAQ-C), quality of life of paediatric asthma questionnaire (PAQLQ).

		Pre-test M (SD)	Post-test M (SD)	Post-pre- difference M (SD)
BMI (kg/m ²)	CG	21.39 (4.78)	21.84 (4.57)	0.44 (2.61)
	EG	19.69 (3.20)	17.49 (2.75)	-2.19 (2.22)
<i>p-value</i>		.049	<.001	<.001
PACES	CG	4.07 (0.68)	4.11 (0.69)	0.04 (0.72)
	EG	4.18 (0.71)	4.85 (0.26)	0.67 (0.71)
<i>p-value</i>		NS	<.001	<.001
PAQ-C	CG	2.75 (0.72)	2.71 (0.70)	-0.03 (0.82)
	EG	2.50 (0.61)	4.12 (0.43)	1.61 (0.70)
<i>p-value</i>		NS	<.001	<.001
Items 2	CG	3.40 (1.51)	3.55 (1.31)	0.15 (1.60)
	EG	3.47 (1.21)	4.52 (0.70)	1.05 (1.45)
<i>p-value</i>		NS	<.001	<.001
Items 3:	CG	2.55 (1.55)	2.43 (1.41)	-0.12 (1.81)
	EG	1.90 (1.20)	4.38 (0.95)	2.48 (1.32)
<i>p-value</i>		.031	<.001	<.001
PAQLQ	CG	3.89 (1.74)	3.99 (1.64)	0.10 (1.58)
	EG	3.66 (1.32)	6.78 (0.35)	3.12 (1.35)
Activity limitation		NS	<.001	<.001
PAQLQ	CG	4.05 (1.67)	3.95 (1.58)	-0.10 (1.83)
	EG	4.11 (1.41)	6.71 (0.43)	2.60 (1.52)
Symptoms		NS	<.001	<.001
PAQLQ	CG	4.94 (1.62)	4.49 (1.63)	-0.45 (1.79)
	EG	4.69 (1.46)	6.71 (0.45)	2.02 (1.50)
Emotional function		NS	<.001	<.001
PAQLQ	CG	4.32 (1.55)	4.15 (1.50)	-0.17 (1.55)
	EG	4.21 (1.33)	6.72 (0.38)	2.51 (1.39)
Total		NS	<.001	<.001

*CG (control group). EG (experimental group). M (mean). SD (standard deviation). NS. No significant. BMI: body mass index. PACES (enjoyment in physical activity questionnaire). PAQ-C (participation in physical activities). Items 2: In the last 7 days, during your physical education (PE) classes, how often were you very active (playing hard, running, jumping, throwing)? Items 3: In the last 7 days, what did you do most of the time at recess? (The lowest activity response being a 1 and the highest activity response being a 5). PAQLQ (Paediatric Asthma Quality of Life Questionnaire). ANCOVA with the analysis was performed on pre- and post-test using sex as a covariate and ANCOVA with post-pre- differences, taking the pre-test and sex as covariates.

Table 2. Results obtained in physical self-concept questionnaire (CAF), six-minute walk test (6MWT) and RPE.

		Pre-test M (SD)	Post-test M (SD)	Post-pre-difference M (SD)
Ability (CAF)	CG	22.87 (5.53)	21.02 (5.57)	-1.85 (5.15)
	EG	22.47 (4.12)	28.83 (1.81)	6.36 (3.78)
<i>p-value</i>		NS	<.001	<.001
Fitness (CAF)	CG	21.13 (6.90)	21.62 (5.76)	0.49 (5.53)
	EG	20.69 (4.26)	28.59 (1.82)	7.90 (4.13)
<i>p-value</i>		NS	<.001	<.001
Attractive (CAF)	CG	20.26 (3.97)	23.09 (4.18)	2.83 (3.29)
	EG	20.17 (3.92)	28.10 (2.26)	7.93 (4.24)
<i>p-value</i>		NS	<.001	<.001
Strength (CAF)	CG	22.13 (5.85)	23.89 (5.18)	1.77 (5.47)
	EG	21.22 (5.00)	29.22 (1.47)	8.00 (4.91)
<i>p-value</i>		NS	<.001	<.001
General physical self-concept (CAF)	CG	25.19 (4.49)	19.60 (4.54)	-5.59 (4.85)
	EG	24.26 (4.68)	24.16 (1.56)	-0.10 (4.59)
<i>p-value</i>		NS	<.001	<.001
General self-concept (CAF)	CG	24.89 (3.52)	23.43 (5.76)	-1.47 (5.52)
	EG	22.19 (4.63)	29.14 (1.31)	6.95 (4.80)
<i>p-value</i>		.001	<.001	<.001
6 MWT (m)	CG	666.79 (71.22)	654.31 (99.42)	-12.48 (130.43)
	EG	739.60 (71.60)	916.09 (79.42)	176.49 (96.92)
<i>p-value</i>		<.001	<.001	<.001
RPE (0-10)	CG	4.37 (2.89)	3.89 (3.05)	-0.47 (1.99)
	EG	5.15 (2.11)	0.73 (1.06)	-4.42 (1.97)
<i>p-value</i>		NS	<.001	<.001

*CG (control group). EG (experimental group). M (mean).SD (standard deviation). NS. No significant. CAF (physical self-concept questionnaire). 6MWT (6 minute walk test). RPE (Rating of Perceived Effort). ANCOVA with the analysis was performed on pre- and post-test using sex as a covariate and ANCOVA with post-pre differences, taking the pre-test and sex as covariates.

Table 3 shows Spearman correlation between the physical activity enjoyment and the increase of variables analysed in this study. The increase of the enjoyment positively correlates

with Δ PAQ-C, Δ items2, Δ items3, Δ limitation of activities, Δ symptoms, Δ emotional function, Δ PAQLQ total, Δ walking metres in 6MWT and Δ CAF.

Table 3. Spearman correlation between physical activity enjoyment and the increase (post-pre differences) of variables analysed in this study.

	Rho of Spearman	<i>p-value</i>
Δ PAQ-C	.383	<.001
Δ Items 2	.258	.008
Δ Items 3	.246	.011
Δ activity limitation	.361	<.001
Δ symptoms	.313	.001
Δ emotional function	.365	<.001
Δ PAQLQ total	.365	<.001
Δ 6MWT	.262	.007
Δ Ability	.357	<.001
Δ Fitness	.190	NS
Δ Attractive	.153	NS
Δ Strength	.228	.019
Δ General physicalself-concept	.342	<.001
Δ General self-concept	.264	.007

*PAQ-C (participation in physical activities questionnaire). Items 2: In the last 7 days, during your physical education (PE) classes, how often were you very active (playing hard, running, jumping, throwing)? Items 3: In the last 7 days, what did you do most of the time at recess? PAQLQ (paediatric quality of life questionnaire). 6MWT (6 minute walk test). NS. No significant.

Discussion

The average attendance at the physical activity program was 95.6%, indicating a high degree of involvement by asthmatic children. The enjoyment of physical activity is an important motivation factor for children in relation to their participation in physical activities (Barr-Anderson *et al.*, 2007; Yli-Piipari, Watt, Jaakkola, Liukkonen, & Nurmi, 2009). The level of satisfaction in the activity realised was measured through the enjoyment of physical activity questionnaire (PACES) and significant differences between both groups were found, meaning an increase in the enjoyment for physical activity in EG in relation to CG. PACES not only value the enjoyment taken in physical or sport activity, but it is also sensitive to the enjoyment grade for other ludic activities. It can be argued that it is not only a valid measure for the adhesion to activity programs, but also for adhesion to leisure or social activities as well. Involvement in social activities is also a factor in enjoyment and satisfaction that can act as an element of social integration.

Regarding the daily physical activity of asthmatic children, several studies confirm that is lower in relation to their healthy peers (Cheng *et al.*, 2010; Manki, Watanabe, Tabenaka, & Ohya, 2011), especially in children with obesity (Sousa, Cabral, Martins, & Carvalho, 2014). The PAQ-C results mark significant differences between the EG and the CG at the end of the intervention, getting an increase with higher values than those obtained by Martínez-Gómez *et al.*, (2009) in teenagers, which emphasizes a greater involvement in physical activity in the EG. Haines and Kim (2013) also found an increase in physical activity in asthmatic children after an educative intervention of asthma and physical education. In this respect, the physical activity level is an enjoyment indicator in physical education class (Barr-Anderson *et al.*, 2008).

Aerobic training programs are associated with an improvement in the quality of life for people with asthma (Andrade, Britto, Lucena-Silva, Gomes, & Figueroa, 2014; Basaran *et al.* 2006; Silva *et al.* 2013). The type of indoor sports physical training performed in this study has proved beneficial to the quality of life of asthmatic children. The quality of life according to the values of restriction in activities, emotional functions, symptoms and PAQLQ total scale result consistent with other previous research (Basaran *et al.*, 2006; Velástegui *et al.*, 2010; Yüksel *et al.*, 2009). The aforementioned variables increased significantly in EG whilst CG remained unchanged.

Significant improvements were found in physical self-concept in EG and significant correlations between Δ PACES with Δ CAF. Also, previous research has shown that perceived physical ability is associated with enjoyment in physical activity (Fairclough, 2003).

The 6MWT is a reliable and valid tool to assess functional exercise tolerance of children and it is a valid tool in assessing asthma control (Lammers, Hislop, Flynn, & Haworth, 2008; Li *et al.*, 2007; Yüksel *et al.*, 2009). Aerobic endurance improved after the intervention in EG as in other studies (Andrade *et al.* 2013; Basaran *et al.*, 2006; Fernández, Roldán, & Lopera, 2009; Van Veldhoven *et al.*, 2001). The results obtained in the EG after training are superior to previous studies (Basaran *et*

al., 2006; Basso *et al.*, 2010; Geiger *et al.*, 2007) and normative references (Lammers *et al.*, 2008; Li *et al.*, 2007). The increase in the 6MWT distance of EG was greater than the highest values estimated for respiratory rehabilitation of individuals with chronic obstructive pulmonary disease (Lacasse, Wong, Guyatt, King, Cook, & Goldstein, 1996), which was 55.7 m.

It is also highlighted in this study a positive relation between the increase of physical activity, enjoyment and the increase in the actual practise of physical activity. Additionally, a significant correlation between enjoyment of physical activity and participation in school-based physical activities was found. Sallis, Prochaska, Taylor, Hill and Geraci (1999) found that enjoyment of physical education predicted participation in physical activity in children. Moreover, an important finding of this study is the positive association between the enjoyment of physical activity and the quality of life of asthmatic children.

Finally, after the intervention, the EG improved in 6MWT, which shows that improvements in fitness were associated with positive changes in exercise enjoyment, similar result was shown in previous studies (Dunton, Schneider, & Cooper, 2007; Fairclough, 2003).

In this study, the motivational climate created during physical activities was focused on the tasks and cooperation among participants, which could have influenced the enjoyment of physical activity. Regarding to this, Yli-Piipari *et al.* (2009) indicated that students with high motivation reported moderate levels of engagement in physical activity, high enjoyment in physical exercise, and low levels of state anxiety. Other authors (Grastén, Jaakkola, Liukkonen, Watt, & Yli-Piipari, 2012) emphasize that tasks involving a motivational climate predict enjoyment in physical education via perceived physical competence and intrinsic motivation in both girls and boys.

Conclusions

According to the findings obtained, an indoor physical activity program, consisting of 3 sessions of 60 minutes per week for 12 weeks, increased the enjoyment in physical activity and the quality of life in children with asthma. Additionally, this change in quality of life was also associated with an improvement in physical activity participation and physical performance in asthmatic children. Physical activity promotion programs in children with asthma should contribute to the enjoyment of exercise, which might increase the physical exercise adherence.

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The children of the province of Jaen

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