Paediatric rheumatology

Disease activity, overweight, physical activity and screen time in a cohort of patients with juvenile idiopathic arthritis

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Abstract

Objective

Physical activity is an important part of children's health and social development. Juvenile idiopathic arthritis (JIA) can lead to decreased physical activity and quality of life. This study characterised clinical aspects, physical activity rates, obesity, and screen time in a group of JIA patients.

Methods

Ninety-seven JIA patients in the Paediatric Rheumatology Clinic at Meir Medical Center were evaluated over a 6-month period and compared by statistical methods to 98 age-matched healthy controls. Information on disease activity, type and amount of physical activity (using the Modified Godin Leisure-Time Exercise Questionnaire), and daily screen time hours were collected.

Results

Among the JIA patients, 56% had oligoarthritis, 22% polyarthritis and 17% systemic disease. Disease activity among all JIA sub-groups was low (average of 1.7/10), two-thirds of patients had disease activity lower than 3, only 4% over 5, and 56% were in clinical remission. Obesity rates in the patient and control groups were 21.5% and 19.4%, respectively. Physical activity levels were similar in both groups. Age at onset of disease and physical activity rate were negatively correlated (r=-0.288, p=0.004). Total weekly leisure activity of the control group was higher (46.9 vs. 38.4 hours, respectively), while daily screen time was similar (3.2 vs. 2.9 hours, respectively).

Conclusion

Physical activity, obesity rates and screen time hours were similar between JIA patients and controls. This lack of difference could be attributed to clinical remission following early, aggressive, treat-to-target therapy.

Key words

juvenile idiopathic arthritis, physical activity, obesity, children, screen time

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Introduction

Juvenile idiopathic arthritis (JIA) is the most common chronic rheumatic disease in children and is a major cause of morbidity and decreased quality of life in the short and long-term (1). In the current treat-to-target (TTT) era, quantitative assessment is an important component of routine care and follow-up. Parents and patients have an essential role in assessing outcomes, including completing child health questionnaires and visual analogue scales of disease activity; both important tools for assessment.

Until recently, most of the information on a child's disease and its activity was based on parents' reports, but studies have shown that parents and children have differing perceptions of health (2, 3). This led to the recognition that the rheumatologic follow-up should incorporate the child's account, in addition to that of the parents.

There is strong evidence regarding the beneficial effects of physical activity (PA) and the disadvantages of a sedentary lifestyle on the overall health of children and adolescents across a broad array of domains. Many studies concerning children and adolescents strongly link increased time spent in sedentary activities with reduced overall activity levels and with higher levels of obesity, impaired lipid profiles, hypertension, and other cardiometabolic risk factors, including insulin resistance and type 2 diabetes. The state of chronic inflammation among children with JIA, further increases cardiometabolic risks. Active children have lower risk of obesity, which can also affect joint load. Moreover, exercise is considered a fundamental part of the normal psychosocial development of children.

Physical activity (PA) is an important part of the treatment for JIA (4). The approach is to permit children to engage in as much PA as they choose, under the assumption that they will limit their own activity as pain arises. PA can help decrease pain, restore muscle tone and strength (5), prevent chronic disability and decreased range of motion (6) and aid in proper muscle growth of the involved limbs (7). Better disease control leads to increased participation in PA and a healthier life style. Consequently, patients who engage in more PA tend to have lower disease activity and pain (8). Aerobic capacity in children with JIA was found to be decreased relative to that of aged-matched, healthy children, during both active disease and remission (9). Nørgaard *et al*. demonstrated that PA measured by accelerometer was inversely correlated with disease activity in JIA patients (10).

Obesity rates among children are increasing worldwide. A study from the United States (11) showed that most American children did not follow recommended PA guidelines or screen time limitations. Also, the prevalence of sedentary life style increases as children age. Only 70% of children abide by the physical activity recommendation, 54% by the screen time limitation recommendation and 38% by both. Age and obesity are inversely correlated with the recommendations.

A Canadian Health Measures survey (12) indicated that only 13% of boys and 6% of girls ages 5–17 years, met the recommended PA guidelines. These children and youth also spend an average of 8 sedentary, waking hours every day. In England (13), the BMI of almost 16% of children ages 2–16 years was over the 95th percentile.

The MABAT survey (the second National Health and Nutrition Survey)(14) was conducted by the Israel Ministry of Health in 2015-2016 regarding children in grades 7–12 (ages 12–18). It found that 21% of boys and 20.8% of girls are overweight (BMI over 85 percentile) and that 18.2% of boys and 10.5% of girls are obese (BMI over 95 percentile). These numbers represent approximately 35% and 70% increases in overweight and obesity rates, respectively, compared to the first MABAT survey conducted in 2003–2004 (15).This survey also reported that 45.4% of boys perform aerobic exercise at least once a week as compared to 39.8% of girls, and 58% of boys play some sort of ball game once a week as compared to only 11.2% of girls. On the other hand, girls reported walking more than boys do (42.4% *vs*. 16%). When asked about music and TV habits, 55% of girls and 44% of boys reported watching TV or listening to music more than 2 hours a day.

To the best of our knowledge, this is the first study to examine screen-time among JIA patients and to add new information by characterising disease activity in a real-life cohort that included all patients with JIA in our centre, and to correlate it with PA, weight and leisure-time activity in comparison to a group of healthy controls.

Patients and methods

All 97 consecutive children with JIA attending a routine follow-up visit in the Paediatric Rheumatology Clinic at Meir Medical Center, Kfar Saba, Israel, within a 6-month period participated in the study. All agreed to participate. Ninety-eight healthy children by history, relatives of the JIA patients, and others recruited from other settings, such as community paediatric health centers served as the control group. The study was approved by the Meir Medical Center Institutional Review Board. Data were collected as part of the EPOCA study (The multinational study of the **Ep**idemiology, treatment and **O**utcome of **C**hildhood **A**rthritis), managed by the Paediatric Rheumatology International Trials Organisation (PRINTO) (16).

The Wallace criteria and physician visual analogue scale (VAS) were used to evaluate disease activity and remission (17). Clinical remission was defined as VAS ≤2 for at least 6 months. Patients completed the Modified Godin Leisure-Time Physical Activity Questionnaire regarding their average PA in the last 4 weeks (18, 19), either independently or with parental assistance (for younger children or if there were reading difficulties). This is a self-reported measure, intended to evaluate the weekly frequency and intensity (strenuous, moderate or mild) of leisure-time PA sessions of "at least 15 minutes". Examples of each intensity are: Strenuous exercise (heart beats rapidly) (*e.g.* running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, and vigorous long-distance bicycling). Moderate exercise (not exhausting) includes (*e.g.* fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing). Mild exercise, defined as minimal effort, includes for example, yoga, archery, fishing from a river bank, bowling, horseshoes, golf, riding a snow mobile, and easy walking).

Participants report how many times a week they perform mild, moderate or strenuous physical activity. These numbers are used to calculate a Weekly Leisure Activity Score = (9×Strenuous) + (5×Moderate) + (3×Light).

Overweight was measured as BMI over the 85th percentile and obesity as BMI over the 95th percentile. Daily hours of screen time were reported and measured as hours in front of a screen (TV, computer, tablet, etc.) on an average day.

Statistical analysis

Data are presented as median or mean and standard deviation for continuous parameters, and nominal parameters as numbers and percentage. Normality distribution was tested for continuous variables (Shapiro-Wilk test). Differences between qualitative data were tested with Chi-Square test. For metric data, the differences between patients and healthy controls were evaluated using *t*-test or Mann-Whitney test. For comparison of three groups, Kruskal-Wallis non-parametric test was used. Associations between continuous variables were tested with Pearson or Spearman correlations, each when appropriate. $P<0.05$ was considered statistically significant. All statistical analyses were performed with SPSS-23 software (IBM, Armonk, NY, USA).

Results

The 97 JIA patients had a mean age of 11.9±5 years and 68% were girls. The control group included 98 aged- and sex-matched children with a mean age of 11.7±3.9 years, of which 62% were girls. The average age at disease onset was 6.8±4.7 years, and disease duration was an average of 5±4 years. All JIA subtypes were represented and patients were grouped accordingly. Most (56%) had oligoarticular type, 21% were RF negative polyarticular type, and 17% systemic onset type. The remaining 6% included 1 with polyarticular RF positive, 2 with psoriatic arthritis, and 3 with enteritis-related arthritis. All 97 patients completed the EPOCA questionnaire and 93 (96%), the Godin questionnaire.

Table I. Frequency of disease activity.

Disease activity score	Patients (n=97)	% of patients
≤ 1	46	47.4%
1 ≤ 2	8	8.3%
2 ≤ 3	11	11.3%
3 ≤ 4	19	19.6%
4 ≤ 5	9	9.3%
5 ≤ 6	3	3.1%
> 6	1	1%

Among the patients, 54 (55.7%) were in clinical remission; 27 had continued activity and the remaining 16 were in a state of flare. No disease activity was present in 46 patients (score = 0). Some were in remission on medication and some with no medication. Only a third of patients had a disease activity score of 3 or above. The highest score was 6; noted in one patient only (Table I). Among the entire cohort, the median number of swollen, painful and limited range of motion joints was 0. Patients with psoriatic and enthesitis-related arthritis had more involved joints. The median ESR of the cohort was 0. All children were treated according to their disease activity based on ACR and EULAR-PReS guidelines, with biologics as needed. Some received physiotherapy.

There were no statistically significant differences between the groups regarding PA (Fig. 1) and screen time. Nonetheless, it is apparent that the absolute numbers for all degrees of PA were higher in the control group. No correlations were found between disease activity, the different subgroups, the amount of PA and total leisure activity (Tables II, IIa, IIb). Age at onset of disease and physical activity rate were negatively correlated (r=-0.288, p=0.004).

In response to an open question, 51% of the JIA group and 59% of the control group answered that they perform sufficient PA. In the JIA group, age was found to be correlated with the degree of PA. The younger children reported performing more mild (p=0.047) and strenuous (p=0.01) PA than the older children did.

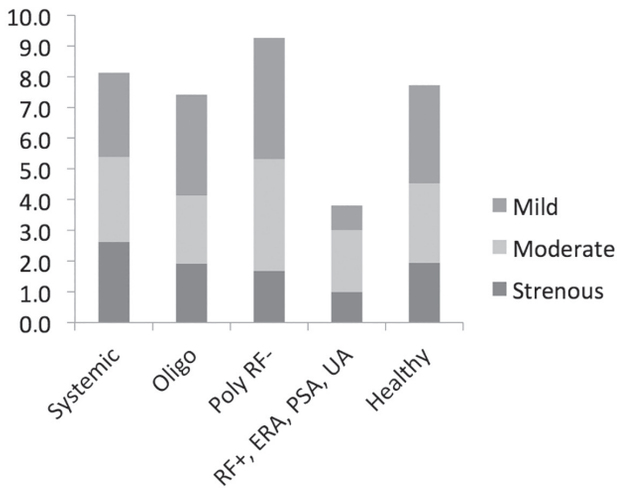

Fig. 1. Physical activity rates in the JIA categories and healthy control group
P for mild = 0.648,
P for moderate = 0.591,
P for strenuous = 0.381
Y axis - weekly physical activity levels.

Table II. Physical activity and screen time among the JIA and control groups.

Physical activity	Mean activity scores		*p*-value
	JIA	Control	
Total (times/week)	7.7 ± 5.9	11 ± 8.6	0.510
Strenuous (times/week)	2.1 ± 1.9	3.4 ± 2.6	0.110
Moderate physical activity (times/week)	3.0 ± 2.6	4.4 ± 3.0	0.403
Mild physical activity (times/week)	3.4 ± 3.2	5.1 ± 2.9	0.672
Total weekly leisure activity score	38.4 ± 30.9	58 ± 46.9	0.199
Screen time (hours a day)	2.9 ± 1.7	3.2 ± 1.5	0.311

Table IIa. Mean physical activity and screen time among participants with JIA (active and remission) and control.

Physical activity	Mean activity scores			*p*-value
	JIA active	JIA remission	Control	
Strenuous (times/week)	2.3 ± 2.0	1.9 ± 1.9	3.4 ± 2.6	0.278
Moderate physical activity (times/week)	2.9 ± 1.8	3.4 ± 3.2	4.4 ± 3.0	0.175
Mild physical activity (times/week)	3.3 ± 3.2	3.3 ± 3.2	5.1 ± 2.9	0.914
Total weekly leisure activity score	35.8 ± 28.9	40.3 ± 32.5	46.9 ± 58	0.394
Screen time (hours a day)	3 ± 1.6	2.9 ± 1.8	3.2 ± 1.5	0.556

Table IIb. Median physical activity and screen time among participants with JIA (active and remission) and control.

Physical activity	Median activity scores			*p*-value
	JIA active n=43 Median (min-max)	JIA remission n=54 Median (min-max)	Control n=98 Median (min-max)	
Strenuous (times/week)	1.5 (0-7)	1 (0-7)	2 (0-20)	0.471
Moderate physical activity (times/week)	2 (0-10)	2 (0-15)	2 (0-30)	0.185
Mild physical activity (times/week)	1.5 (0-10)	2 (0-12)	0 (0-30)	0.208
Total weekly leisure activity score	28 (0-107)	36 (0-132)	35 (0-390)	0.698
Screen time (hours a day)	3 (0-9)	2.9 (0-9)	3 (1-8)	0.408

Physical measurement of weight between the JIA and the control groups (41.4±19.3 kg *vs*. 40±16.2 kg, respectively), height (1.4±0.2 metres in both groups) and BMI (18.9 v*s*. 18.8, respectively) were very similar. There were no statistically significant differences in obesity rates between the two groups (Table III).

Average daily screen time hours in the control group was slightly higher than it was in the JIA group (3.2 *vs*. 2.9, respectively; *p*=0.311; Table IV).

Discussion

The objective of the holistic approach to JIA is to allow patients to function and to be as involved in social and physical activities as their peers are. This goal is important for normal social and academic development.

Most studies suggest that PA is safe for patients with JIA (20). It does not treat the basic disease, but helps maintain aerobic fitness, improve joint agility and range of motion. This helps to prevent contractures and decreased bone density, maintain muscle mass, and improve self-image, energy level and quality of life. In addition, PA helps increase muscle strength and function, decreases disease activity and reduces pain and medication use (20-23). The current approach with JIA is TTT, in order to achieve remission or decrease disease activity. Our results suggest that patients with low disease activity should perform as much PA as their peers do. In addition, their weights are similar to those of healthy children, as is their screen time.

These results differ from those of previous studies where poor aerobic capacity and low activity were found in children and adolescents with JIA (24).According to data from the Participation and Activity Limitation Survey in Canada in 2006, an estimated 4,350 children, ranging in age from 5 to 14 years, were living with arthritis (25). Fifty-six percent of parents reported that arthritis restricted their child's participation in leisure activities, and pain was a limiting factor according to 14%. Ambulatory restrictions inhibited 37% and poor hand function 34%. Almost all of the children were reported to exhibit sedentary behaviour. Although 74% participated in unorganized physical activity and 53% played organized sports weekly, only 33% participated in PA daily.

In their 2014 systemic review, Cavallo *et al*. (26) found that children with JIA did not participate in social and physical activities as much as their healthy peers did. They identified potential determinants of leisure participation, including socio-demographic, anthropometric and disease-related factors. In another report (27), the same group described their findings from a study characterising leisure activity participation among 107 children and adolescents with JIA, ages 8–17 years, by analysing answers

Table III. Weight ranges in the JIA and control groups.

Weight (percentile)	JIA group n (%)	Control group n (%)	Total	*p*-value
Underweight (<5)	9 (9.7%)	12 (12.2%)	21 (11%)	0.799*
Normal (5-85)	64 (68.8%)	67 (68.4%)	131 (68.6%)	
Overweight (85-95)	13 (14%)	10 (10.2%)	23 (12%)	
Obese (>95)	7 (7.5%)	9 (9.2%)	16 (8.4%)	
Overweight + obese (>85)	20 (21.5%)	19 (19.4%)	39 (20.4%)	0.717
BMI	18.9 ± 5.4	18.8 ± 5.4	18.8 ± 5.4	0.976
BMI percentile	53.1% ± 32.3	51.6% ± 32.8	52.3 ± 32.5	0.750

*For 4 degrees of obesity.

Table IV. Daily screen time hours of JIA *vs*. Control / JIA sub-types / active *vs*. in remission.

Disease type/status	n. of patients	Daily screen time (hours)	*p*-value
Systemic	16	3.2 ± 2.4	0.0928
Oligoarticular	53	2.8 ± 1.3	
Polyarticular RF (-)	19	2.6 ± 1.6	
Other	5	4.6 ± 2.5	
Disease status			
Active	42	3.0 ± 1.6	0.556*
In remission	51	2.8 ± 1.7	
Total	93	2.9 ± 1.7	
Controls	99	3.2 ± 1.5	

*Active *vs*. remission *vs*. control. Between active and inactive, p=0.717.

from the Children's Assessment of Participation and Enjoyment (CAPE). Individuals with JIA more often engaged in informal rather than formal leisure activities, most often social and recreational. Their top five daily activities were listening to music, doing homework, watching television, playing with pets, and playing computer/video games. Those with active arthritis were involved in less diverse and less intense participation in active physical activities, and less frequent involvement in informal activities compared with those who were asymptomatic and with those who were healthy.

A Dutch study (28) demonstrated that JIA patients have lower aerobic capacity and strength when compared to healthy children, even during remission. A study from Denmark also described less PA in JIA patients, when measured by an accelerometer. This was not explained by pain or objective signs of inflammation (29). Patients with HLAB27 positive juvenile ankylosing spondylitis participated less in PA as compared to population controls (30). In contrast, a recent Norwegian study reported results similar to ours: normal PA levels in JIA patients with low disease activity compared to controls (31).

Our findings of PA comparable to that of healthy controls could be explained by the low disease activity in our cohort; almost half of the patients were in remission, and most had oligoarticular JIA. Also, it is possible that JIA patients in Israel come to the Paediatric Rheumatology Clinic earlier in the course of their disease, as was found in a recent SHARE survey of European countries (32), resulting in earlier treatment. The characteristics of the subgroups in our cohort were similar to those quoted in the literature. It is important to note that our center has an aggressive TTT protocol aiming to achieve remission or low disease activity. This includes repeated intra-articular steroid injections and early systemic therapy, which may be related to the high remission and low disease activity status of many of our patients. We can only speculate that the lack of difference between the JIA and control groups is the result of two opposing processes. On one side, a decrease in physical activity among healthy children and on the other increased physical activity among children with JIA.

Weight, height and BMI in the JIA and the control groups were almost identical. This indicates the homogeneity and similarity of the groups, and more importantly, demonstrates that JIA has a minimal effect on height and weight, if any.

Although no differences were found in overall PA, we found interesting differences in the intensity of PA children reported. Children with JIA reported 1.9 sessions of strenuous PA per week, as opposed to 2.6 times per week in the control group (35% difference), and 2.6 times of moderate PA per week in the JIA group, as compared to 3 times per week in the control group (15% difference). On the other hand, the JIA group performed mild PA (3.2 times per week) more often than the control group did (2.9 times per week). This finding is not completely surprising, because patients with rheumatic disease tend to decrease their own PA, because during periods of active disease they usually perform no PA and during remissions they tend to perform mostly mild activity that does not cause pain (such as walking).

The number of times per week patients in the three main JIA sub-groups performed PA was inversely correlated with its intensity. Thus, more strenuous PA was performed fewer times per week. When we correlated age with amount of PA, we found an inverse relationship between mild PA, strenuous PA and the total leisure activity score; meaning, younger children perform more (mild and strenuous) activity, and as a result, the total leisure activity score increases. This finding agrees with the fact that younger children perform more leisure time PA. Teenagers are more inclined to sedentary behaviours (which includes more hours of television, computer, tablets and mobile phone and less PA), than are younger children, who have not yet succumbed to these habits. Another explanation could be that questionnaires of most of the younger children were completed by their parents, who may have overestimated the amount of PA.

The degree of PA and social functioning might also be related to pain symptoms, and it is important to measure pain during each visit, as it may persist despite adequate treatment (33). Daily screen time hours were similar between the JIA and control groups, with a median of 3 hours. When completing the ques-

tionnaires, several children noted that if we would have included the hours they spend with mobile devices, their screen time hours would have been considerably higher.

The current study had several limitations. Data were based on subjective questionnaire reports, and not direct measurements of PA and screen time. A recent study noted that a reliable PA diary needs 3 weeks of data, and the correlation between accelerometer and diary reports is moderate to poor (34). Physical fitness was not examined. Even though PA was similar in both groups, fitness might be lower in children with JIA due to the chronic inflammatory state.

The strengths of our study are that all consecutive children participated. This limits the potential bias of including only those who were willing to participate, and might be more highly motivated and perform more PA. The study reports current, real-world practice data from the entire group of JIA patients in our centre. The control and JIA groups completed the same questionnaire, so the same level of inaccuracy would be expected when compared to accelerometer data.

In conclusion, we found no statistically significant differences in obesity rates, overall PA and screen time between the JIA and control groups. Our JIA cohort demonstrates that earlier attention and care by a paediatric rheumatologist, and an intensive TTT approach, may help children with JIA maintain a lifestyle similar to that of their healthy peers.

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