

CASE STUDY OF A CHILDREN'S JUDO CLASS: MUSCULOSKELETAL FITNESS CHANGES

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ABSTRACT

We evaluated the musculoskeletal fitness changes in 18 children enrolled in the Montana Tech Fall Judo Camp (test sample) and 12 children from a 3rd grade class at a local elementary school in Butte, Montana (control sample). The musculoskeletal fitness tests included push-up test, pull-up test, and one-minute timed sit-ups for the test sample and push-ups and one minute timed sit-ups for the control sample, with five minutes of rest between each test. The test sample increased their performances in pull-ups, sit-ups, and push-ups by 0.7, 3.7, and 6.6 repetitions, respectively. The control sample decreased in their sit-up performance by 1.3 repetitions, and improved their push-up performance by 0.2 repetitions. These results show that the test sample improved their musculoskeletal fitness as measured by these tests.

Key words: grappling, martial arts, cardiovascular, children, adults

INTRODUCTION

Judo is a system of self-defense, and can take many forms. As a grappling sport like wrestling, judo requires a high level of physical fitness although some participants have no interest in competing in judo tournaments and practice judo in a recreational manner. Judo coaches believe that this activity offers an excellent systematic method for improving physical fitness. Judo is even recommended as an activity for developing fitness for other sports (Richards 1982) although our review of pertinent literature yielded only one study showing how judo affects child participants.

Amtmann et al. (2004) studied the effects of a judo class on average heart rates on six children and 15 adults and concluded that beginning judo classes effectively elevated heart rates to a level that can improve overall health and fitness. They also recommended further study to determine changes in musculoskeletal fitness.

The research question guiding this study was, 'What kinds of musculoskeletal fitness changes will occur during a 7-week judo

camp?' The 18 children in the experimental group averaged 8 years of age, and we used a first grade class at a local elementary school as a comparison group. We used the case study format to describe the results of this study because the assumption of meeting the central limit theorem was not met.

A comprehensive literature review yielded no studies on musculoskeletal fitness effects from judo. Max VO_2 as influenced by cardio-respiratory fitness is the amount of oxygen that can be utilized by the body. Cipriano (1993) measured max VO_2 of elite wrestlers and reported values between 60 and 70 $\text{mlkg}^{-1}\text{min}^{-1}$. Horswill (2000) reported a range of 50-62 $\text{mlkg}^{-1}\text{min}^{-1}$ for scholastic age to Olympic level wrestlers. Grappling sports also require a high degree of musculoskeletal fitness. Those athletes whose cardiovascular and musculoskeletal systems perform efficiently have a clear advantage.

Combat sport, including judo, wrestling, boxing, and karate, are physically demanding, and developing overall physical fitness clearly is a prerequisite for successful

participation in these sports. Most of the research in this area has focused on sport-specific requirements, physiological effects of training methods, and physiological profiles of high-level athletes rather than child participants. Our study sought the answer to this question, 'Will improvements in musculoskeletal fitness occur as a by-product of participating in a 7-wk judo camp?'

METHODS

Our case study used a quasi-experimental nonequivalent control group design. Eighteen children of ages 5-12 years who participated in a fall judo camp at Montana Tech of the University of Montana served as subjects for the test sample. The control sample consisted of 12 third grade students at a local elementary school in Butte, Montana, all of ages 8-9 yrs. The university approved all procedures, and each subject and a parent/guardian signed an informed consent document. All participants volunteered for the project of which all completed a physical activity readiness questionnaire.

On the first day of the camp, each participant completed a push-up test to failure, a pull-up test to failure, and a one-minute timed sit-up test with a five-minute rest between tests. This same test procedure was used on the last day of the seven week camp. The coaches were instructed to maintain normal class procedures during the seven weeks. A typical judo class consists of the following phases (Dewey 2003): (1) warm-up; (2) instruction; (3) drills; (4) randori (freestyle practice); (5) fitness/judo exercises; and (6) cool-down.

The duration of each phase varied and depended on factors such as age, experience, and objectives of participants. For a beginner class, phases may last from 5-20 min, and for a children's class there's considerably more time devoted to games.

The frequency of the Montana Tech Judo Camp sessions were only one day/wk, and instructors encouraged child participants to continue the physical fitness exercises during the rest of the week. Coaches instructed the children to perform the sit-ups,

pull-ups and push-ups, as well as other fitness exercises two other days/wk on their own.

Following the Fall Judo Camp, we administered the push-up test and, following a 5-min rest, a 1-min timed sit-up test to the control sample. The school did not have a pull-up bar to test for pull-ups. Following an additional 7 weeks, students were given the same test.

RESULTS

The test sample increased average performances in pull-ups, sit-ups, and push-ups by 0.7, 3.7, and 6.6 repetitions, respectively (Table 1). The control sample decreased their average sit-up performance by 1.3 repetitions, and improved their average push-up performance by 0.2 repetitions (Table 2).

DISCUSSION

Although many judo coaches state that their art is effective in improving overall physical fitness, a comprehensive literature search found no research on this topic as it pertains to musculoskeletal fitness. The results show that the children involved in the Fall Judo Camp at Montana Tech improved musculoskeletal fitness as measured by a 1-min timed sit-up test, pull-up test to exhaustion and push-up test to exhaustion. These results are more important in light of the minimal changes seen by the school kids.

However, there were limitations in our experimental design of which one included small non-representative samples. The age range of 5-12 was quite large from which subjects from the two groups were not age, height or weight matched. This possibly may have affected children's physiological response to exercises they participated in and/or their performance on tests. Also, we did not obtain information on extracurricular activities each child participated in, which also may have affected their performance.

So, we acknowledge two threats to internal validity. First, there was a selection bias because samples were nonprobability convenience samples. This selection effect also threatens the external validity.

Table 1. Test sample performance results.

Subject	Sit-up 1	Sit-up 2	Pull-up 1	Pull-up 2	Push-up 1	Push-up 2
1	19	18	0	0	14	16
2	29	38	4	5	30	14
3	16	17	0	0	14	21
4	27	34	0	0	1	3
5	23	29	1	2	6	23
6	28	36	0	1	1	13
7	32	34	4	5	24	40
8	29	35	1	3	2	17
9	41	46	5	7	22	23
10	37	32	4	8	18	30
11	44	46	1	1	16	20
12	30	36	0	0	2	7
13	29	37	5	5	19	30
14	23	30	0	0	19	21
15	23	27	0	0	3	10
16	28	24	1	1	8	18
17	15	21	0	0	0	3
18	40	43	5	7	12	21
Average	28.5	32.4	1.7	2.5	11.7	18.3

The second included a maturation threat because, as mentioned earlier, we did not match samples by specific developmental or growth stage.

At the time of the study, we were unaware that the elementary school where the school kids (control group) were tested did not have a pull-up bar. We could have done a pull up test outside, but weather did not favor doing so. Also, we were unable to quantify exactly how many days each week the judo kids exercised outside of judo class although judo coaches encouraged the test sample to continue their exercises two other days each week.

Motivation is an important factor in tests to exhaustion. Some children are naturally more competitive than others and have the inner desire to do their best, whereas others are more complacent in their approach to this kind of testing. As a result, subjects in both groups could have done better or worse based on individual personalities.

Studies show that American children are becoming increasingly overweight, which may lead to chronic lifestyle diseases at an accelerated pace (Strauss and Pollack 2001, Troiano and Flegal 1998). Children should be encouraged to participate in a variety of activities that exercise all major muscle

groups. Identifying activities such as judo that are healthy although somewhat non-traditional are important because they may in part offer a solution for many American adults and children.

According to the American College of Sports Medicine (2000:220), benefits for children participating in regular physical activity are great, and include (1) greater strength and endurance, (2) enhanced bone formation, (3) weight management, (4) reduced anxiety and stress, (5) improved self-esteem and self-efficacy, (6) minimization of heart disease risk factors, (7) fun and/or enjoyment, (8) social interaction, and (9) skill development.

This project also raised the question of whether school physical education courses effectively provide opportunities for children to improve physical fitness. Reputable organizations recommend daily physical education classes at each grade level (American College of Sports Medicine 2000, United States Department of Health and Human Services 2005). Our control sample attended physical education classes twice weekly, and other students only have physical education once/week. This is a common situation throughout the country according to the National Association for Sport and Physical Education's (2001) most

Table 2. Control sample performance results.

Subject	Sit-up 1	Sit-up 2	Push-up 1	Push-up 2
1	0	0	2	1
2	44	39	4	2
3	19	20	3	5
4	40	39	30	33
5	43	42	18	15
6	27	22	3	2
7	33	33	12	13
8	42	41	7	10
9	36	36	8	6
10	18	14	10	10
11	32	35	5	5
12	36	33	10	12
Average	30.8	29.5	9.3	9.5

recent survey. Only Illinois among all states mandates daily physical education for all grades K-12.

Some teachers and administrators fear that a daily physical education requirement will reduce time allowed for more important academic activities. The Accountability clause of the No Child Left Behind Act signed into action in January of 2002 requires schools to demonstrate adequate yearly progress, which might perpetuate a desire of educators to sacrifice time devoted to physical education. Based on achievement tests, however, Sallis et al (1999) reported that students in a health-related physical education program did as well academically as students who spent half as much time each week in physical education. Further research should focus on changes in fitness over greater periods of time and changes in musculoskeletal fitness from one judo camp to the next.

PRACTICAL APPLICATIONS

Although this is a descriptive study, and no causal relationships can be derived, our results imply that judo can be an effective method for improving musculoskeletal fitness. However, benefits that may be derived from training with a judo club, or any athletic club for that matter, may vary depending on a variety of factors, including but not limited to overall mission of the club and coaching quality.

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LITERATURE CITED

American College of Sports Medicine. 2000. ACSM's Guidelines for Exercise Testing and Prescription. Sixth Edition. Franklin, B., Editor. Philadelphia, Pennsylvania: Lippincott, Williams and Wilkins.

Amtmann, J., S. Berry, and W. Spath. 2004. Effects of a Beginning Judo Class on Heart Rate. *Intermountain Journal of Sciences* 10:20-24.

Cipriano, N. 1993. Technical-tactical Analysis of Free-style Wrestling. *Journal of Strength and Conditioning Research* 7:133-140.

Dewey, C. 2003. Coach Education Manual: Level III. United States Judo Association, Colorado Springs, CO.

Horswill, C. 2000. Physiology of Wrestling. Pp. 955-964 *in* W. Garret and D. Kirkendall, Editors. Exercise and Sport Science.

National Association for Sport and Physical Education. 2001. Shape of the Nation Report, http://www.aahperd.org/naspe/pdf_files/shape_nation.pdf.

Ogasawara, N. 1988. Textbook of Judo. Kokushi Dojo, Inc., Montvale, NJ.

- Pulkkinen, W. 2001. *The Sport Science of Elite Judo Athletes: A Review & Application for Training*. Pulkinetics, Inc., Guelph, Ontario, Canada.
- Richards, J. 1982. Conditioning for Judo and Judo as a Conditioner for Other Sports. Pp. 32-34 in *NSCA Journal*, Feb-Mar.
- Sallis, J., T. McKenzie, B. Kolody, M. Lewis, S. Marshall, and P. Rosengard. 1999. Effects of Health-Related Physical Education on Academic Achievement: Project Spark. *Research Quarterly in Exercise and Sport* 70:127-234.
- Strauss, R., and H. Pollack. 2001. Epidemic increase in childhood overweight, 1986-1998. *Journal of the American Medical Association* 286:2845-2848.
- Troiano, P., and K. Flegal. 1998. Overweight children and adolescents: description, epidemiology, and demographics. *Pediatrics* 101:497-505.
- United States Department of Health and Human Services. 2005. Physical activity and health: adolescents and young adults. Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion. Internet Available: <http://www.cdc.gov/nccdphp/sgr/adoles.htm>. Date of Download: April 15.

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