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Original Article

Judo Practice in Early Age Promotes High Level of Bone Mass Acquisition of Growing Boys' Skeleton

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Abstract

The current study aimed to exhibit effects of judo training for at least 2 yr on bone mass parameters in growing boys. Our population was composed of one hundred and thirty boys in tanner stage 1 and aged 10.52 ± 0.86 yr. Eleven judo players were therefore, excluded from the study because they do not have participate regularly to the judo training sessions during the last 2 yr. The resting sample was divided into two groups: 50 judo players (JU group) and 69 controls (C group). Bone mineral density (BMD), bone mineral content (BMC), and bone area (BA) were evaluated by using dual-photon X-ray absorptiometry on weight-bearing sites: the whole body, lumbar spine (L2-L4), legs, femoral necks and hips and on the non-weight bearing sites: arms and radiuses. Our findings displayed that judo participation was markedly associated with greater values of bone mass parameters in young judo players than control group. Accordingly, the BMD and BA results exhibited significant differences in the whole body, legs, dominant total hip, arms and both whole radiuses in addition to the dominant femoral neck, the non-dominant total hip and except the non-dominant whole radius for the BMC parameter. Additionally, data of the subject within *t* test has shown significant differences of bone mass parameters only in the non weight-bearing sites in the judo players without any obvious variation in the controls. Differences of BMD observed on the dominant arm and whole radius in addition to the increased BMC values showed in the dominant whole radius compared with their contra-lateral sites in judo players without any marked variation of BA parameters in all sites in both groups. In growing boys, judo practice was obviously associated with osteogenic effects in specific sites.

Key Words: Bone area; bone mineral content; bone mineral density; judo players; prepubescent boys.

Introduction

In the literature, physical exercise is recommended as one determining factor in bone mass acquisition. It is as important as nutrition, hormonal regulation, and calcium intake *(1)*. In most cases, the development of skeleton is widely stimulated by movements and locomotion; there, mechanical constrains provided by physical training play a role to build this complex structure *(2)*. Bone stimulation varies during life. Childhood, as well known, is one decisive period of bone mass acquisition. "During growth, increased body weight, muscle strength, and longitudinal bone growth leads to increased loads placed on the skeleton." It was recognized that during childhood, exercise contributes 0.6%–1.7% greater annual increases in bone accrual with pronominal effects on children who were in prepubertal phase *(1)*. Accordingly, it has been suggested that the skeleton is more sensitive to loading before than after puberty *(3)*. In adult men and women, practicing sport is

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beneficial to increase bone mineral density (BMD) and to obtain higher peak bone mass, thus retarding fracture risk later in life *(4)*. Contrarily to aquatic activities, loaded and impact sports are mostly reported to accelerate bone process and to enhance gain of bony substance in growing children. Previously, it has been demonstrated that gymnastic practice, as one loaded sport generating a strong ground impact, contributes to greater osteogenic effect than sports with predominant energy such as cycling or swimming *(5)*. Recently, other cross-sectional studies have shown that sports with high level of impact such as volleyball, basketball, and handball are beneficial to increase the bone mass parameters. Accordingly, volleyball and basketball increased the bone mineral content (BMC) at the whole body and in most weight-bearing and non–weight-bearing sites in prepubescent athlete group in comparison with the control group *(6)*. However, handball training increased the BMD in the femoral necks and the total hips and the BMC of legs and right total hip in prepubescent male athletes than their matched peers *(7)*. More importantly, a number of research focused on the effects of loaded sports such as combat sport in different populations. As shown, judo is one Olympic sport widely practiced worldwide. According to the analysis of Claudino et al, this sport is frequently based on many sessions of break falls (Ukemis), repetition of techniques (Uchikomi), training kimono grip changes, attack-defense (Kakari-geiko), and alternate projection in addition to combat training (Handori) *(8)*. They also showed that practicing judo in postmenopausal women with low BMD was associated with an increased BMD in the lumbar spine in comparison with the control group *(8)*. Additionally, Platen et al *(9)* showed a higher BMD in the lumbar spine and femurs in the martial arts group, including judoists compared with athletes practicing different sports, such as cyclists and team sports. Likewise, in male and female elite judoists, several studies have suggested that the regular judo practice led to powerful osteogenic stimuli *(10)*. In adolescent male population, Nasri et al exhibited a greater BMD in judoists and other combat sport athletes than in sedentary group *(11)*. In other perspectives, Andreoli et al marked that young judoists displayed higher BMD values in the whole body, arms, and legs in comparison with karate and water polo players and in comparison with the control group *(12)*. To our knowledge, no report on bone health has focused on the effect of practicing judo on boys in prepubertal period. Therefore, the aim of the current cross-sectional study was to verify whether this sport might have an optimal osteogenic potential that might be expressed by greater values of BMD, BMC, and bone area (BA) expansion in the weight-bearing and the non–weight-bearing bones in prepubescent boys.

Methods and Materials

Population

One hundred thirty voluntary prepubescent boys aged 9–12 yr were recruited from sport schools and clubs of Tunisian Sahel region. Eleven judo players were therefore excluded from the study because they did not participate regularly in the judo training sessions during the past 2 yr. The rest of the sample was divided into 2 groups. The sportive group was composed of 50 judoists who practiced judo for at least 2 ± 0.1 yr in addition to physical education at school. They completed 3–6 h of training weekly plus other tournaments and meeting seasons during the school year. The other 69 subjects were assigned to the control group. They participated only in the physical education curriculum at school (2 weekly sessions of 50 min each).

In its majority, practicing Judo is exercised with a partner. Training sessions lasted 45–60 min, including about 15–20 min of warm-up, low-intensity games and stretching exercises, 20–25 min of technical exercises with a session of breaking falls (Ukemi) such asfall back (The Uchikomi), sideways fall (Renzoku-Waza) and fall before (Randori), 5 min of standing or ground combat section (Shiai) with dominance of ground fights, and 5–10 min of active recovery.

Each boy having chronic diseases that might affect bone metabolism was automatically excluded from the study. The study was approved by the Independent Ethics Committee of Farhat Hached Hospital in Sousse (Tunisia). All subjects and their parents were asked to sign written informed consent forms.

Anthropometric Measurements

Height was measured to the nearest 0.001 m using a wall-mounted stadiometer (model S-220; Seca, Hanover, MD), and weight was assessed to the nearest 0.1 kg using a Seca electronic weighing scale (model 770; Seca). Body mass index (BMI, in kg/m^2) was calculated as follows: $BMI = Weight/Height^2$.

Calcium Intake

The dietary calcium intake of each boy was measured using the Bilnut program (version 2.01 1990; SCDA Nutrisoft, Cerelles, France), a method of recording food for 3 consecutive days.

Bone Measurements

The BMD (in g/cm^2), BMC (in g), and BA (in cm^2) of the whole body (WB), lumbar spine (L2-L4), legs, right and left radii, fat mass (FM, in kg), and lean body mass (LBM, in kg) were determined. These parameters were measured by dual-energy X-ray absorptiometry (Lunar Prodigy, model DXPA 2004, Software version 3.6; GE Healthcare Lunar Global Headquarters, Madison, WI) in the Rheumatology Department of Sousse University Hospital.

Physical Activity Parameters

VO_2 Max

The physical ability of children was assessed by indirect estimation of the maximal oxygen uptake (VO_2 max) through a 20-m shuttle run test of Leger et al *(13)*.