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Effects of Bear Walking and Crocodile Animal Movement Training on Shoulder and Hip Joint Range of Motion in Children Aged 10–12 Years

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Abstract: This study aimed to examine the effects of animal movement exercises, namely bear walking and crocodile, on shoulder and hip range of motion (ROM) in children aged 10–12 years. A quasi-experimental pretest–posttest control group design was used. Participants were selected through purposive sampling and assigned to a bear walking group (n=14), crocodile group (n=13), and control group (n=10). ROM was measured using a goniometer and analyzed with paired sample t-tests, Wilcoxon signed-rank tests, and One-Way ANOVA. The results showed significant improvements in shoulder and hip ROM in both exercise groups ($p<0.05$). Improvements in shoulder ROM were comparable between groups, while the crocodile group showed greater gains in hip ROM than the bear walking group. These findings indicate that animal movement exercises are effective for improving joint mobility in school-aged children. 10

Keyword: Animal movement, Bear walking, Crocodile, Shoulder joint, Hip joint, Children

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INTRODUCTION

Physical activity plays a fundamental role in supporting children's growth and development, particularly during the ages of 10–12 years. Regular physical activity contributes to the development of the musculoskeletal system, improves coordination and body balance, and enhances both fine and gross motor skills (Marzena Walasek et al., 2025; Wang & Liu, 2025; Zhao et al., 2023). However, physical activity levels tend to decline within this age range. This decline may be influenced by various factors, including increasing academic demands at school, reduced time allocated for physical education, and additional time spent studying and participating in extracurricular academic activities (E et al., 2023; Habyarimana et al., 2025). Reduced physical activity negatively affects movement function quality, including fine and gross motor coordination, muscle strength, and postural balance, which functionally contributes to a decrease in range of motion (ROM) (D'Anna et al., 2024; Engel et al., 2018). According to Schoenfeld dan Grgic (2020), ROM refers to the degree of movement occurring at a joint during physical activity and may play an important role in muscular adaptation to exercise.

One form of physical activity that has the potential to improve ROM is animal movement. Animal movement is a bodyweight training approach that incorporates movements inspired by animal locomotion patterns, including walking, transitioning, and crawling movements to enhance physical fitness (Buxton et al., 2022). This study focuses on joint mobility, particularly the shoulder and hip joints, through bear walking and crocodile movements. These two movement patterns possess different biomechanical characteristics and are therefore assumed to produce different mobility stimuli for both joints. Although the benefits of animal movement have been widely reported in adults, athletes, and children with specific characteristics (J. Buxton et al., 2024; Eckart, 2023; Matthews et al., 2016; Moreside & McGill, 2012; Savaş et al., 2025; Sidik et al., 2025), studies involving general populations of school-aged children aged 10–12 years remain limited, particularly regarding comparisons between animal movement variations and changes in shoulder and hip joint ROM.

Most previous studies have focused on general fitness, muscle strength, and stability rather than specific analyses of joint ROM. The age of 10–12 years represents a critical period in motor development due to the occurrence of peak height velocity, which is not always accompanied by adaptations in muscle and soft tissue flexibility, potentially resulting in biomechanical imbalance and reduced neuromuscular control. Furthermore, adequate shoulder and hip joint mobility plays an important role in supporting physical fitness, posture, and long-term injury prevention while also contributing to physical performance and cognitive function (Gasbarro et al., 2020; Ituen et al., 2025; Lloyd & Oliver, 2012). The novelty of this study lies in the comparative analysis of two animal movement variations, namely bear walking and crocodile, on changes in shoulder and hip joint ROM among children aged 10–12 years from the general population, an area that remains underexplored in current scientific literature.

Therefore, this study aims to analyze the effects of bear walking and crocodile animal movement exercises on shoulder and hip joint ROM in children aged 10–12 years and to examine the differences in outcomes between the two interventions. Practically, the findings are expected to provide a scientific basis for physical education teachers and coaches in designing animal movement-based training programs that align with children's developmental characteristics. Theoretically, this study is expected to enrich the literature regarding joint mobility development through functional movement-based exercise.

METHOD

This study employed a quantitative quasi-experimental design using a pretest–posttest control group design to analyze the effects of animal movement exercises (bear walking and crocodile) on shoulder and hip joint range of motion (ROM) and to compare the effects of both interventions. This study was categorized as quasi-experimental because random assignment was not applied in group allocation (Sugiyono, 2024). The study population consisted of children aged 10–12 years, with a total sample of 37 participants selected using purposive sampling based on inclusion and exclusion criteria. Purposive sampling was employed to ensure that participants met characteristics relevant to the objectives of the study (Taherdoost, 2016). The study was conducted at Training Zone Indonesia Fitness Center, Surabaya, from April to May 2026. ROM measurements were performed during the pretest and posttest stages using a goniometer and a smartphone inclinometer and were recorded in degrees (°). Participants were then allocated into the bear walking group (n=14), crocodile group (n=13), and control group (n=10) using a matching method based on pretest scores to ensure comparable baseline characteristics among groups (Creswell, 2014). The training program was conducted for 6 weeks with a frequency of three sessions per week (18 total sessions), each lasting 30 minutes with 1–2 minutes of rest between sets. The exercise dosage was determined based on principles of neuromuscular adaptation in growing children (Biren, 2015; Faigenbaum et al., 2009; Morawietz et al., 2024). Data were analyzed using SPSS. Descriptive statistics were used to present mean values, standard deviations, maximum values, and minimum values. Hypothesis testing was conducted using the paired sample t-test, Wilcoxon signed-rank test, and One-Way ANOVA.

RESULT

Table 1. Descriptive Statistics

Characteristics	**Side**	**Groups**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
			M ± SD		**Minimum-Maximum**	
Shoulder Flexion	Right	Bear Walking	183.2 ± 5.1	189.6 ± 6.7	170–190	175–210
		Crocodile	183.7 ± 6.2	194.6 ± 7.1	175–200	185–230
		Control	178.1 ± 5.9	181.5 ± 3.4	170–190	175–185
	Left	Bear Walking	183.6 ± 5.3	187.1 ± 7.5	175–195	175–210
		Crocodile	184.5 ± 6.5	189.6 ± 7.4	175–200	180–200
		Control	177.5 ± 5.7	181.5 ± 2.6	165–185	180–185
Shoulder Abduction	Right	Bear Walking	183.1 ± 4.9	188.8 ± 6.6	170–190	175–205
		Crocodile	182.5 ± 2.9	190.0 ± 5.6	178–185	180–200
		Control	177.5 ± 3.8	179.5 ± 4.1	170–180	175–185
	Left	Bear Walking	184.2 ± 4.7	187.5 ± 6.9	175–195	175–195
		Crocodile	184.2 ± 3.4	190.8 ± 6.2	180–190	180–200
		Control	177.0 ± 4.1	181.0 ± 3.9	170–180	180–185
Shoulder Mid-lat	Right	Bear Walking	86.5 ± 5.1	93.2 ± 4.8	75–91	85–110
		Crocodile	85.2 ± 5.4	90.4 ± 5.1	80–91	80–95
		Control	76.0 ± 11.3	88.0 ± 2.7	55–90	80–95
	Left	Bear Walking	88.1 ± 6.2	92.4 ± 3.9	79–94	90–100
		Crocodile	84.3 ± 5.8	90.0 ± 5.3	80–91	80–95
		Control	77.0 ± 10.8	88.5 ± 2.4	50–85	85–90
Hip Internal Rotation	Right	Bear Walking	40.2 ± 12.1	82.1 ± 9.1	23–75	70–103
		Crocodile	44.2 ± 10.5	94.8 ± 12.1	22–59	75–120
		Control	43.5 ± 24.8	51.0 ± 23.9	20–85	30–85
	Left	Bear Walking	35.6 ± 10.8	78.4 ± 10.5	18–58	60–93
		Crocodile	38.7 ± 9.8	90.6 ± 11.3	17–54	70–112
		Control	45.0 ± 24.0	55.0 ± 24.3	20–80	30–80
Hip External Rotation	Right	Bear Walking	82.5 ± 10.4	99.6 ± 9.1	60–110	90–122
		Crocodile	102.4 ± 11.6	102.3 ± 9.4	85–128	93–117
		Control	74.8 ± 22.7	73.5 ± 22.8	35–100	30–90
	Left	Bear Walking	84.1 ± 11.2	100.3 ± 8.7	45–107	87–114
		Crocodile	99.8 ± 10.9	103.1 ± 8.7	85–122	93–112
		Control	73.5 ± 22.6	72.5 ± 22.8	30–90	30–90

Notes. *N Bear Walking = 14; N Crocodile = 13; N Control = 10; shoulder ROM = flexion, abduction, and mid-lat; hip ROM = internal and external rotation; unit: degrees (°).*

Based on Table 1, all groups demonstrated changes in ROM values from pre-test to post-test. Overall, greater increases in mean ROM were observed in the Bear Walking group (right shoulder flexion: 183.2° to 189.6°; right hip internal rotation: 40.2° to 82.1°) and the Crocodile group (183.7° to 194.6°; 44.2° to 94.8°) compared with the control group.

Table 2. Effects of Bear Walking and Crocodile Training on Shoulder and Hip Joint ROM

Characteristics	***Pretest***	***Posttest***	**Test Statistics**	**p**
	M ± SD	**M ± SD**		
Animal Movement Bear Walking				
Shoulder Joint ROM	149.64 ± 4.27	156.96 ± 9.25	Z = -2.386	0.017
Hip Joint ROM	47.73 ± 5.17	93.89 ± 6.67	$t(13)$ = -18.084	< 0.001
Animal Movement Crocodile				
Shoulder Joint ROM	150,36 ± 3,82	158.40 ± 3.46	Z = -3.110	0.002
Hip Joint ROM	48.12 ± 3.95	98.35 ± 7.86	$t(12)$ = -27.034	< 0.001
Control Group				
Shoulder Joint ROM	142.77 ± 5.00	150.92 ± 1.54	$t(9)$ = -4.719	0.001
Hip Joint ROM	60.50 ± 16.78	61.80 ± 16.90	$t(9)$ = -2.164	0.059

Notes. *N for Bear Walking = 14, N for Crocodile = 13, and N for Control = 10. Shoulder ROM was calculated as the average of shoulder flexion, abduction, and mid-lat measurements on the right and left sides. Hip ROM was calculated as the average of internal and external hip rotation measurements on the right and left sides. Z = Wilcoxon signed-rank test; t(df) = paired samples t-test. All measurements were expressed in degrees (°).*

Based on Table 2, bear walking and crocodile training resulted in significant improvements in shoulder and hip joint ROM ($p < .05$). In the control group, a significant improvement was observed only in shoulder ROM ($p = .001$), whereas hip ROM did not show a statistically significant change ($p = .059$).

Table 3. One-Way ANOVA Results for Improvements in Shoulder and Hip Joint ROM

Measures	**Walking Bear**	**Crocodile**	**Kontrol**	**F(2, 34)**	**η^2**
	M ± SD	**M ± SD**	**M ± SD**		
Shoulder ROM Gain	7.32 ± 8.67	8.04 ± 5.00	8.20 ± 5.50	0.057	0
Hip ROM Gain	46.16 ± 9.55	50.20 ± 6.70	1.30 ± 1.90	155.87***	0.9

Notes. M = mean; SD = standard deviation; F = ANOVA test statistic; η^2 = eta squared (effect size); $p < .001$.

Based on Table 3, there was no significant difference in shoulder ROM improvement among the groups ($F(2,34) = 0.057$, $p > .05$, $\eta^2 = 0.003$), indicating that bear walking and crocodile training produced relatively similar improvements in shoulder ROM. In contrast, a highly significant difference was found in hip ROM improvement ($F(2,34) = 155.87$, $p < .001$, $\eta^2 = 0.90$), with the crocodile group ($M = 50.20$) demonstrating greater improvement compared to the bear walking ($M = 46.16$) and control groups ($M = 1.30$).

DISCUSSION

Descriptive analysis in Table 1 showed changes in ROM values from pre-test to post-test. In the crocodile group, right-side external rotation showed minimal change (102.4° to 102.3°), whereas the left side increased from 99.8° to 103.1°. This difference may be associated with functional biomechanical asymmetry, including variations in femoral torsion, acetabular version, pelvic tilt, limb dominance, and neuromuscular control affecting bilateral movement distribution (Chadayammuri et al., 2016; Donati et al., 2024; Kiapour et al., 2024; Kiba et al., 2024; Promsri et al., 2018, 2020). Meanwhile, the improvement in internal rotation may be influenced by the dominant restriction of the iliofemoral ligament on external rotation, as in vitro studies have demonstrated that reducing this restriction can significantly increase external rotation (Myers et al., 2011). These findings suggest that internal rotation is more strongly influenced by neuromuscular control and posterior soft tissues, making it more responsive to dynamic animal movement-based training (Baba et al., 2022).

The analysis presented in Table 2 demonstrated that bear walking and crocodile training significantly improved shoulder and hip joint ROM, consistent with previous findings (J. D. Buxton et al., 2023; Sidik et al., 2025). Animal movement involves bodyweight and multi-joint movement patterns that combine dynamic stretching, eccentric activation, and light resistance, thereby enhancing ROM. This training approach is categorized as bodyweight resistance training based on a closed kinetic chain, which contributes to greater muscle activation, stability, and postural control. Alizadeh et al. (2023) reported that resistance training contributes to ROM improvement through neuromuscular adaptations. At the age of 10–12 years, neuromuscular responsiveness remains high, making children more adaptive to dynamic exercise. This is consistent with Abdulazeez et al. (2025) who stated that ROM development in children is influenced by age and anthropometric factors, highlighting the relevance of exercise interventions for this age group. Although the control group demonstrated variation in several variables, the changes were inconsistent, particularly in hip ROM. These variations may be explained by daily physical activity, differences in neuromuscular adaptation, and repeated measurement effects.

The analysis in Table 3 indicated no significant difference between bear walking and crocodile training in improving shoulder ROM. Although these exercises differ in movement amplitude, both are classified as closed kinetic chain exercises. According to Luedeka et al. (2026), during closed kinetic chain training, the upper extremities support body weight, causing the shoulder joint to experience compressive and shear forces that must be stabilized by the deltoid, serratus anterior, trapezius, and rotator cuff muscles. Therefore, despite differences in movement patterns, the functional stimulus applied to the shoulder joint was likely similar, resulting in relatively equivalent improvements in shoulder ROM. In contrast, a highly significant difference was found in hip ROM improvement, with crocodile training producing superior outcomes compared with bear walking. Biomechanically, Wiseman et al. (2021), explained that crocodile movement is performed in a lower body posture (sprawl), which requires greater hip mobility and multiplanar lower-extremity movement during locomotion. Furthermore, repeated active–passive stretching may improve ROM through increased stretch tolerance and neuromechanical tissue adaptation, although muscle–tendon stiffness may remain unchanged (Ikeda et al., 2024). Conversely, bear walking involves relatively moderate hip and knee ROM and does not reach extreme movement ranges according to functional kinematic studies (Hindle et al., 2020). Therefore, crocodile training likely provided greater stimulus, leading to greater improvements in hip ROM.

The findings of this study indicate that animal movement training may serve as an alternative functional exercise to improve shoulder and hip joint ROM in children aged 10–12 years. The main findings showed that both bear walking and crocodile training improved shoulder ROM to a relatively similar extent, whereas crocodile training produced greater improvements in hip ROM than bear walking. These findings may provide an evidence-based foundation for developing training programs aimed at improving movement quality and physical readiness in children. This study was limited by the relatively small sample size, lack of control over daily physical activity, and the absence of additional biomechanical measurements such as muscle activation and kinematic analysis. Nevertheless, this study contributes novelty by comparing two variations of animal movement on shoulder and hip ROM using quantitative ROM measurements expressed in degrees with standardized measurement instruments in a school-aged population.

CONCLUSION

This study demonstrated that animal movement training, specifically bear walking and crocodile exercises, was effective in improving shoulder and hip joint ROM in children aged 10–12 years. Both exercises resulted in relatively similar improvements in shoulder ROM, whereas crocodile training produced greater improvements in hip ROM compared with bear walking.

These findings indicate that the movement characteristics of each animal movement variation may produce different responses in joint mobility. Therefore, animal movement has the potential to be used as an alternative functional exercise to support movement quality improvement in school-aged children. Future studies are recommended to involve larger sample sizes, control participants' physical activity levels, and incorporate additional biomechanical measurements to obtain a more comprehensive understanding of the mechanisms underlying ROM improvement.

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