DEVELOPMENT OF THROWING ACCURACY IN ELEMENTARY SCHOOL HANDBALL PLAYERS

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The purpose of this study was to investigate throwing accuracy in children aged 7-12 belonging to hand ball club team. Participants were divided into three age groups and performed 30 overhand throws. Three sessions in each of 3 conditions of optimum, accurate, and speed conscious throws to a target 7m from the thrower were examined. Throw Location (TL), Ball Speed and Radial Error (RE) were obtained from each session. The minimum RE was 20.9cm performed by a 12 years old girl in the accuracy conscious session. The significant differences were observed for age groups in all of the three conditions analysed. In age of 11-12, speed–accuracy trade-off was observed. The current data showed distribution of TL became smaller with older age, indicating development of accuracy. The greater development was observed between age 7 to 9 compared to age 9 to 12.

KEYWORDS: handball, children, motor development.

INTRODUCTION: In order to promote physical fitness during childhood and lifespan, understanding developmental sequence of motor skill is necessary. Overhand throwing has been considered as one of the Fundamental motor Skill in childhood. This is also adapted into various kinds of sports. Competitive Handball players are required to throw the ball with both high velocity and accuracy. Speed and accuracy have been frequently analysed in team hand ball players both expert and novice levels (Gracia et al., 2013. Rousanoglou et al., 2015). Under the instruction that emphasizes accuracy, novice players reduced throwing speed in order to increase accuracy. On the other hand, experts maintained their accuracy regardless of increase in speed (Gracia et al. 2013). However, little is known about how throwing accuracy develops during early stage in childhood with the maturity. Therefore, the present study aimed to quantitatively evaluate throwing accuracy to reveal developmental changes in elementary school handball players.

METHODS: Twelve schoolchildren, both boys and girls, 7-12 yrs belonging to handball team were participated in this study (Table 1). All participants, 6 boys and 6 girls were divided into three age groups, 7-8 (n=3), 9-10 (n=5), and 11-12 (n=4). Eleven of 12 participants were right-handed and one girl in age11-12 was left handed. All participants provided informed consent prior to data collection, and had no shoulder or elbow-related injuries. The participants were instructed to throw a handball from the spot of 7m line to the goal as a penalty throw to hit the target displayed on the upper right inside position at the corner of the goal post. After warming up, each participants performed each ten throw session in three different conditions. The provided instructions in three different conditions were 1) throw at comfortable speed to hit the target (Optimum, OP), 2) throw as accurate as possible to hit the target (Accurate, AC), and 3) throw with the maximum speed to hit the target (Speed, SP). The typical intra-throw interval was approximately 10-30s. A rest period of at least 10 minute was given between sessions. Ball velocity was measured by using a radar gun (ATLAS, BSG-1) from behind the goal post. The throw location (TL) was recorded by a digital video camera (Panasonic HC-V100M, Japan). The camera was set at a position of 5-6 m ahead from the goal post. Kruskal - Walis test and Mann Whitney U test were used to statistical analysis.

Table 1: Physical characteristics of participants

Age groups	age 7-8 (n=3)	age 9-10 (n=5)	age 11-12 (n=4)
Height (cm)	121.7±6.3	136.0±2.6	152.3±9.7
Weight (kg)	29.5±4.4	29.0±1.7	42.3±8.1
Experience (month)	9.7±0.6	16.0±6.9	52.0±18.3
Long throw (m)	7.2 ± 4.3	18.8 ± 5.1	24.9 ± 2.3
Dominant grip strength (kg)	9.2±1.9	15.2±1.2	21.9±3.4
Non dominant grip strength (kg)	9.3±2.3	13.7±3.3	19.6±6.3

RESULTS: Distributions of TL of each group in three conditions were shown in Figure1.

Figure 1: Distribution of Throw Location in three conditions among age groups.

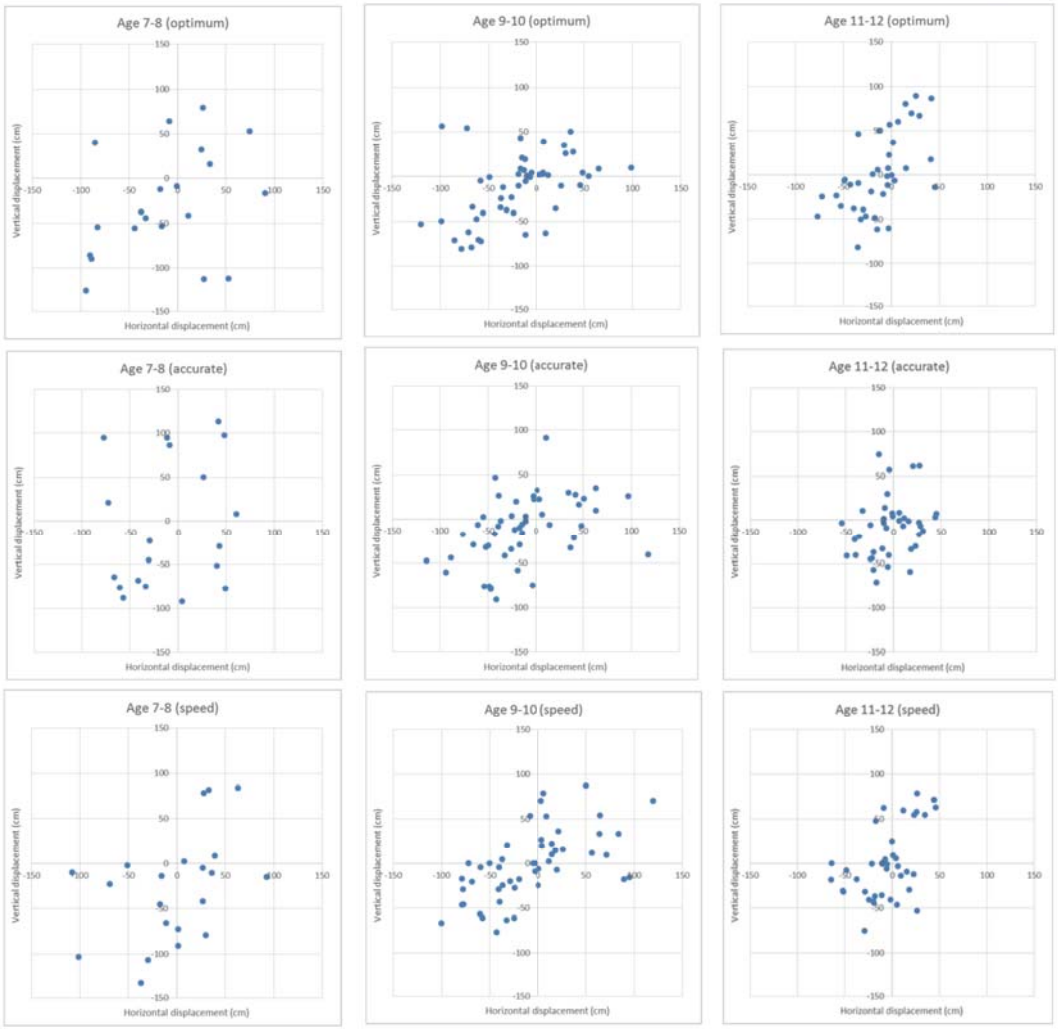


Figure 2: Ball speed in three throwing conditions among age groups (k/h)

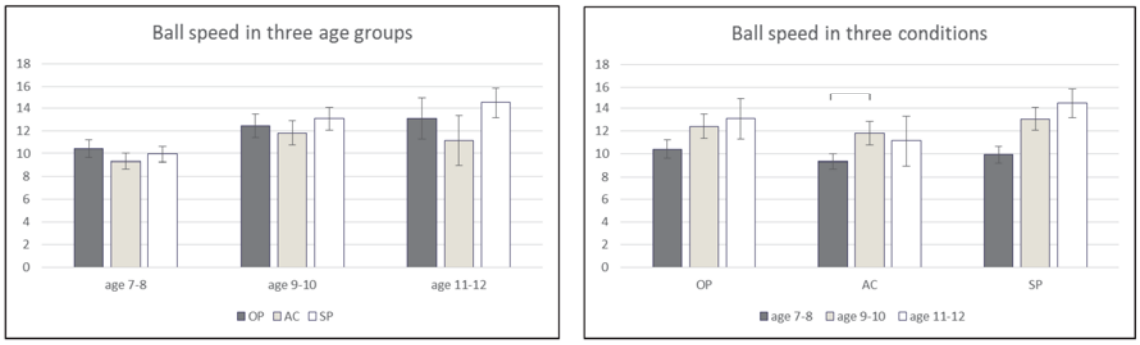
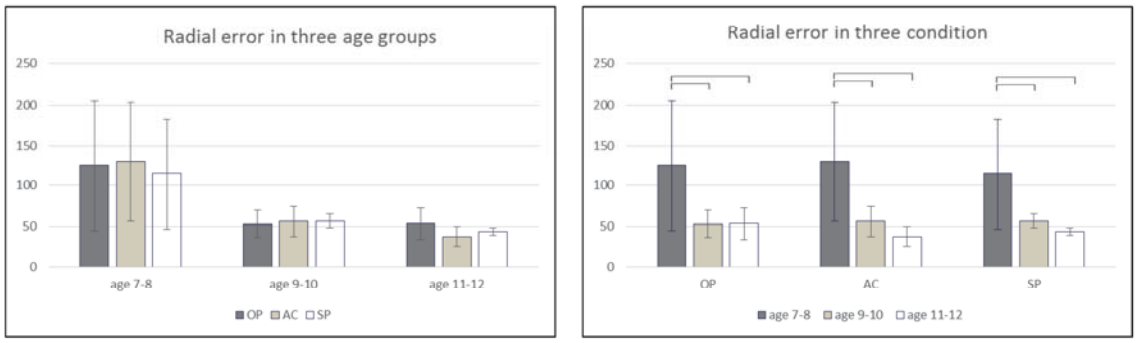


Figure 3: Radial error in three throwing conditions among age groups (cm).



Distributions of TL in three conditions were shown in Figure1. Visually speaking, distributions of TL were improved with age in all three conditions (Figure 1).The age 11-12 group seemed to have the smaller size of TL compared to the other age groups. The distribution of age 9-10 seemed to spread to lateral direction. In regard to the ball speed, the significant difference was found in ball velocity between Age 7-8 and Age 9-10 in the accuracy condition (Figure 2). In the three conditions no statistically significant differences in ball velocity were seen in each age group. Significant differences of RE were shown between age 7-8 and the other two age groups in all three conditions (Figure 3). The accuracy was negatively correlated with ball speed ($r=-0.74$, $p<0.05$) under speed focus condition. The Long throw data were remarkably correlated to both RE in AC ($r=-0.80$, $p<0.05$), and Speed in SP ($r=0.86$, $p<0.05$) condition. Ball speed was also highly correlated with dominant grip strength in optimum ($r=-0.71$, $p<0.05$) and in speed condition ($r=-0.81$, $p<0.05$). Ball speed tended to degrease in accuracy focus condition in all age groups. The speed was captured at about 85% to 95% in the optimum condition. In accuracy conscious condition, age 11-12 decreased 15% of usual speed and performed the most precise accuracy.

DISCUSSION:

We examined developmental changes in throwing accuracy and ball speed in children belonging to handball teams. Although we did not quantify sizes of TL distribution, qualitatively, the smaller distribution of TL was observed in age 9-10 and 11-12 groups as compared to age 7-8. In the optimum condition, RE of Age 9-10 and Age11-12 were similar at about 53 cm. RE of Age 7-8 was about 125cm, which was two times more than that of age 9-10, and 11-12. Our data suggest that participants over 9 yrs old could throw closer to the target with the smaller TL distribution. In the accuracy condition, ball speeds were decreased in all groups, but only the age 11-12 group could throw more accurately than optimum condition. Age 7-8 one girl with 9 month experiences could not reach 7m in the most of throws, so that the result was not included in those group, meaning TL distribution and RE were underestimated in the age 7-8 group. The greater deviations

of RE but not speed in all three conditions were found in 7-8 years old. Our data showed that the 12 years old girl and 9 years old boy possessed the high accuracy in 7m throw which were first to third highest score of RE in all participants under three conditions. The highest accuracy was performed in the condition of AC in age 11-12 and which Radial error was 37.2 ±12.2 cm with speed of 85% in optimal condition. Age 11-12 could regulate ball speed and performed highest velocity. The results suggest in only age of 11-12, so-called speed accuracy trade off was observed, suggesting that a sort of speed-modulation strategy appears in relatively late stage in the throwing skill development.

CONCLUSION: The current study demonstrated developmental sequences of throwing accuracy with three age groups. It was suggested that the throwing accuracy develops rapidly and largely in age before 9.

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