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Reverse-Relative Age Effect on motor fitness of district level handball players of West Bengal in course of talent hunting

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ABSTRACT

In the present study the role of age on the anthropometric characteristics and physical activities of several young handball players hailing from different parts of West Bengal has been undertaken in order to find out players from different age groups with potential of becoming good. A total of sixty five (N=65) male handball players with at least one year training were selected from different district handball associations of West Bengal, as subjects for this study. The subjects were divided in to three groups according to their ages - i) under 15 (N = 25, Age = 13.27 ± 0.67 (y), height = 155.08 ± 8.3 (cm), mass = 42.92 ± 8.77 (kg)), ii) under 17 (N = 20, Age = 15.7 ± 0.47 (y), height = 165.2 ± 5.43 (cm), mass = 53.55 ± 8.39 (kg)) and iii) under 19 (N = 20, Age = 16.86 ± 0.91, height = 164.57 ± 6.25 (cm), mass = 55.86 ± 8.5 (kg)). They were tested for: speed through 30 meter dash on a flat field, agility through 4 x 10m shuttle run on the same field, power through standing broad jump on a broad jumping pit and medicine ball throw on the field, positive work done through standing vertical jump against a straight wall, strength endurance through standard push up, pull up and sit ups and endurance through Astrand-Ryhming step test performed as per standard technique. Normality of the data was tested through Anderson-Darling test and data analysis was done using one-way ANOVA followed by Post-Hoc [Tukey Kramer new multiple range test (MRT)] analysis through Gnumeric software. Our observation and assessment point somewhat reversal of Relative Age Effect on the motor fitness (parameters defined earlier) of junior level athletes and a better future prospect of the handball players of under 15 years age group. The reason behind this could be their psychological motivation of doing better contrary to the general idea that performance maturity of players develops with age. A time based analysis with insights is required for determining the specific anthropological characteristics in the choice of quality level of physically and physiologically fit players.

Keywords: Handball, Relative Age Effect, Motor fitness, Agility, power

INTRODUCTION

Now handball game is played all over the world and it has become one of the most popular ball games. The game handball is played by approximately 27 million players distributed over 800 thousand teams from 197 member federations accredited by the International Handball Federation (Source: Wikipedia 2020). In summer Olympics team handball is played regularly. In this sport, body size, strength, endurance, speed and agility, in

addition to technical skills are considered determining factors for successful participation at

elite levels [1,2]. Handball game is a high-intensity, high velocity, body contact game. A score of different approaches and models have been adopted to identify talent [3-7]. This game demands high aerobic and anaerobic fitness level [8]. Good anthropometric and physical structures of the participants are basic requirements for the handball players of different playing positions in the game [9-13]. This concept is clear from the available research on this issue [6,10,14,15]. Hence, anthropometric parameters, physical and motor test have been frequently used as fundamental requirement in order to determine the performance in handball.

It has been observed that the relative age difference has a very important role in the classification of players with future potential for handball game in particular and also in other team sports. A Study by Fernández regarding

anthropometry, have demonstrated that body composition could have an effect on the performance of the players[16]. Granados have shown that due to higher values of fat-free mass (lean mass), a higher performance could be seen among the quality handball players [17], especially because of the increase in the muscular power and strength. In addition to the physical factors, different motor skills can also be the decisive performance factors in the game [18]. On the other hand, in a battery of tests to identify motor, physical and skill variables [6] have seen a wide overlap between the groups of selected and non-selected players showing no preference for either of these two groups. However, some studies have reported that wings were lighter and smaller when compared to players in other positions showing utilities of younger players [19]. These contradictory views warrant for in depth scientific validation with more field data It is generally believed that for talent hunting RAE (Relative Age Effect), which is a prevalent phenomenon observed in sports performance by young people [20] and is typified by a group of athletes born near the date of selection showing more maturity, has an edge over other methods in selection process of different sporting events. According to Matthys anthropometrical and maturational characteristics are generally used by coaches to select players for specific field positions [21]. This strategy seems to them as risky since anthropometry and maturity status change over the years. In the study of Mohamed it was shown that Under 16 handball players were significantly taller than the reference group [2]. This was not observed in the case in the Under 14 age group. Multivariate analysis of covariance (maturation and chronological age as covariates) showed that the Under 16 elite players were heavier and had greater muscle circumferences than their non-elite peers. Discriminant analysis between elite and non-elite players revealed that height, running speed, and agility are superior parameters for talent identification. In different sports and games the RAE at the youth level is quite influential [22-24], but the possibility of existence of a 'relative age effect reversal' which defies the 'RAE', have been raised by some pioneering studies [25]. This paves the way of investigating whether older handball players may be more skilled, or have higher technical ability than those players with lower age.

However, there is no conclusive evidence on the existence of an RAE and reverse RAE in popular games and sports. For the career length in basketball and soccer the study of [26] has been found to be inconclusive. In the games of German handball, study of Schorer did not find a difference in height, weight or technical skills of players which could be attributed to relative age differences [27]. In the study of Fumarco one can find that Italian football players of lower age group received lower salaries in comparison with the older peers [28].

Interest on identifying and developing sporting talent is more complex in team sports than in individual sports with discrete objective measures of performance [29]. The RAE is interesting as there is a tendency for coaches, during the identification and selection of new players, to include the taller and stronger players while the smaller and thinner players are often excluded from the team. In order to verify RAE hypothesis for the junior handball players of West Bengal we have undertaken a programme for identification of talents of handball players in different age groups through a battery of tests. The results from the tests show a unique feature which shows comparable performances of both lower and upper age group players indicating a reversal of the RAE hypothesis. In view of our observations on the performances of selected handball players in the tests we propose a hypothesis which states that it is possible to reverse the relative age effect (RAE) with strong psychological motivation.

Materials and Methods

The study was performed on 65 male volunteers from different district Handball Associations of West Bengal, namely, Burdwan, Howrah, Murshidabad, Nadia, North 24 Parganas. All the subjects have participated at state level (Certified by West Bengal State Council For School Games & Sports, 2019)) and have training of minimum one year to maximum three years. The subjects were divided in to three groups according to their ages- i) under 15 (N = 25) (chronological age between14.0 and 14.9 years), ii) under 17 (N = 20) (chronological age between16.0 and 16.9 years) and iii) under 19 (N = 20) (chronological age between18.0 and 18.9 years). As some of them were minors, written consent letters from the actual guardians of all the subjects were taken after detailing them about the procedures to be followed and potential risks involved, if any, during the battery of tests and the future of the outcome. There were certain exclusion criteria which included injury or illness, presence of chronic or genetic disorder and current performances status. The general characteristics of handball game are intense body contact, intermittent running which are quite frequent, one-on-one confrontations with opponents and rapid direction changes in combination with challenging coordination. As a result contact related injuries form a major component in all types of injuries in handball games. The players with history of getting injured during any game, requiring prolonged treatment or getting sick with Hepatitis

B, have been excluded. The research study was conducted after obtaining necessary permission and approval from the Board of Research Study and Human Ethical Committee of Ramakrishna Mission Vivekananda Educational and Research Institute. Appropriate measures were taken following the guide lines of Helsinki Protocol of Human Subject Data Collection 1976 and guide lines of Indian Council of Medical Research (Human Ethical Consideration). Utmost care was taken in imparting the knowledge of expected outcomes and possible risks. No invasive tests were taken in this study.

Procedure

The general procedure for measuring motor fitness of any athlete is to measure variables like balance, speed, power, agility and physiological variables like percentage of body fat, lean body mass, aerobic capacity, anaerobic capacity, fatigue index, resting heart rate etc. The items that were tested in finding out the motor fitness of candidates are shown in the Table 1 below

Table 1: Measured Tests Items of the Fitness Components of the Subjects (Kansal, 1996)

FITNESS COMPONENTS	TEST ITEMS
• Speed.	1. 30 meter dash.(s)
• Agility.	2. 4 X 10 meter shuttle run.(s)
• Power.	3. Standing Broad Jump.(m) 4. Vertical Jump (height achieved) (m) 5. Medicine Ball Throw.(m)
• Strength Endurance.	6. Push-ups (in one minute).(n) 7. Pull-ups (in one minute).(n) 8. Sit-ups (in one minute).(n)
• Endurance.	9. Astrand-Ryhming step test.(n)

In this study following instruments were used for data collection:- i) weighing machine for measurement of body mass in kg.(VENUS BS-945, ± 0.05 kg), ii) stopwatch (Racer, ± 0.01s), iii) Anthropometric rod for measuring height in cm., (± 0.1 cm), iv) flat and clear surface of at least 50 meters for measuring speed., v) four wooden blocks for measuring agility, vi) a wooden table (height 40 cm, ± 0.1cm) for measuring endurance, vii) .medicine ball (Nivea) for measuring power, viii) hanging bar for measuring strength endurance.

All tests [30] were performed in bare feet (except the endurance shuttle run). In addition to these fitness tests, height, body mass were measured with the participants wearing minimal clothing. Ages of the participants were noted from their birth certificates. For determination of motor fitness parameters several tests were taken in the following manner: on the first day 30m dash, Medicine ball throw, Vertical Jump, Pull-ups, Sit-ups were performed. On the second day 4 x 10 m shuttle run, Push-ups, Standing broad jump, Astrand-Ryhming Step test were performed by the players. In order to find out the acceleration (m/s2) and speed (m/s) of handball players a 30 m dash test was performed by every player on a flat 50 meter long flat piece of land. Out of three trials best timing was noted. To determine agility for the same set of players, 4 X 10 m shuttle run were performed by the players on the same piece of land. Again best timing out of three trials was noted for each athlete. To evaluate the power of legs of the handball players, at first they were asked to perform standing broad jump test on a broad jump pit prepared for the test.. Secondly, to determine power of legs vertical jumps performed by the players against a clear vertical wall were also used. For measurement of the power (watt) of shoulder girdles and arms, medicine ball throw test was performed. To measure the strength endurance of arms and shoulder girdles of the handball players, push ups and pull ups by standard technique were used. In order to determine strength endurance of abdominal muscles of the players sit up tests were performed on a piece of mat over a flat surface. Moreover, we have determined the maximal aerobic speed (MAS) of the subjects required in connection with the intermittent shuttle-run tests using the prescription of [31]. Astrand- Ryhming step test (VO2 max) by stepping on a 40 cm high table was taken for each player in which VO2 max was calculated using the formula:

VO2 max (L/min) = 3.744{(BW+5)/(HR-62)} [32],

where BW = Body Weight, HR = Heart Rate. Maximal oxygen consumption score for age of the subject has been obtained by multiplying it by the appropriate age correction factor in the Table 2 shown below.

Table 2. Factors for calculation of VO2 max according to age (Astrand Ryhming Nomogram)

Age	**≤15**	**15-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	**51-55**	**56-60**	**≥65**
Factor	1.10	1.05	1.00	0.94	0.87	0.83	0.78	0.75	0.71	0.68	0.65

Results and Discussions

For all types of analysis we have used Gnumeric Spreadsheet software. The data were first tested for outliers, and then for normal distribution using the Anderson - Darling test. Pearson correlations were calculated for normally distributed data Statistical significance was considered at $p < 0.05$. To compare the motor fitness performances of the handball players of different groups we have performed One-way ANOVA followed by Post-Hoc test [Tukey Kramer new multiple range test (MRT)] on the results of several tests taken by the players.

In Table 3 we show the calculated output of VO2 max value using table No 2 and in Table 4 we present results of one-way ANOVA test with Post-Hoc analysis of VO2 max data.

Table 3. Absolute value of VO2 max (ml/kg/min)

Under-15 (N=25)	**Under-17 (N=20)**	**Under-19 (N=20)**
63.87	67.69	61.88
63.25	55.00	49.11
59.46	74.80	73.68
58.00	52.80	56.69
71.18	66.00	49.61
60.79	69.59	51.13
60.50	65.00	66.00
68.75	54.00	61.35
46.47	55.93	51.86
62.86	60.39	64.34
67.69	53.51	63.77
48.47	59.10	56.72
66.25	60.85	62.02
68.00	63.87	54.55
86.98	78.57	52.80
65.53	48.13	57.87
83.02	58.00	61.11
69.35	51.89	51.07
65.48	62.67	58.37
55.00	57.12	52.80
81.71		
94.29		
52.88		
61.73		
75.26		

Table 4.: One Way Analysis of Variance of the Endurance (Absolute Value of VO2max (ml/kg/min)) of the Subjects

ANOVA of three groups of volunteers				
MS_W	**F**	**P-value**	**F critical**	**Remarks**
81.7088911	5.1050894	0.0088632	3.1452584	Significant (0.05)
Post Hoc test (Q value = 2.83)				
GROUP-A	GROUP-B	Difference	SE	Q
Under-15 (N=25)	Under-17 (N=20)	5.5247195	1.9175245	2.8811729
Under-15 (N=25)	Under-19 (N=20)	8.4353054	28.6133376	0.2948033
Under-17 (N=20)	Under-19 (N=20)	2.9105859	28.6204758	0.1016959

The analysis showed a significant variation in the mean. The reliability of the collected data was maintained by using the same environmental and geographical condition for every subject's i.e. same altitude, identical wind speed, similar or near similar climatic conditions. The consistency of the data was maintained because of the different activities were taken in the same order with a short break between each of around 60-120 sec. Hygroscopic constant of the atmosphere was recorded from the website of Indian Meteorological Survey due to non-availability of the equipment for measuring the corresponding data.

The Personal Data are presented in Table 5 below. To understand the distribution pattern of the data set Anderson-Darling Normality Test was performed. According to the distribution pattern the individual data set was found to be either normal or probably normal.

Table 5: A comparative study of anthropometric data of groups of handball players of different countries

Parameter	**Flemish Reference (n = 430)**	**Under-15 (n = 25) (Mean ± SD)**	**Flemish Reference (n = 430)**	**Under-17 (n = 20) (Mean ± SD)**	**Flemish Reference (n = 430)**	**Under-19 (n = 20) (Mean ± SD)**
Age (in year)	13.1	13.27 ± 0.67	15.0	15.7 ± 0.47	N.A.	16.86 ± 0.91
Height (in cm)	159	155.08 ± 8.3	171	165.2 ± 5.43	N.A.	164.57 ± 6.25
Body Mass (in kg)	48.4	42.92 ± 8.77	59.1	53.55 ± 8.39	N.A.	55.86 ± 8.5

The results of the anthropometric measurements for the Flemish reference population and under 15, under 17 handball players are shown also in Table 5. More information regarding this study can be found in [38]. The reason for including the Flemish data is to get an idea about the anthropometric parameters of players of the similar age group from a different continent and make a comparative study. As there were no data available for players Under-19 age group we could not compare our data. One comment is pertinent here-the average age of this group lies on the lower side. The personal data in Table 5 showed an increase of body mass with age which is quite normal in West Bengal, India. However, the height of the players show a stabilising effect after age of the player reaches around seventeen which is characteristic in this age group of young adults. We would like to comment here that anthropometric data clearly shows that the Flemish cohort has an edge over Bengal cohort in height and body mass.

The purpose of the study was to find out whether there was an enhancement in the motor fitness level of male players with age. As the age increases, it is expected that growth of the male players help them in performing better in all the departments as the ranges of motion (ROM) of their limbs and joints increase [33]. In Table 6 and 7 we present results of our analysis for groups under 15 years of age with under 17 years of age and groups under 17 and under 19 years of age in order to find out if there is an effect of RAE prevalent in young handball players of West Bengal. From the tables it is apparent that the analyses show variations in the mean values of results for all the tests. However, the Post-Hoc analysis shows that in all these tests the variation in mean is significant between the groups of under 15 and under 17 and again under 17 and under 19, as F > Fcritical in all the cases and P-values are quite small. Excep-

tions are there for groups under 15 and under 17 in the cases of 4 x 10 m shuttle run, standing broad jump and push up where Q is less than the table value of Q = 2.83 indicating non-significant variation in the mean. Only in pull-ups and Astrand-Ryhming step test for groups under 17 and under 19 we find Q is less than the table value for these groups. One interesting comment can be made here – though the mean values for the tests undertaken by the age group under 15 are on the lower side in comparison to those from the higher age groups of under 17 and under 19, actual raw data clearly demonstrated the better performance of some of the lower age group members in all the tests. Actually the zeal to outperform the seniors in a competition provided the impetus.

Table 6: Results for ANOVA with Post-Hoc analysis on different tests of motor performance between groups under 15 and under 17

Items	Diff	SE	Q	F	Q value (Table)	P-Value	$F_{critical}$
30 m dash (s)	0.35	0.0744	4.6778	13.0638	2.83	$1.84x10^{-5}$	3.1452
4 x 10m Shuttle Run (s)	0.68	1.6280	0.4164	10.6533	2.83	$1.05x10^{-4}$	3.1452
Standing Broad jump(m)	0.38	0.5964	0.6384	25.1315	2.83	$1.01x10^{-8}$	3.1452
Medicine ball Throw (m)	1.83	0.2058	8.9081	44.6202	2.83	$1.01x10^{-12}$	3.1452
Standing High Jump (m)	0.10	1.3696	7.3962	23.8520	2.83	$2.08x10^{-8}$	3.1452
Push-up (n)	4.60	1.9529	2.356	5.5719	2.83	$5.95x10^{-3}$	3.1452
Pull-up (n)	3.81	0.6965	5.4699	17.3301	2.83	$1.05x10^{-6}$	3.1452
Sit-up(n)	0.58	0.8723	3.8112	12.1563	2.83	$1.05x10^{-4}$	3.1452
Astrand-Ryhming Step Test (n)	5.52	1.9175	2.8812	5.1051	2.83	$8.86x10^{-3}$	3.1452

Table 7: Results for ANOVA with Post-Hoc analysis on different tests of motor performance between groups under 17 and under 19

Items	Diff	SE	Q	F	Q value (Table)	P-Value	$F_{critical}$
30 m dash (s)	0.17	0.0744	7.0160	13.0638	2.83	$1.84x10^{-5}$	3.1452
4 x 10m Shuttle Run (s)	0.18	0.1091	4.5545	10.6533	2.83	$1.05x10^{-4}$	3.1452
Standing Broad jump (m)	0.10	0.0266	10.554	25.1315	2.83	$1.01x10^{-8}$	3.1452
Medicine ball Throw (m)	0.82	0.2058	12.8780	44.6202	2.83	$1.01x10^{-12}$	3.1452
Standing High Jump (m)	0.02	1.3696	9.0025	23.8520	2.83	$2.08x10^{-8}$	3.1452
Push-up (n)	4.60	1.9529	4.7119	5.5719	2.83	$5.95x10^{-3}$	3.1452
Pull-up (n)	1.80	10.3940	0.5397	17.3301	2.83	$1.05x10^{-6}$	3.1452
Sit-up(n)	1.85	11.6743	6.7523	11.8754	2.83	$1.57x10^{-6}$	3.1452
Astrand-Ryhming Step Test (n)	0.80	28.6133	0.2948	5.1051	2.83	$8.86x10^{-3}$	3.1452

In figure 1, a comparative study of performances of handball players of under 15 and under 17 age groups has been presented for the different tasks they had undertaken for the assessment of their motor performances. Except for a few tasks, (e.g.. Medicine ball throw, Pull-up and Push-up) the group under 15 years of age has performed almost at the same level of the group under 17 years of age which points towards reverse relative age effect (RAE). In fact during the process of data taking, an intense eagerness was observed among the handball players under 15 group to outperform the senior players in all the tests given to them. This degree of enthusiasm was seldom observed in other age groups.

Figure 1. Comparative study (Mean and Standard Error) of performances of different age groups (under 15 and under 17) in different tasks

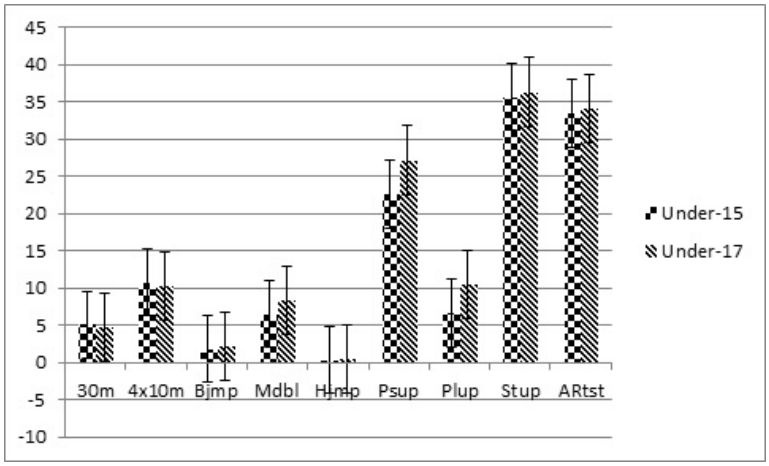
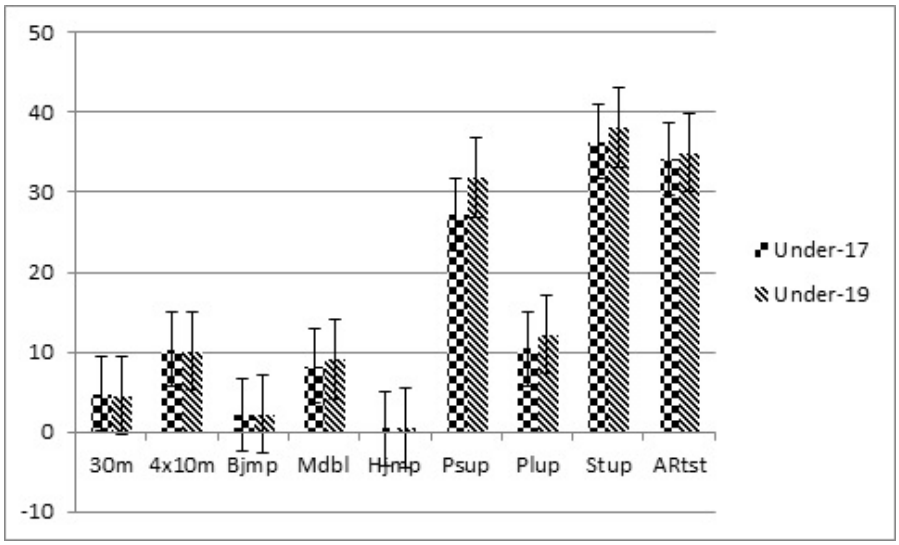


Figure 2. Comparative study (Mean and Standard Error) of performances of different age groups (under 17 and under 19) in different tasks



Legends(x-axis): 30m – 30m dash, 4x10m – 4x10m shuttle run, Bjmp – Broad jump, Hjmp – High jump, Psup – Push up, Plup – Pull up, Stup – Sit up, ARtst – Astrand-Ryhming step test.

It can be seen from the fig. 2 that in the run section, Medicine ball throw section as well as in high jump section the performances of both groups are comparable.. Actually performances of some players of lower age group were at the same level of that of higher age group. In this graphical representation we do not get a clear picture of RAE. From the figure 2 one can infer that except for push-ups the performance level in different tests have reached an almost plateau which is not expected at this early stage. An increasing trend is expected at the competitive level if we accept the hypothesis of Relative Age Effect (RAE)..However, in the cases we have studied so far, no such clear indication could be found. This is further vindicated by the calculation of maximal aerobic speed (MAS) of the three groups of handball players under study as shown in Table 8.

Table 8. A comparative study of maximal aerobic speed (MAS) of handball players

Age group ->	**Under - 15**	**Under - 17**	**Under - 19**
MAS (km/hr)	15.05 ± 1.07	15.86 ± 0.62	16.20 ± 0.82

Finally we have analysed the data of tests for the handball players under 15 and under 19 age groups to see the presence of a RAE. The results are shown in Table 8. One-way ANOVA followed by Post-hoc analysis was also done. Since the players of one of these groups have quite a bit of experience, the comparison of these two groups needs special consideration.

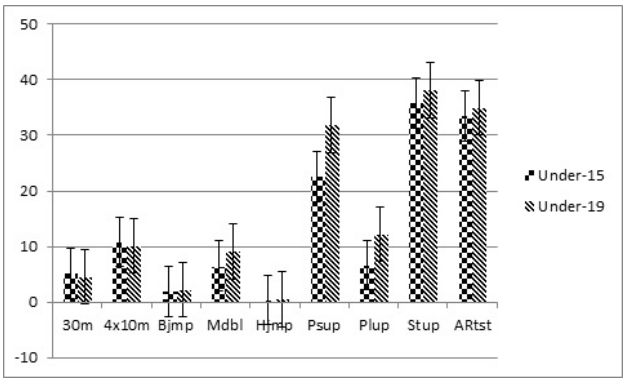
Table 9. Results for ANOVA with Post-Hoc analysis on different tests of motor performance between groups under 15 and under 19

Items	Diff	SE	Q	F	Q value (Table)	P-Value	$F_{critical}$
30 m dash (s)	0.52	0.0744	7.0160	13.0638	2.83	$1.84x10^{-5}$	3.1452
4 x 10m Shuttle Run (s)	0.67	0.1091	4.5545	10.6533	2.83	$1.05x10^{-4}$	3.1452
Standing Broad jump (m)	0.28	0.0266	10.554	25.1315	2.83	$1.01x10^{-8}$	3.1452
Medicine ball Throw (m)	2.65	0.2058	12.8780	44.6202	2.83	$1.01x10^{-12}$	3.1452
Standing High Jump (m)	0.12	1.3696	9.0025	23.8520	2.83	$2.08x10^{-8}$	3.1452
Push-up (n)	9.20	1.9529	4.7119	5.5719	2.83	$5.95x10^{-3}$	3.1452
Pull-up (n)	5.61	10.394	0.5397	17.3301	2.83	$1.05x10^{-6}$	3.1452
Sit-up(n)	2.43	0.2102	12.6734	39.4352	2.83	$1.01x10^{-12}$	3.1452
Astrand-Ryhming Step Test (n)	1.51	28.6133	0.2948	5.1051	2.83	$8.86x10^{-3}$	3.1452

It can be inferred from the table 9 that as P-values are quite small and F is greater than Fcritical, the variation in means of the tests is quite significant. However, for pull-ups and Astrand-Ryhming step tests we have got Qs which are smaller than the table value of Q (2.83) which indicates a non-significant variation. The most important feature of this study is that the players of upper age group (Under 19) did not show any remarkable achievements by having more time in practices.

In fig. 3 we have presented a comparative study on the performances of the handball players of age group under 15 and age group under 19. For these age groups, the p values are quite small but it is indicative of a competitive increase in the performance level of players of lower age group. If we look critically at the figure we may come up with an opinion that with increasing age the motor performances of the handball players show an upward trend which corroborates the Relative Age Effect (RAE) hypothesis. However, sometimes the juniors in competition with seniors push themselves so assiduously that they outperform the seniors. This may be the evidence of the RAE reversal we theorized despite the fact that generally the junior players are not expected to surpass the performance levels of higher age group.

Figure 3. Comparative study (Mean and Standard Error) of performances of different age groups (under 15 and under 19) in different tasks



Handball is a high intensity ball game. Strength, stamina, excellent ball skills, strong teamwork and tactics are vital for success in Handball. Generally it is perceived that with age and experience the maturity of a player comes. Relative Age Effect is not only observed in all types of ball games, it is also one of the key factors in identification of talents in Handball games. Usually the motor performance of the players improves with hours of practice they put either in their training sessions or in the matches they play. In our study we have found significantly better performances of senior players than their lower age group counterparts in standing high jump, medicine ball throw and pull-ups. However, the lower age group players have shown exceptional zeal in doing better in all the tests. The flavor of this kind of intense motivation can be seen from the next three figures (4 - 6).

Figure 4. Comparative study of performances of three age group handball players in 30 metre dash for testing speed (Mean ± SD).

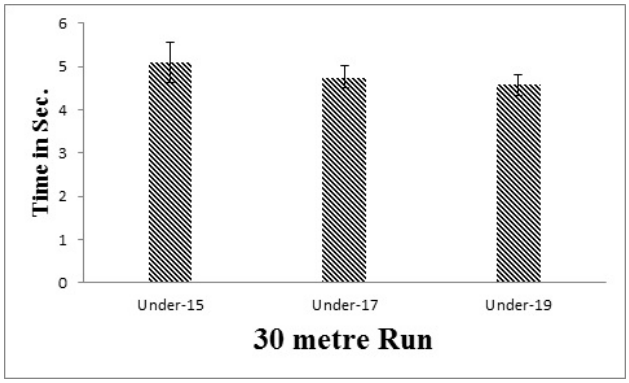


Figure 5 Comparative study of performances of three age group handball players in 4 X 10m shuttle run for testing agility (Mean ± SD).

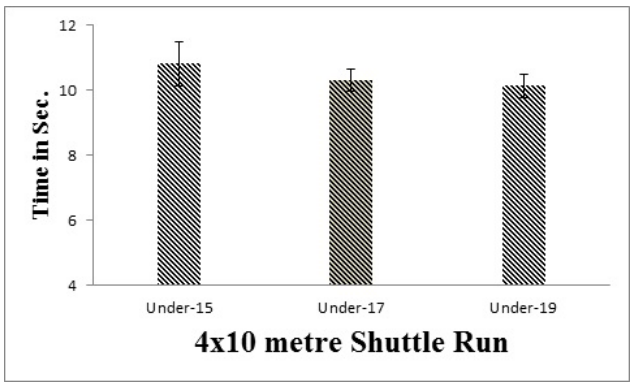
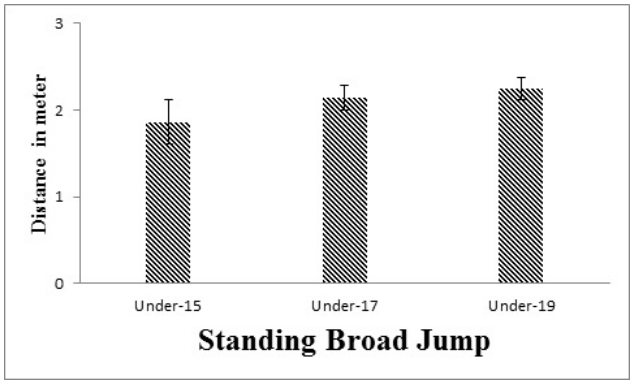


Figure 6 Comparative study of performances of three age group handball players in Standing broad jump for testing power (Mean ± SD).



In the literature one can get only a limited number of studies that have reported assessments of some the handball-specific characteristics and anthropometric measurements of junior as well as senior level handball players [1,6,34,35]. As per the study of [36] for the elite volley ball players with average age of 16.4 years, the height, body mass and standing broad jump values are 189 ± 3 cm, 75.6 ± 5.9 kg and 231 ± 11 cm respectively, whereas in our case the corresponding values for age is 16.86 years, body mass is 55.86 ± 8.5 kg, height is 165 ± 6 cm and jump length is 224 ± 13 cm Despite having lower body mass and height the local handball players have executed comparable broad jumps which can be treated as a good indicator of agility. For quality handball players the requirements are very specific – good strength, agility, explosive power, speed, endurance and cardiovascular endurance Now, if one looks critically at our data one can discern that the players of different age groups of West Bengal satisfy more or less the aforementioned criteria. What actually needed is to follow a disciplined protocol which will enhance their performances in the tournaments. In order to identify talents amongst these players clubs and federations should look at the scientific analyses of the continuous performances in training as well as match sessions. Here we can add our observation – the performances in different tests should be judged along with the degree of motivation. The outcome of our study clearly sends a signal that relative age effect (RAE) can be reversed by enthusiasm of the participants to surpass one's self in practical situations [27,37].

Conclusion

We may conclude by offering two explanations to understand why a RAE reversal may occur.- one is psychological. Players in the lower age group demonstrate higher than average resilience due to their ability to overcome age limitations. Secondly, in order to show their competence against their relatively older and bigger peers, the players of lower age group try to work harder, showing a positive peer effect which generates resilience and improved motivation. The disadvantage with which they have started will eventually work in their favor These dark horses are better equipped to overcome subsequent obstacles. Similar phenomenon of reversal of relative age effect (RRAE) has been observed in the training programme for junior table tennis players organised in the Yuba Bharati Krirangan Stadium in Kolkata, India in 2019, where a large assorted group of young adults gathered for training. So, we feel and have proved that the advantage the older players enjoy due to their earlier entry can be overtaken by the younger generation with strong determination imbibed in them by their coaches and trainers. However, we need to emphasise

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author, [RB], upon reasonable request.

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