Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/15383
DOI URL: http://dx.doi.org/10.21474/IJAR01/15383

RESEARCH ARTICLE

CHANGE OF PERFORMANCE CHARACTERISTICS IN DIFFERENT AGE GROUP OF KHO KHO PLAYERS

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Manuscript Info

Manuscript History
Received: 15 July 2022
Final Accepted: 17 August 2022
Published: September 2022

Key words:-
Anthropometric Measurement, Physical Fitness, Kho-Kho, Speed Endurance, Agility

Abstract

In India, khokho is one of the oldest and most well-known tag games. The purpose of the study was to compare the physical fitness parameters and anthropometric parameters among the three age groups of Kho-Kho players as physical fitness and anthropometricparameters are the most important factors to execute performance in competitive situation. To accomplish the purpose of the study BMI, Arm length, Foot length, speed, agility and speed endurance were taken as the variables.Toconduct the study total 45girls' subjects were selected from three different age group of Kho-Kho. The mean and S.D. of scores of each variables were computed, there after 'F' test was computed to find out the significance of differences among the score of each variable of physical fitness and anthropometric parameters among three groups of Kho-Kho players and LSD was computed to find out the significant difference among three groups. There was a gradual increase of height and body weight with age. The BMI of the junior group(18.03 ± 2.55 kg/m^2) was the lowest and the most senior group(20.02 ± 1.57 kg/m^2) was highest.The speed of the middle age group(7.69 ± 0.34sec) was best. The agility of the junior group(10.97± 3.07sec.) showed best than the other groups. The speed endurance of middle group(81.13 ± 7.15sec) was better than the other two groups. The average foot length of junior most groups (21.86 ± 1.24cm) was lowest and the middle aged group(22.86 ± 1.12cm) was highest. The average arm length of junior most group(62.80± 4.17cm) lowest and the senior most group(69.53 ± 4.85cm) was highest.It may conclude thatthe characteristics of anthropometric parameters and physical fitness variables vary with the different age but no such specific direction of increase or decrease of such variables is drawn.

Introduction:-

A highly regarded indigenous sport in India is kho-kho. [23][15][6] In India, khokho is the most widely practised traditional sport.Kho-Kho is a very intricate and strategic sport.Kho-Kho is a tag sport in which teams of twelve players attempt to avoid being touched by members of the opposing team; only nine players from each team enter the field. It is one of the two traditional tag games most played in South Asia, along with Kabaddi.It is played elsewhere besides South Asia (primarily Bangladesh, India, and Pakistan).[22]KhoKho's ancestry is difficult to

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determine, but many historians think that it is a modified version of the game "Run Chase," which in its most basic form entails chasing and touching.[12]Fast and furious action is needed in khokho.[8]

Physical fitness is the state of having the optimum possible functioning of the heart, blood vessels, lungs, and muscles.[9]The primary goal of sports training is the enhancement and maintenance of physical fitness.[23]Physical fitness forwards an athlets for better athletic performance. Athletes should develop the ability to play the game with good skill and perform consistently well.[24]Naturally kho-kho game is vigorous and combative types. For excellent execution of the kho-kho skills like dodging, feinting, and bursts of speed players at individual level requires the variables of stamina, endurance, strength, and agility.[12]For develop excellent physical Fitness, Kho-Kho players requires important variables like Speed, Explosive Strength,VO_2 Max, Agility, Flexibility etc.[10]In quick games and sports like basketball and khokho, agility and speed are crucial elements. Players on both the offensive and defensive sides can change directions quickly and with good speed, but switching positions is uncommon.[18]Due to the need of swift movements in confined spaces, kho-kho games require excellent agility, explosive strength, and endurance.[28]Age is a crucial biomarker that reveals athletes' performance traits.Physical function changes as people age.Different games may be appropriate for different ages.[2]

Performance is determined by endogenous variables like anthropometric, genetic and physiological traits.[16][21] Several researchers hypothesisedthat various body types, shapes and proportions are advantageous for various types of physical activity.[17][13][24] A number of anthropometric traits, including body composition and somatotype, have been linked to athletic success.[7][11]An athlete's ideal physique, successful participation and level of performance for a certain sport may be determined by their anthropometric and physical attributes.[14] "Body types" play an important role in sports.Anthropometric measurements have shown a relationship between physical attributes, body type, and athletic ability.Height, weight, and other anthropometric factors are extremely important to player performance in all games.The most crucial deciding factors in winning games are anthropometric characteristics and physical prowess, particularly when both teams' skill and planning levels are comparable.Anthropometric measurements are important for determining weight and height at various ages and for assessing one's growth.[5]

In many games, physical structure, particularly height and arm length, provides a clear and decisive advantage.Similarly, segmental length of individual body parts, specifically arm length, provides a significant advantage in certain athletic events and games.[29]The ability to balance, move quickly, and direct voluntary movements of people toward a goal are all physical traits that are related to the feet, particularly when changing directions and maintaining balance while using attacking and defending techniques.When performing fundamental motions like standing, running, and jumping, the length and width of the foot are very important.[5]

Some specific anthropometric traits are necessary to succeed in a sporting event.There are certain distinctions between athletes' physical structures and composition in respective to team and individual sports.[19]The ability to perform daily tasks may be limited by an individual's physical and physiological characteristics, including skill performance and anthropometric variables.Butin sports field efficiency of the execution of movement and sustainable capacity may not be similar for athletes with same height and weight. Consequently, segments of the body part vary in terms of their length, breadth, and circumference.[31]Anthropometric and Physical performance measurements of running, hop-testing, and jumping were found to have a significant and relevant association.[1]

There are appropriate research-based criteria for selecting standard players, which are also lacking in KhoKho.Research-based experience is always beneficial in the development of various games and sports, which is also important for 'KhoKho' field.[8]The aim of present study is to find out the selected anthropometric determinants and physical fitness variable as the performance Characteristics of Kho-Kho and to compare them among three different age groups.

Materials and Methods:-

Selection of Subjects:

To conduct the study total 45 girls Kho-Kho players were taken and their age ranges between 14 to 23 years. All the subjects were selected from BandelKodaliaSangha, KheyaliSangha, Hooghly and Jadavpur University. All subjects were equally divided into three groups. Each group had possessed with 15 players and the groups were namely Gr-A, Gr-B and Gr-C. The Gr-A was of 14-16 years, Gr-B of 16-18 years and Gr-C of 18-23years.

Selections of variables:

B.M.I, Foot length and Arm length were taken as Anthropometric variables and Speed, Agility and Speed Endurance were taken as Physical Fitness variables.

Design of the study:

All the anthropometric measurements were taken such as height and weight for BMI, Arm length and foot length etc. After that the test of 50 meter dash and4×10 mtrshuttle run were taken to measure speed and agility as fitness variables. Then 30 minutes rest has been given. After 30 minutes rest 400 meter run were conducted to measure speed endurance.

Statistical Technique:

The mean and S.D. of scores of each variables were computed, there after 'F' test was computed to find out the difference among the score of each variable of physical fitness and anthropometric parameters among three groups of Kho-Kho players, the LSD was computed to find out the significant difference among three groups. The level of significance was set at 0.05 level ($p<0.05$).

Results and Discussion:-

Table no. 1:- Mean, S.D. of age, height, weight and BMI of different Age Groups.

Groups	Mean±S.D. of age (yrs.)	Mean±S.D. of height (cm.)	Mean±S.D. of weight (kg.)	Mean±S.D. of BMI(kg./mtr.^{2})
A	15.20 ± 0.41	144.73 ± 8.97	38.06 ± 7.94	18.03 ± 2.55
B	17.33 ± 0.48	153.06 ± 8.31	44.53 ± 5.04	19.04 ± 2.07
C	21.20 ± 1.97	153.46 ± 6.03	46.60 ± 3.68	20.02 ± 1.57

It was observed from table-1, that the Mean & S.D. of age of group A was 15.20 ± 0.41yrs., group B was 17.33 ± 0.48yrs. and group C was 21.20 ± 1.97yrs. From the above table it was clear that the Mean and S.D. of height of Group A was 144.73 ± 8.97cm., group B was 153.06 ± 8.31cm. and group C was 153.46 ± 6.03cm. It has observed that there was a linear progression of height with age. This was very inevitable as the height increases with the anatomical growth and that continued generally up to the age of 18yrs$^+$ & above in case of girls. It has indicated that the Mean and S.D. of weight of group A was 38.06 ± 7.94kg., group B was 44.53 ± 5.04kg. and group C was 46.60± 3.68kg. There was a gradual increase of body weightalso with age. It was simply due to the growth pattern of the considered age group. The Mean and S.D. of BMI of the group A was 18.03 ± 2.55 kg./mt.^{2}, the group B was 19.04 ± 2.07 kg./mt.^{2} and the group C was 20.02 ± 1.57 kg./mt.^{2}. The Mean score of the BMI of group A was lowest and the group C was highest.

Table no. 2:- ANOVA on BMI Component of Different Age Groups.

Source	Sum square	d. f.	Mean square variance	'p' value	F-Ratio
Between Gr.	29.663	2	14.831	0.045*	3.350
Within gr.	185.969	42	4.428		
Total	215.632	44			

Level of significance at 0.05%

Table-2 shows that there was significant difference existed among the groups as the 'p' value was less than the significance level 0.05. Hence to found the relative comparativeness between the said 3 groups and to understand the difference between groups the LSD Post Hoc test were applied.

Table no. 3:- Post Hoc Tests (LSD), Multiple Comparisons of BMI.

Group (I)		Group (J)	Mean Difference (mean of group I-Mean of group J)	Std. Error	Sig.	95% confidence Interval	
						Lower Bound	Upper Bound
14$^+$-16 Yrs.	Gr. A	B	-1.00733	0.76836	0.197	-2.5579	0.5433
		C	-1.98867	0.76836	0.013**	-3.5393	-0.4381
16$^+$-18 Yrs.	Gr. B	C	-0.98133	0.76836	0.209	-2.5319	0.5693

BMI is an energy indicator that correlates total mass and height, allowing athletes to be compared across varied distances.[27]It has seen from table-3, that there was significant difference existed only between group A and C. It has reported similarly that the BMI increased significantly with the increase of age and this result almost support the present investigation.[3][4]Body mass index above 23 kg/m^2 was strongly correlated with nearly all Kho-Kho abilities, with an overall coefficient of correlation was 0.83.[8] Marc et al study's shows an optimum BMI of 19.8 kg/m^2, despite the fact that the top ten performers of all time have BMIs ranging from 17.5 to 20.7 kg/m^2.[20]

Table no. 4:- Mean, S.D. of foot length, arm length, speed, agility, speed endurance of different Age Groups.

Groups	Mean ± S.D. of foot length (cm.)	Mean ± S.D. of arm length (cm.)	Mean ± S.D. of speed (sec.)	Mean ± S.D. of agility(sec.)	Mean ± S.D. of speed endurance(sec.)
A	21.86 ± 1.24	62.80± 4.17	8.12 ± 0.38	10.97± 3.07	101.33 ± 5.85
B	22.86 ± 1.12	68.26 ± 3.30	7.69 ± 0.34	11.33 ± 0.68	81.13 ± 7.15
C	22.80 ± 1.08	69.53 ± 4.85	8.34 ± 0.31	11.34 ± 0.65	97.53 ± 6.18

The Mean and S.D. of foot length of the group A was 21.86 ± 1.24 cm., the group B was 22.86 ± 1.12 cm and the group C was 22.80 ± 1.08 cm. The Mean score of the foot length of group A was lowest and the group B was highest. From table value it was shows that there was a difference in foot length among the groups.

The significance of statistical differences in foot length among the groups was assessed by applying "F" test.

Table no. 5:- ANOVA on Foot Length Component of Different Age Groups.

Source	Sum square	d. f.	Mean square variance	'p' value	F-Ratio
Between Gr.	9.378	2	4.689	0.038^{**}	3.525
Within gr.	55.867	42	1.330		
Total	65.244	44			

Level of significance at 0.05%

From table- 4; it was cleared that there was significant difference existed among the groups as the 'p' value was less than the significance level 0.05. Hence to found the relative comparativeness between the said 3 groups and to understand the difference between groups the LSD Post Hoc test were applied.

Table no. 6:- Post Hoc Tests (LSD), Multiple Comparisons of Foot length.

Group (I)		Group (J)	Mean Difference (mean of group I - Mean of group J)	Std. Error	Sig.	95% confidence Interval	
						Lower Bound	Upper Bound
14^{+}-16 Yrs.	Gr. A	B	-1.00000	0.42113	0.022^{**}	-1.8499	-0.1501
		C	-0.93333	0.42113	0.032^{**}	-1.7832	-0.0834
16^{+}-18 Yrs.	Gr. B	C	0.06667	0.42113	0.875	-0.7832	0.9166

Significant differences were found between group A and B & between group A and C.Darwish in his study found thatfoot length, transitional speed test, and agility all significantly correlate with one another.[5]Nearly all KhoKho skill exhibited a strong link with long leg length (40 inches and above), and the total coefficient ofcorrelation was 0.82.[8]

The Mean and S.D. of arm length of the group A was 62.80± 4.17cm., the group B was 68.26 ± 3.30cm. and the group C was 69.53 ± 4.85cm. The Mean score of the arm length of group A was lowest and the group C was highest.Singh& Jaiswal, (2016)in their study also found almost similar results about arm length i.e.72.54 ± 3.6cm (ages spanning 17 to 26 years).[28]

Table no. 7:- ANOVA on Arm Length Component of Different Age Groups.

Source	Sum square	d. f.	Mean square variance	'p' value	F-Ratio

Between Gr.	384.133	2	192.067	0.000**	11.095
Within gr.	727.067	42	17.311		
Total	1111.200	44			

Level of significance at 0.05%

From table- 7; it was cleared that there was significant difference observed among the groups of Kho-Kho players at 0.05 levels in respect of arm length. To understand the difference between groups the LSD Post Hoc test were applied.

Table no. 8:- Post Hoc Tests (LSD), Multiple Comparisons of Arm length.

Group (I)		Group (J)	Mean Difference (mean of group I - Mean of group J)	Std. Error	Sig.	95% confidence Interval	
						Lower Bound	Upper Bound
14+-16 Yrs.	Gr. A	B	-5.46667	1.51926	0.001**	-8.5327	-2.4007
		C	-6.73333	1.51926	0.000**	-9.7993	-3.6673
16+-18 Yrs.	Gr. B	C	-1.26667	1.51926	0.409	-4.3327	1.7993

Significant at .05 level

It has seen that there was a significant difference existed between group A and B & group A and C but there was no significant difference between group B and C.

KhoKho skills were shown to have overall coefficients of correlation of 0.75, 0.59, 0.68, 0.65, and 0.68 with regard to height, weight, BMI, arm length, and leg length. The findings showed a significant ($p<.01$) relationship between all of the anthropometric factors and KhoKho abilities. It has been observed that having a long arm (32 inches or more) has a high link with almost all KhoKho skills, with an overall coefficient of correlation of 0.80.[8]

The mean and S.D. of speed of the group A was 8.12 ± 0.38sec., group B was 7.69 ± 0.34sec. and group C was 8.34 ± 0.31sec. The speed of the middle age group B was maximum.

Table no. 9:- ANOVA on Speed Component of Different Age Groups.

Source	Sum square	d. f.	Mean square variance	'p' value	F-Ratio
Between gr.	3.248	2	1.624	0.000**	13.371
Within gr.	5.101	42	0.121		
Total	8.348	44			

Level of significance at 0.05%

From table- 9; it was cleared that there was significant difference existed among the groups as the 'p' value was less than the significance level 0.05. Hence to found the relative comparativeness between the said 3 groups and to understand the difference between groups the LSD Post Hoc test were applied.

Table no. 10:-Post Hoc Tests (LSD), Multiple Comparisons of speed.

Group (I)		Group (J)	Mean Difference (mean of groupI-Mean of groupJ)	Std. Error	Sig.	95% confidence Interval	
						Lower Bound	Upper Bound
14+- 16 Yrs.	Gr.A	B.	0.42600	0.12725	0.002**	0.1692	0.6828
		C	-0.22133	0.12725	0.089	-0.4781	0.0355
16+-18 Yrs.	Gr. B	C	-0.64733	0.12725	0.000**	-0.9041	-0.3905

Significant at .05 level

It has seen from the above table that the mean difference between group A and B was significant and between group B and C was significant. In the table of ANOVA it has declared that there were significant differences in case of speed of these three groups. We know that speed is stimulated by leg explosive strength and the muscle attached

with pelvis which indicates that the maturity of muscles growth is very important and it is mainly a genetic factor. The speed is measured by stride length and stride frequency and the stride length is largely influenced by the lower limb length. At this age group, in the late adolescents' period the growth pattern took maximum spurt with sudden increase of strength. All these factors are very much boosting in case of speed performance.In terms of speed, Sahu D. P., (2019) observed that national level KhoKho player exhibit greater sprinting performance when compared to state level KhoKho players.[26]But the present researcher has not found any such speed related result when taking into account their age group.

The Mean and S.D. of the time taken to cover 4×10 mtr., asshuttle run, which was indicated the agility of the group A was 10.97± 3.07sec.and group B was 11.33 ± 0.68sec. and group C was 11.34 ± 0.65sec. The mean score of the agility component of group A was better followed by group B and group C. Singh &Jaiswal, (2016),in their study also found almost similar results about agility i.e. 12.1 ± .65sec. (ages spanning 17 to 26 years &agility run test was of 4x15mtr.).[28]

Table no.11:- ANOVA on agility component of different age groups.

Source	Sum square	d. f.	Mean square variance	'p' value	F-Ratio
Between Gr.	1.315	2	0.658	0.827	0.191
Within gr.	144.916	42	3.450		
Total	146.231	44			

Level of significance at 0.05%

From the above table of ANOVA it has clear that there was no significant difference in case of agility among those three groups. We know that agility is a component which is a combination of speed and quick turning ability. These two factors again stimulated by leg explosive strength and the muscle of pelvis which indicate that the maturity of muscles growth is very important. Here the present researcher considered the three groups whose age totally ranged between 14 to almost 23yrs. In this age group the anatomical structure almost became matured and the Physiological functioning became maximum. As the participants were from the village area so naturally they are habituated enough with high intensity movement as considering their daily life style. Hence considering the said different factors it is clear that, in said specific age range there were a little possibility to differ in case of a combined effect of speed in a very short distance and turning ability as also they are mainly stimulated by genetic factor.

Higher agility players (7.96 seconds and lower) had strong relationships with almost all Kho-Kho skills, with an overall coefficient of correlation of 0.86.[8]In a different study in the area of agilitySahu D. P., (2019)observered that national level KhoKhoplayers exhibit better agility performance in comparison to state level KhoKho players.[26]Female khokho players at different levels were shown to have significant differences in their agility, which gradually increases from the sub-junior group to the senior group, according to Roy et al. (2016).[23]

The Mean and S.D. of the time taken to cover 400mtr., which indicates the speed endurance of the group A was 101.33 ± 5.85sec., group B was 81.13 ± 7.15sec. and group C was 97.53 ± 6.18sec. The Mean score of the speed endurance component of group B was better followed by group C and Group A.

Table no.12:- ANOVA on Speed Endurance Component of Different Age Groups.

Source	Sum square	d. f.	Mean square variance	'p' value	F-Ratio
Between Gr.	3457.200	2	1728.600	0.000**	41.947
Within gr.	1730.800	42	41.210		
Total	5188.000	44			

Level of significance at 0.05%

It shows that there was significant difference observed among the three groups of Kho-Kho players at 0.05 levels. So, to understand the difference between groups the LSD Post Hoc test was applied.

Table no. 13:- Post Hoc Tests (LSD), Multiple Comparisons of Speed endurance.

Group (I)	Group(J)	Mean Difference (mean of group I -	Std. Error	Sig.	95% confidence Interval	
					Lower	Upper

			Mean of group J)			Bound	Bound
14^{+}-16 Yrs.	Gr. A	B	20.20000	2.34406	0.000**	15.4695	24.9305
		C	3.80000	2.34406	0.112	-0.9305	8.5305
16^{+}-18 Yrs.	Gr. B	C	-16.40000	2.34406	0.000**	-21.1305	-11.6695

Significant at .05 level

In the table of ANOVA it has declared that there were significant differences in case of speed endurance of these three groups. We know that speed endurance is stimulated by leg explosive strength and through the aerobic capacity which indicate that the maturity of muscles growth is very important and it is mainly a genetic factor. At this age group, in the late adolescents' period the growth pattern took maximum spurt with sudden increase of strength. All these factors are very much boosting in case of speed endurance performance.Ghoshet.al (2014) in a different study found that the overall coefficients of correlation between KhoKhoskillswith cardio-respiratory endurance,agility and 50m dash were 0.58, 0.60, and 0.65 respectively and suggested that all the selectedphysicalvariableswere significantly($p < .01$)relatedwiththeKhoKhoskills.[8]

Conclusions:-

On the basis of result obtain it has concluded that there was a gradual increase of height and body weight with age.The speed of the middle age group was best than the other two groups.The agility of the junior mostgroup showed better than their senior groups.The speed endurance of middle group was better than the other two groups. The BMI of the senior group was the highest and the junior most group was lowest. The average foot length of junior most groupwas lowest and the middle aged group was highest.The average arm length of junior most group lowest and the senior most group was highest. Finally, the present study concludes that specific age groups are characterized with some specific anthropometric and fitness variables. This study provides reference values of anthropometric characteristics and physical fitness status about the different age group kho-kho players which may be informative for coaches to frame and control the training process in order to enhance talent identification in khokho, as well as players' performances.

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