

# Kinanthropometric Positional Differences Between Senior and Junior National Male Hockey Players

Sukhdeep Singh Kang\*

## ABSTRACT

*The present kinanthropometric study has been conducted on senior (n=26) and junior (n=42) national male Hockey players of India. Seven anthropometric parameters, like decimal age, height, body weight, four skinfolds, and three derived parameters, like height weight ratio, % body fat, % lean body mass and four skinfolds total, were taken by using standard instruments and standardized techniques. The results revealed that senior Hockey players examined were older, taller, heavier and fattier, with respect to junior counterparts. Playing position wise, it was observed that goalkeepers and defenders were found older, taller, heavier and fattier with respect to midfielders followed by forwards. Decimal age, body height and body weight has shown significant differences between senior and junior Hockey players in groups, position wise in groups and within groups. There was found non-significant differences between senior and junior Hockey players for % body fat, % lean body mass and four skinfold total. On comparing with international Hockey players studies, Indian senior players were found of lesser age, having same body weight and height and lesser % body fat, with respect to international players, But reciprocal results were investigated for Indian junior Hockey players who were found younger, lighter, shorter and lesser amount of % body fat, with respect to other international Hockey players' studies.*

## KEYWORDS

Anthropometric parameters, Height, Body Weight, % body fat, Hockey players

## INTRODUCTION

Morphological characteristics and body composition have been known to be fundamental to excellence in Athletics performance [Mathur & Salokun 1985]. Specific Athletics events require different body types and weights for maximal performance [ADA, 1987]. Today, it has been widely accepted by the experts that top performance in sports is achieved if an athlete possesses the basic anthropometric characteristics, suitable for the event. Therefore, the athletes, in a particular sport, must possess such typical characteristics which are of advantage to their performance. Body composition also makes an important contribution to an individual's level of physical fitness for performance;

particularly, in such sports that require one to carry one's body weight over a distance, which is facilitated by a large proportion of active tissue (muscle) in relation to a small proportion of fat tissue [Sodhi, 1991; Singh & Malhotra, 1989; Sharma et al, 1990 and Jain, 2004].

The main purpose of this study was to find out the kinanthropometric differences between senior and junior Hockey players, as a whole group, position wise, within groups and also compared with other international studies to explore the selected anthropometric parameters of male Hockey players, which helps us to select children at early ages for talent identification and to make guidelines and counseling about their body composition and physical fitness.

\* Junior Scientific Officer, Department of Sports Anthropometry, SAI NSNIS, PATIALA



## METHODOLOGY

The present anthropometric data have been taken on elite Indian senior and junior male Hockey players, in April & June 2013 during national Hockey camp, held at SAI, NSNIS, Patiala, as shown in Table 1. Seven anthropometric measurements like decimal

age, body height, body weight and four skinfolds were taken with standard instruments and standard techniques (Ross et, al 1980 ; Durnin & Womersley, 1974). Appropriate statistic is used to analyze the data (i.e. mean, standard deviation, student 't' test and ANOVA F test).

**Table-1: Sample Size of Elite Indian Male Hockey players Position wise**

	Junior Hockey players	Senior Hockey Players
Position wise Group	N	N
Defenders	04	05
Forwards	20	13
Midfielders	14	05
Goalkeepers	04	03
Total Number	42	26

## RESULTS & DISCUSSION

In this study, senior and junior Hockey players are compared as whole groups, position wise between groups, position wise within groups and also compared with international hockey players' anthropometric studies.

### Decimal Age (years)

Table 2 depicted the mean decimal age of junior and senior male Hockey players in total and playing position wise. It was found that junior Hockey male players decimal age (19.11 years) has shown significant differences (t test value= 11.33 at 5% level) with respect to senior counterpart (24.63 years). While comparing senior and junior Hockey players, playing

position wise, decimal age has shown significant differences at 1% level between defenders (3.90\*\*), forwards (9.01\*\*), midfielders (11.62\*\*) and goalkeepers (6.50\*\*), respectively. In junior Hockey players, goalkeeper were found older followed by defenders, midfielders and forwards having no significant ANOVA f value (2.04), but in senior Hockey players, decimal age has shown significant ANOVA f value (4.17\*) in which goalkeepers were found older followed by midfielder, forwards and defenders. On Applying Scheffe's Post Hoc Test, it was examined that decimal age mean difference was found significant at 5% level between forwards and goalkeepers (shown in Table 2, 9 & 10).

**Table-2: Decimal Age (in Years) of Junior and Senior Hockey Players in Total and Position wise**

S. no	Decimal Age (in Years)	N	Junior Hockey Players				N	Senior Hockey Players				't' test Values
			Mean	SD	Mini mum	Maxi mum		Mean	SD	Mini mum	Maxi mum	
1	Total Group	42	19.11	0.95	16.79	21.07	26	24.63	3.58	19.67	35.26	11.33*
2	Defenders	04	19.44	1.31	17.89	21.07	05	23.69	2.53	20.19	26.87	3.90*
3	Forwards	20	18.92	0.92	16.79	20.43	13	23.71	2.98	19.67	30.23	9.10*
4	Midfielders	14	19.02	0.88	17.58	20.24	05	24.40	2.73	20.49	27.57	11.62*
5	Goalkeepers	04	20.10	0.50	19.46	20.59	03	30.26	4.72	25.87	35.26	6.50*
	ANOVA F Values		2.04					4.17*				

T Values: \*Significant at 5% level (for DF=67, 1.98; DF=8, 2.30; DF=32, 2.02; DF=18, 2.10; DF=6, 2.44)  
ANOVA F Values: \* Significant at 5% level (DF=22, 2.99; DF=38, 2.84)



**Body Height (cm)**

Senior Hockey players were found 4cm taller with respect to junior ones and has shown significant t test value(2.51\*) at 5% level. On comparing senior and junior players, playing position wise, there was found non-significant differences between all four positions. In junior Hockey players among playing position wise, the f ratio of ANOVA has shown significant differences (5.36\*) at 5% level. Defenders were found

tallest followed by goalkeepers, forwards and midfielders, respectively. On Applying Post hoc t test for body height among junior Hockey players' position wise, significant results were observed between defenders and forwards and defenders and midfielders. Body height has shown non-significant f ratio of ANOVA for senior Hockey players among various positions (shown in Table3, 9 & 10).

**Table-3: Body Height (cm) of Junior and Senior Hockey Players in Total and Position wise**

S. no	Body Height (cm)	N	Junior Hockey Players				N	Senior Hockey Players				't' test Values
			Mean	SD	Mini Mum	Maxi mum		Mean	SD	Mini mum	Maxi Mum	
1	Total Group	42	171.86	6.66	156.70	193.80	26	175.43	6.98	165.60	191.00	2.52*
2	Defenders	04	181.60	8.86	174.70	193.80	05	181.42	7.88	170.30	191.00	0.04
3	Forwards	20	170.46	5.47	156.70	179.50	13	173.59	6.73	166.50	189.70	1.98
4	Midfielders	14	169.90	5.22	161.20	182.10	05	171.84	4.44	165.60	177.60	1.27
5	Goalkeepers	04	175.98	6.28	170.40	184.20	03	179.37	2.42	177.50	182.10	1.28
	ANOVA F Values		5.36*					2.78				

T Values:\*Significant at 5% level (for DF=67, 1.98; DF=8, 2.30; DF=32, 2.02; DF=18, 2.10; DF=6, 2.44)  
ANOVA F Values:\* Significant at 5% level (DF=22, 2.99; DF=38, 2.84)

**Body Weight(kg)**

Senior Hockey players (73.31kg) were found heavier with respective to junior players (63.33kg) by 10kg and has shown significant t test value (5.76\*\*) at 5% level. On comparing body weight of senior and junior Hockey players position wise significant differences of t test values were investigated between senior-junior forwards (5.66\*), midfielders (3.69\*) and goalkeepers (7.89\*) and non-significant 5%

differences between defenders. ANOVA f values were found significant at level among positions for Senior (4.91\*) and junior (7.50\*) players. For junior Hockey players, post hoc t test was found significant between defenders and forwards and defenders and midfielders as seen in body height; other positions has shown non-significant results for post hoc t test. In senior Hockey players, a significant difference was observed between defenders and forwards (12.37\*) as shown in Table 4 and 10).

**Table-4 : Body Weight (Kg) of Junior and Senior Hockey Players in Total and Position wise**

S. no	Body Weight (Kg)	N	Junior Hockey Players				N	Senior Hockey Players				't' test Values
			Mean	SD	Mini Mum	Maxi Mum		Mean	SD	Mini mum	Maxi Mum	
1	Total Group	42	63.33	7.84	46.50	87.10	26	73.31	8.95	60.00	92.00	5.76*
2	Defenders	04	76.65	11.98	63.50	87.10	05	82.10	11.09	65.00	92.00	0.91
3	Forwards	20	60.44	5.95	46.50	69.60	13	69.73	6.60	60.00	81.00	5.66*
4	Midfielders	14	62.61	5.76	53.50	73.20	05	69.30	6.67	62.00	80.00	3.69*
5	Goalkeepers	04	67.00	4.08	63.00	71.00	03	80.83	1.89	79.50	83.00	7.89*
	ANOVA F Values		7.50*					4.91*				

T Values:\*Significant at 5% level (for DF=67, 1.98; DF=8, 2.30; DF=32, 2.02; DF=18, 2.10; DF=6, 2.44)  
ANOVA F Values:\* Significant at 5% level (DF=22, 2.99; DF=38, 2.84)



### Height-Weight Ratio

Table 5 depicted mean height weight ratio of junior and senior Hockey players. junior players were found lighter with respect to senior players and has shown significant t test differences for height weight ratio (5.28\*) at 5% level. On comparing position wise, senior forwards and midfielders were recorded significantly

heavier with respect to junior forwards and midfielders; but, senior defender and goalkeepers has shown non-significant differences with respect to junior defenders and goalkeepers. On applying ANOVA, the f values for both junior and senior Hockey players were reported non-significant results among playing positions within senior and junior groups.

**Table-5: Height Weight Ratio of Junior and Senior Hockey Players in Total and Position wise**

S. no	Height Weight Ratio	N	Junior Hockey Players				N	Senior Hockey Players				't' test Values
			Mean	SD	Mini Mum	Maxi Mum		Mean	SD	Mini mum	Maxi mum	
1	Total Group	42	43.20	1.16	41.04	46.29	26	41.99	0.98	39.85	43.84	5.28*
2	Defenders	04	42.86	1.31	41.17	43.96	05	41.83	1.19	39.85	42.94	1.59
3	Forwards	20	43.49	0.88	42.25	45.29	13	42.22	1.04	40.62	43.84	5.08*
4	Midfielders	14	42.84	1.21	41.04	44.22	05	41.88	0.84	40.87	42.98	2.80*
5	Goalkeepers	04	43.36	2.02	41.69	46.29	03	41.49	0.76	40.92	42.35	2.11
	ANOVA F Values		1.01					0.52				

T Values:\*Significant at 5% level (for DF=67, 1.98; DF=8, 2.30; DF=32, 2.02; DF=18, 2.10; DF=6, 2.44)  
ANOVA F Values:\* Significant at 5% level (DF=22, 2.99; DF=38, 2.84)

### Body Fat (%)

As shown in Table 6, average % body fat was found slightly higher in senior Hockey players with respect to junior players and found non-significant differences between them. On comparing position wise between senior and junior players (forwards, midfielders, defenders and goalkeepers), it was

recorded non-significant results for all positions but senior players have shown slightly higher % body fat with respective to junior players in all groups. On applying ANOVA, the f values for both junior and senior Hockey players were reported non-significant results among playing positions within senior and junior groups.

**Table-6: % Body Fat of Junior and Senior Hockey Players in Total and Position wise**

S. no	% Body Fat	N	Junior Hockey Players				N	Senior Hockey Players				't' test Values
			Mean	SD	Mini Mum	Maxi Mum		Mean	SD	Mini mum	Maxi Mum	
1	Total Group	42	13.80	3.31	7.48	22.53	26	14.86	3.25	8.61	22.98	1.54
2	Defenders	04	14.47	3.66	10.25	17.61	05	16.28	2.69	12.71	29.20	1.11
3	Forwards	20	12.80	2.72	7.48	17.17	13	13.78	2.98	8.61	18.94	1.31
4	Midfielders	14	14.36	3.89	8.77	22.53	05	13.94	1.92	12.17	16.18	0.39
5	Goalkeepers	04	16.17	2.76	13.83	19.44	03	18.72	4.50	14.02	22.98	1.38
	ANOVA F Values		1.54					2.85				

T Values:\*Significant at 5% level (for DF=67, 1.98; DF=8, 2.30; DF=32, 2.02; DF=18, 2.10; DF=6, 2.44)  
ANOVA F Values:\* Significant at 5% level (DF=22, 2.99; DF=38, 2.84)

### Lean Body Mass (%)

As shown in Table 7, average % lean body mass was investigated slightly higher in junior Hockey players with respect to senior players and found non-significant

differences between them. On comparing position wise between senior and junior players (forwards, mid fielders, defenders and goalkeepers), it was recorded nonsignificant results for all positions; but,



junior players have shown slightly higher % lean body mass with respect to junior players in all groups. On applying ANOVA, the f values of % lean body mass for both

junior and senior Hockey players were reported non-significant results among playing positions within senior and junior groups.

**Table-7: % Lean Body Mass (LBM) of Junior and Senior Hockey Players in Total and Position wise**

S. no	% Lean Body Mass	N	Junior Hockey Players				N	Senior Hockey Players				't' test Values
			Mean	SD	Mini Mum	Maxi Mum		Mean	SD	Mini Mum	Maxi Mum	
1	<b>Total Group</b>	<b>42</b>	86.20	3.31	77.47	92.52	<b>26</b>	85.14	3.25	77.02	91.39	<b>1.54</b>
2	<b>Defenders</b>	<b>04</b>	85.53	3.66	82.39	89.75	<b>05</b>	83.72	2.69	79.70	87.29	<b>1.11</b>
3	<b>Forwards</b>	<b>20</b>	87.20	2.72	82.83	92.52	<b>13</b>	86.22	2.98	81.06	91.39	<b>1.31</b>
4	<b>Midfielders</b>	<b>14</b>	85.64	3.89	77.47	91.23	<b>05</b>	86.06	1.92	83.82	87.83	<b>0.39</b>
5	<b>Goalkeepers</b>	<b>04</b>	83.83	2.76	80.56	86.17	<b>03</b>	81.28	4.50	77.02	85.98	<b>1.38</b>
	<b>ANOVA F Values</b>		<b>1.67</b>					<b>2.85</b>				

T Values:\*Significant at 5% level (for DF=67, 1.98; DF=8, 2.30; DF=32, 2.02; DF=18, 2.10; DF=6, 2.44)

ANOVA F Values:\* Significant at 5% level (DF=22, 2.99; DF=38, 2.84)

#### Four Skinfold Total (mm)

As shown in Table 8, mean of four skinfold total was examined higher in senior Hockey players with respect to junior players, but found non-significant differences between them. On comparing position wise between senior and junior players (forwards, mid fielders, defenders and goalkeepers), it has also shown non-

significant test results for all positions; but senior players have shown slightly higher four skinfold total with respect to junior players in all sub-groups. On applying ANOVA, the f values of four skinfold total for both junior and senior Hockey players were reported non-significant results among playing positions within senior and junior groups.

**Table-8: Four Skinfold Total(mm) of Junior and Senior Hockey Players in Total and Position wise**

S. no	Four Skinfold Total	N	Junior Hockey Players				N	Senior Hockey Players				't' test Values
			Mean	SD	Mini Mum	Maxi Mum		Mean	SD	Mini mum	Maxi Mum	
1	<b>Total Group</b>	<b>42</b>	33.14	10.52	18.00	70.20	<b>26</b>	37.01	11.82	20.10	73.00	<b>1.68</b>
2	<b>Defenders</b>	<b>04</b>	34.90	11.30	22.60	44.80	<b>05</b>	41.26	10.28	29.20	57.70	<b>1.14</b>
3	<b>Forwards</b>	<b>20</b>	29.72	7.25	18.00	42.50	<b>13</b>	33.28	9.33	20.10	51.20	<b>1.66</b>
4	<b>Midfielders</b>	<b>14</b>	35.48	13.32	20.30	70.20	<b>05</b>	33.06	5.84	27.80	40.00	<b>0.67</b>
5	<b>Goalkeepers</b>	<b>04</b>	40.30	10.36	31.40	53.50	<b>03</b>	52.67	20.06	32.90	73.00	<b>1.59</b>
	<b>ANOVA F Values</b>		<b>1.54</b>					<b>3.30</b>				

T Values:\*Significant at 5% level (for DF=67, 1.98; DF=8, 2.30; DF=32, 2.02; DF=18, 2.10; DF=6, 2.44)

ANOVA F Values:\* Significant at 5% level (DF=22, 2.99; DF=38, 2.84)

**Table-9: Post Hoc't' test values for Male Junior Hockey Players among Different Playing Positions**

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
Height (cm)	Defender	Forward	11.14*	3.17	.013
		Midfielders	11.70*	3.28	.011
Weight (Kg)	Defender	Forward	16.21*	3.53	.001
		Midfielders	14.04*	3.66	.006

\*The mean difference is significant at the 0.05 level.



**Table-10: Post Hoc't' test values for Male Senior Hockey Players among Different Playing Positions**

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
Decimal Age (Years)	Forwards	Goalkeepers	-6.70*	1.93	.021
Body Weight (Kg)	Defender	Forward	12.37*	3.88	.036

\*The mean difference is significant at the 0.05 level.

Table 11 revealed the comparative anthropometric studies of different nations with present study. It was observed that china and Poland players were older followed by Malaysia, Switzerland, India senior of present study, Srilanka, Pakistan and India junior of present study respectively. Body weight was ranged between 70.0 kg to 75.0kg. Switzerland players were found heavier followed by Poland, India senior, South Australian, Pakistan, Srilanka and India junior, respectively. Height was recorded between

170cm to 179cm, found maximum in Switzerland players followed by Poland, India senior, Pakistan, India junior, China and Malaysia respectively. % body fat was observed maximum in Malaysia Hockey players followed by Poland, Switzerland, China, South Australia, Srilanka, India senior, India junior, Pakistan and India university players respectively. Same results were examined by Karkare, A. (2011) on Hockey players playing in different position found to differ on anthropometric measurements and body composition.

**Table-11: Anthropometric Comparison Among Various Hockey Players Studies with Present Study**

S. no.	Countries References	Age(yrs)	Weight (kg)	Height (cm)	Body fat (%)
1	Malaysia Demuth et al.2007	25.31	70.4	170.5	18.81
2	China Demuth et al. 2007	26.44	70.9	171.9	16.91
3	Poland Demuth et al. 2007	26.36	73.6	177.2	18.04
4	Switzerland Demuth et al. 2007	25.20	75.0	179.2	18.28
5	S. Australia Withers et al. 1977	----	73.2	170.0	16.70
6	India Universities Singh et al. 2010	20.54	66.6	172.6	7.77
7	Sri Lanka Universities Singh et al. 2010	22.55	65.4	171.1	14.90
8	Pakistan Universities Singh et al. 2010	19.90	71.9	172.2	12.40
9	Indian Junior Hockey Players Present Study	19.11	63.33	171.86	13.80
10	Indian Senior Hockey Players Present Study	24.63	73.31	175.43	14.86

## CONCLUSION

From this study, it was concluded that

a) Decimal age has shown significant differences between senior and junior male Hockey players as whole group and also playing position wise, it was found significant results at 5% level between defenders (3.90\*\*), forwards (9.01\*\*), midfielders (11.62\*\*) and goalkeepers (6.50\*\*), respectively. In junior Hockey players, goalkeepers were found older followed by

defenders, midfielders and forwards having no significant ANOVA f value (2.04). In senior Hockey players, decimal age was recorded significant f value (4.17\*) in which goalkeeper were found older followed by midfielder, forwards and defenders. It was examined significant post hoc t test results between forwards and goalkeepers.

b) Senior Hockey players were found taller with respect to junior ones significantly.

On comparing senior and junior players, playing position wise, there was found non-significant differences between all four positions. junior Hockey players has shown significant f value (5.36\*) at 5% level among different playing positions. Defenders were found tallest followed by goalkeepers, forwards and midfielders, respectively. Body height has shown non-significant f ratio for senior Hockey players among various positions.

- c) Senior Hockey players were examined heavier with respect to junior ones and has shown significant t test value (5.76\*\*) at 5% level. On comparing playing wise between senior and junior players, significant differences of t test values were recorded between senior-junior forwards (5.66\*), midfielders (3.69\*) and goalkeepers (7.89\*) and non-significant differences between defenders. ANOVA f values were found significant at 5% level among positions for senior (4.91\*) and junior (7.50\*) Hockey players, respectively. For junior Hockey players, post hoc t test was found significant between defenders and forwards and defenders and midfielders as seen in body height, other positions has shown non-significant results for post hoc t test. In senior Hockey players, a significant difference was observed between defenders and forwards (12.37\*)
- d) Height weight ratio has shown significant t test differences (5.28\*) at 5% level between senior and junior players. On comparing position wise, senior forwards and midfielders were found significantly heavier with respect to junior counterparts, but senior defender and goalkeepers has shown

non-significant differences with respect to junior defenders and goalkeepers. The f values for both junior and senior Hockey players were reported non-significant results among playing positions within senior and junior groups.

- e) % body fat was found slightly higher in senior Hockey players with respect to junior players and found non-significant differences between them. On comparing position wise between senior and junior players, it was recorded non-significant results for all positions but senior players have shown slightly higher % body fat with respect to junior ones. The f values for both junior and senior Hockey players were also reported non-significant results among playing positions within senior and junior groups.
- f) Indian senior players were found lesser age, having same body weight and height and lesser % body fat with respect to international Hockey player' studies. But Indian junior players were found younger, lighter, shorter and lesser amount of % body fat.

## SUGGESTIONS

1. This study will help to understand the anthropometric characteristics and body composition of senior and junior Hockey players of the India.
2. It will serve as reference data for Scientists, physical educationists and coaches for the selection of young Hockey players' position wise.
3. This will also help to understand the relationship among the variables under study.

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