

# The Contribution of Physical Fitness and Skill Domains in Top Skill Level of Hand Ball Players

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運動遂行에 있어서 高技術 水準의 핸드볼 선수들에 대한  
體力 및 技術領域의 影響

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## Summary

The purpose of the present study was to investigate the relative contribution of physical fitness and skill domain according to the different skill level of hand ball players.

Thirty three physical fitness and hand ball skill measures chosen from physique(6 items), muscular strength(5 items), muscular power(5 items), agility(3 items), balance(2 items), flexibility(3 items), cardio-respiratory endurance(2 items), and hand ball skill(4 items) domains were tested on national representative(N=19), junior national representative(N=21), university(N=34), and high school(N=30) hand ball players.

Product moment correlations between 33 measures were computed separately for each group, and principal component factor analysis and normal varimax criterion procedure of orthogonal rotation were applied. In order to investigate the relative contribution, communalities of 9 physical fitness and hand ball skill domains were evaluated for each different skill level group.

The results indicated that degrees of contribution to total variance were increasing tendency from 44.17% to 57.08% as the hand ball skill level increased. It implies that higher skill level groups are more explainable from 33 measures chosen than the lower skill level groups. In mean contribution to total variance for each 9 physical fitness and hand ball skill domain: physique, flexibility, cardio-respiratory endurance and hand ball skill domains were relatively high (11.50% to 14.45%), agility, muscular strength and muscular endurance domains were moderate(10.65% to 11.50%), and muscular power and balance domains were relatively low(8.88% to 9.70%). But these tendencies were not always same for each different skill level group.

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## Introduction

It has been well investigated that physical ability, such as motor ability or physical fitness has been measured and assessed with test scores of motor performance. Human motor performance, however, particularly in sports activities, is accomplished actually as the results to which various kind of ability domains contribute with interaction.

Many researchers have asserted that any motor performance can not be accomplished with a single motor ability (McCloy, 1934; Buxton, 1938; Larson, 1940; Barry and Cureton, 1961; Matsuura, 1968, 1979, 1980).

Several studies on top skill level of hand ball players have been reported from various point of view (Shin, 1985; Kang, 1985; Son, 1985; Park, 1985), but studies on the contribution of various kind of physical fitness and skill domains for top skill level of hand ball players were quite a few. Thus in present study, it was attempt to investigate the relative contribution of physical fitness and hand ball skill performance domains in different top skill level of hand ball players.

## Method (Procedure)

Thirty three physical fitness and hand ball skill measures chosen from physique (standing height, body weight, sitting height, chest girth, finger reach span, and lower limb length), muscular strength (back strength, grip strength : left and right, and leg strength : left and right), agility (burpee test, side step test, and zig zag run), flexibility (trunk flexion, trunk extention, and bend twist touch),

balance (stick test and frog stand balance), muscular power (hand ball throw for distance, standing broad jump, vertical jump, 100m run and 40m dash), muscular endurance (pull-up, sit-up, and dipping), cardio-respiratory endurance (1500m run, and 400m run), and hand ball skill (step shoot, jump shoot, front wall pass, and zig zag dribble) domains were tested.

The subjects involved were 104 male hand ball players subdivided into national representative players (n=19, ages 17-24 years); junior national representative players (n=21, ages 16-23); university players (n=34, ages 19-25); and high school players (n=30, ages 15-19)

Product moment correlations between 33 variables were computed separately for each group, and principal component factor analysis were applied for each correlation matrix. And normal varimax criterion procedure of orthogonal rotation was applied.

In order to investigate the relative contribution, communalities of 9 physical fitness and hand ball skill domains, and of 33 variables were evaluated for each different skill level of group.

## Results and Discussion

Table 1 shows the communalities ( $\sum h^2$ ) and degree of contribution to total variance for each group. The degree of contribution for national representative and junior national representative players ranged from 57.08% to 57.78%, and for university and high school players ranged from 44.17% to 46.15%.

These results indicated that the degree of contribution to total variance were shown evidently group difference according to skill

Table 1. The communalities ( $\Sigma h^2$ ) and degree of contribution (D.C)

Group	$\Sigma h^2$	D.C. (%)
National representative	18.83700	57.08
J. national representative	19.06710	57.78
University	15.22886	46.15
High school	14.57550	44.17

level. It implies that higher skill groups are more explainable from 33 measures chosen than the lower skill level groups.

Table 2 and figure 1 present the relative contribution of 9 physical fitness and hand ball skill domains for each group. The degree of contribution ranged from 12.6% to 16.1% in physique domain, 7.0% to 16.8% in muscular strength domain, 6.9% to 13.3% in muscular power domain, 7.2% to 10.7% in balance domain, 8.3% to 14.5% in muscular endurance domain, 8.8% to 14.5% in flexibility domain, 9.3% to 12.9% in cardio-respiratory endurance domain, and 10.1% to 12.7% in hand ball skill domain for each group.

Relatively high degree of contribution to total communalities shown domains are muscular endurance, physique, and agility domain in national representative (12.4%-14.5%), physique, flexibility, and muscular strength in junior national representative (12.9%-14.4%), and muscular strength, physique and agility in high school (12.5%-16.8%) players.

Relatively low degree of contribution to each total communalities shown domains were flexibility and balance in national representative (7.0%-9.2%), muscular endurance, balance and muscular power in junior national representative (6.9%-9.0%), muscular endurance, muscular power and agility in university (6.7%-8.3%), and flexibility,

balance and muscular power in high school (7.4%-8.8%) players.

Based on these results, it was not found the consistent trend in degree of contribution between the different skill level of groups. But in general, physique and balance domain indicated the consistently high (12.6%-16.1%) and low (8.8%-10.1%) degree of contribution respectively for each group.

Due to the group differences were not evident in 9 subdomains for each group, the degree of contribution of 33 variables were combined into one for subsequent analysis. Table 3 shows the degrees of contribution of 33 variables to combined mean communalities for total group.

Degree of contribution of physique domain (6 variables) was 22.9%. Among the physique domain, finger reach span, standing height, body weight and sitting height variables indicated relatively high degree of contribution (3.7%-5.0%) in contrast to that of chest girth and lower limb length (2.7% all).

Muscular strength domain (5 variables) indicated 15.1% degree of contribution. Except leg strength (left : 3.4%), other 4 variables were below the mean degree of contribution (2.7%-3.0%).

Muscular power domain (5 variables) indicated 15.1% degree of contribution. Except leg strength (left : 3.4%), other 4 variables

Table 2. The degree of contribution of 9 physical fitness and skill domain to total contribution for each group.

Domain	Group	Contri- bution (c)	Varia- bles (v)	v/9=d	c/d=p	p/q*100
Physique	A	20.67550	6	0.667	30.997	12.6
	B	23.52528	6	0.667	35.270	14.7
	C	23.02247	6	0.667	34.516	14.4
	D	24.73665	6	0.667	37.086	16.1
Muscular strength	A	9.54939	5	0.556	17.175	7.0
	B	18.67033	5	0.556	33.580	14.0
	C	10.92958	5	0.556	19.658	8.2
	D	21.57954	5	0.556	38.812	16.8
Muscular power	A	15.27850	5	0.556	27.479	11.2
	B	9.13380	5	0.556	16.428	6.9
	C	17.66725	5	0.556	31.776	13.3
	D	9.48215	5	0.556	17.054	7.4
Agility	A	10.13580	3	0.333	30.438	12.4
	B	8.54425	3	0.333	25.658	10.7
	C	5.34118	3	0.333	16.040	6.7
	D	9.61236	3	0.333	28.866	12.5
Balance	A	5.02007	2	0.222	22.613	9.2
	B	3.82630	2	0.222	17.236	7.2
	C	5.67876	2	0.222	25.581	10.7
	D	4.19217	2	0.222	18.884	8.2
Muscular endurance	A	11.89653	3	0.333	35.725	14.5
	B	7.13375	3	0.333	21.423	9.0
	C	6.65802	3	0.333	19.994	8.3
	D	7.82443	3	0.333	23.497	10.2
Flexibility	A	8.29623	3	0.333	24.914	10.1
	B	11.53556	3	0.333	34.641	14.5
	C	10.29689	3	0.333	30.292	1.29
	D	6.75737	3	0.333	20.292	8.8
Cardio-respiratory endurance	A	6.09041	2	0.222	27.434	11.1
	B	6.87294	2	0.222	30.959	12.9
	C	6.81876	2	0.222	30.715	12.8
	D	4.76169	2	0.222	21.449	9.3
Hand ball skill	A	13.05801	4	0.444	29.410	11.9
	B	10.75733	4	0.444	24.228	10.1
	C	13.58677	4	0.444	30.600	10.8
	D	11.05369	4	0.444	24.896	10.8
Total	A	100.00000	33		q=246.185	100.0
	B	100.00000	33		q=239.423	100.0
	C	100.00000	33		q=239.802	100.0
	D	100.00000	33		q=230.836	100.0

Note:

- A : National representative players  
 B : Junior national representative players  
 C : University players  
 D : High school players

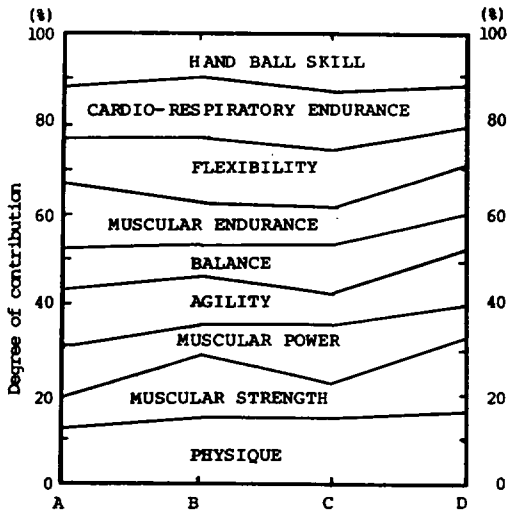


Figure 1. The degree of contribution of physical fitness and skill domain to total contribution for each group.

Note : A : National representative players  
 B : Junior national representative players  
 C : University players  
 D : High school players

were below the mean degree of contribution (2.7%–3.0%).

Muscular power domain (5 variables) indicated 12.8% degree of contribution. Except 40m dash (3.4%), other 4 variables were below the mean degree of contribution (1.8%–2.8%). Running broad jump variable was shown lowest degree of contribution (1.8%) among the total 33 variables.

Agility domain (3 variables) showed 8.5% degree of contribution. Except burpee test (3.5%), other variables were below the mean degree of contribution (2.1%–2.9%).

Muscular endurance domain (3 variables) presented 8.4% degree of contribution. These

3 variables were shown moderate degree of contribution (2.7%–3.0%).

Balance domain (2 variables) indicated 4.7% degree of contribution. These 2 variables were shown comparatively low degree of contribution (2.1%–2.6%).

Flexibility domain (3 variables) indicated 9.4% degree of contribution. Bend twist touch variable was shown relatively high degree of contribution (3.9%), but trunk flexion variable was shown comparatively low (2.2%).

Cardio-respiratory endurance domain (2 variables) showed 6.2% degree of contribution. These 2 variables were moderate degree of contribution (3.1% all).

Hand ball skill domain (4 variables) indicated 12.0% degree of contribution. Among these variables, step shoot variable was shown relatively high degree of contribution (3.7%), but front wall pass was relatively low (2.4%).

Summarized above results, high ranked variables in order were finger reach span (5.0%), standing height (4.6%), body weight (4.2%), bend twist touch (3.9%), sitting height (3.7%), and step shoot (3.7%). And low ranked variables in order were running broad jump (1.8%), zig zag run (2.1%), stick test (2.1%), and trunk flexion (2.2%). Among the high ranked variables, 4 variables were involved in physique domain. It seems that physique domain is major factor in hand ball games.

## Conclusions

Based on the results of the present study, 1) the degree of contribution to total variance was shown evident group difference between the high skill and low skill hand ball players (44.1%–57.7%), 2) it was not found the consistent different degree of contribution in 9

Table 3. The degree of contribution of 33 variables to total mean communality for total group.

Domain	Variables	$\Sigma h^2/4$	D.C.
Physique	Standing height	0.78111	4.6*
	Body weight	0.71146	4.2*
	Chest girth	0.45688	2.7
	Sitting height	0.63400	3.7*
	Lower limb length	0.45025	2.7
	Finger reach span	0.83922	5.0*
	sub total	3.87292	22.9
Muscular strength	Back strength	0.50902	3.0
	Grip strength (L)	0.45929	2.7
	Grip strength (R)	0.49949	3.0
	Leg strength (L)	0.56911	3.4*
	Leg strength (R)	0.50520	3.0
	sub total	2.54211	15.1
Muscular power	Hand ball throw	0.47523	2.8
	Vertical jump	0.40864	2.4
	100m run	0.41125	2.4
	40m dash	0.57719	3.4*
	Running broad jump	0.30072	1.8
	sub total	2.17303	12.8
Agility	Side step test	0.49533	2.9
	Burpee test	0.59454	3.5*
	Zig zag run	0.34834	2.1
	Sub total	1.43821	8.5
Balance	Stick test	0.35185	2.1
	Frog stand balance	0.43591	2.6
	sub total	0.78776	4.7
Muscular endurance	Pull up	0.46288	2.7
	Dipping	0.46042	2.7
	Sit up	0.51558	3.0
	sub total	1.43888	8.4
Flexibility	Trunk flexion	0.36769	2.2
	Trunk extension	0.55674	3.3
	Bend twist touch	0.65437	3.9*
	sub total	1.57882	9.4
Cardio-respiratory endurance	1500m run	0.52932	3.1
	400m run	0.51822	3.1
	sub total	1.04754	6.2
Hand ball skill	Step shoot	0.62592	3.7*
	Jump shoot	0.50914	2.4
	Front wall pass	0.41384	2.4
	Zig zag dribble	0.49887	2.9
	sub total	2.04777	12.0
	Total		16.92711

Note : \* : above the 3.33% (100%/33 variables)

physical fitness and hand ball skill domain between the different skill level of groups, 3) but in general, physique and balance domains indicated the consistently high (12.6%-16.1%) and low (8.8%-10.1%) degree of contribution respectively in each group, 4) in the degree of contribution of 33 variables to total mean communality, high ranked variables in order

were finger reach span (5.0%), standing height (4.6%), body weight (4.2%), bend twist touch (3.9%), sitting height (3.7%), and step shoot (3.7%), 5) and low ranked variables in order were running broad jump (1.8%), zig zag run (2.1%), stick test (2.1%), and trunk flexion (2.2%).

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國文抄錄

運動遂行에 있어서 高技術 水準의 핸드볼선수들에  
대한 體力 및 技術 領域의 影響

本 研究의 目的은 最高水準의 Hand ball 선수들의 體力 및 技術 領域이 운동수행에 있어서 각각 어느정도의 공헌을 하고 있는지를 비교 분석하는데 있었다.

체격, 근력, 근지구력, 순발력, 민첩성, 평형성, 유연성, 심폐지구력과 핸드볼 기술의 9개 영역으로부터 33개 측정 item을 정하고 국가대표선수(19명), 주니어 국가대표선수(21명), 대학선수(34명), 고교상비군 선수(30명)에 각각 측정된 자료를 사용했다.

얻어진 측정자료를 전체 및 각 집단별로 적률 상관계수를 구하고 主因子 解法의 因子分析과 Normal Varimax 基準 의한 回轉을 적용 分析했다. 그리고 각 영역의 상대적 공헌도를 비교하기 위해 體力 및 기술 영역의 Commuality 및 각 변인별로 Commuality를 구해 비교분석하였다.

분석결과 전문산에 대한 공헌도는 핸드볼경기 기술수준의 증가에 따라 점차 증가하는 경향을 보였다. 9개 體力 및 기술영역의 공헌도는 체격, 유연성, 심폐지구력 그리고 기술영역이 비교적 높은 공헌도를 나타냈으며, 민첩성, 근력, 근지구력은 중 정도의 공헌도를 순발력, 평형성 영역은 비교적 낮은 공헌도를 나타냈다.