Relations among Motor Abilities and Skills in Handball

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Abstract: The objective of the research was to determine the relationship between motor abilities and levels of acquisition of certain specific motor skills. On 80 students / adults who participated, with average (X_1±SD) age of x=19 years, mass of 76±3.5 kg,179±4.7 cm tall, standard tests for the assessment of anthropometric characteristics, basic and specific motor abilities, and motor skills in performing different handball techniques were assessed. Statistically significant relations between abilities and skills were determined, especially among the speed, precision and technique of performing the shooting techniques in handball.

1 INTRODUCTION

Techniques, motor skills, motor stereotypes, kinetic chains, biomechanically optimized spatial-time variables and parameters are verbal constructs that in their essence/definition - and due to their inextricable correlation - are intertwined with certain definitions of motor abilities. It should be respected in standard planning procedures, programming and control of the teaching&training process. An integrative approach to training certain abilities and knowledge is a prerequisite for shaping algorithms with clearly defined procedures for achieving set goals.

According to Gruić, 2014, and Gruić and Vrbik, 2018, "knowledge, abilities, morphology etc., are organized trough function, form & content, and by understanding allometry (McMahon, 1984) and method of partializations (Milas, 2009) power of insight in practical research and applications may be improved (Gruić, 2015)".

Main objective of the research was to define the relationship of certain anthropological characteristics, mainly between the level of development of certain motor abilities and levels of acquisition of certain specific motor skills.

2 METHODS

The sample of entities for the purposes of this research was sampled from the final population of students of the first year of studies at the Faculty of Kinesiology, University of Zagreb (n = 171) in the academic 2008/2009. Finally, in all aspects of the experimental set, 80 students / adults participated, with average (X_1±SD) age of x=19 years, mass of 76±3.5 kg and being 179±4.7 cm tall, whose health status did not differ from satisfactory.

Sample of variables was comprised of batteries of standard tests for the assessment of anthropometric characteristics, basic and specific motor abilities, and motor skills in performing different techniques of handball (table 1).

Data processing. Basic and specific motor abilities were measured by professional staff at Diagnostic Centre within Institute of Kinesiology, UniZg. Efficacy of performance of 9 specific handball motor skills were assessed by 6 experts in the field of top-level sports and education (Table 2.). The precision is defined by a hit in one of the 9 segments of the goal - 3 points for the upper left and upper right corners, 2 points for the left and right lower corners, 0 for the central segment, the goal post and the miss, and 1 point for the lower central, upper central, middle left and middle right segment of goal. The flight velocity of the thrown ball has been measured by a radar (STALKER radar; applied Concepts, Inc.; 2609 Technology Drive, Plano, TX, 75074, U.S.A)

For all variables in the sample, basic parameters of descriptive statistics with basic measures of central

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tendency, dispersion parameters and measures of curvature and asymmetry were determined. Normality of distribution of results in variables was tested with K-S test. Pearson's correlation coefficient was used to analyse the relationship among expert assessments of performed specific motor skills (handball knowledge). Metric properties of existing standardized and newly constructed measuring instruments and expert system for evaluating the elements of handball techniques were analysed and interpreted through central and dispersion parameters of variables, measures of asymmetry and elongation/flatness. Cronbach α was used as a measure of reliability, and to assess the homogeneity average correlation among the particles was used.

The contributions of individual final grades of motor abilities to performance of certain elements of handball technique were analysed by regression analysis. Non-parametric statistical methods were used to analyse all the results in the observed variables that were not normally distributed - Spearman's rank correlation was used to determine the correlation between accuracy, speed and evaluated performance of shooting,

Data processing was conducted in statistical package Statistica 5.0.

Table 1: Sample of variables – basic and specific abilities and handball techniques.

No	NAME	Test ID	OBJECT OF MEASUREMENT
BASIC MOTOR ABILITIES			
1	20m running (s) – cells (5,10m) (s)	MESP20M	Power – explosive strength of sprinting
2	Bosc 3 - 5 feet jumps -t.platform (index)	MESRSn	Power – explosive strength of jumping
3	Bosc max (arms swing)-t.platform (cm)	MESMAX	Power – explosive strength of jumping
4	Sit-ups in 60 seconds – repetitions	MRSSPT6	Dynamic repetitive-relative strength
5	Hold in back extension (s)	MSSEL	Static strength
6	Bench press- 70% TT (repetitions)	MRSSBP7	Dynamic repetitive-relative strength
7	Lateral steps (s)	MAGKUS	Agility
8	20 yards (s)	MAG20Y	Agility
9	Shoulder rotation test with a stick (cm)	MFLIP	Flexibility
10	Straddle (V) sit forward bent (cm)	MFLPRR	Flexibility
SPECIFIC MOTOR ABILITIES AND SKILLS			
11	Stance shot -radar 6m (km/h)	MESBL2	Specific throwing explosive power
12	Jump-shot - radar 9m (km/h)	MESBL4	Specific throwing explosive power
13	20m dribbling (10m, 5m) (s)	MESPV20M	Power – explosive strength of sprinting
14	dribbling the ball – VL (grade)	VL	technique
15	catching and passing the ball in a motion(grade)	HDK	technique
16	basic stance shot(grade)	OU	technique
17	shots from backcourt attacking positions(grade)	SS	technique
18	shots from left wing (grade)	LK	technique
19	shots from right wing(grade)	DK	technique
20	shots from pivot position with rolling(grade)	KN	technique
21	single feint to the left with a pass to the right(grade)	FLD	technique
22	single feint to the right with a pass to the left with a "coating"(grade)	FDL	technique
23	Ball velocity after basic shot (km/h)	OU_BR	velocity
24	Ball velocity after jump shot from backcourt att. position (km/h)	SS_BR	velocity
25	Ball velocity after jump shot from left wing (km/h)	LK_BR	velocity
26	Ball velocity after jump shot from right wing (km/h)	DK_BR	velocity
27	Ball velocity after jump shot from pivot (km/h)	KN_BR	velocity
28	basic shot precision (points)	OU_PR	precision
29	jump shot precision from backcourt att. position (points)	SS_PR	precision
30	jump shot precision from left wing(points)	LK_PR	precision
31	jump shot precision from right wing(points)	DK_PR	precision
32	jump shot precision from right wing(points)	DK_PR	precision

Table 2: Example of the evaluation criteria of the level of knowledge required for performance of jump-shooting (Gruić and Vrbik, 2018., adjusted from Gruić, 2011).

Point	Element	Code	Jump Shot from backcourt attacking position
0	Ball control	K	No ball control (dropping the ball during performance – no points for subject on any basis)
0/1	Position/posture	S	The throw performed during flight phase (opposite shoulder and hip are at least are little in front of the shutting arm)
0/1	All Phases	F	All phases performed (start-up, take-off, flight, shot, controlled landing)
0/1	Gross coordination	GK	Correct performance – gross coordination (if the element is performed by the game rules) (efficiency, rhythmical cohesion, vertically directed jump, movement amplitude)
0/1	Fine coordination	FK	Correct performance – fine coordination (trunk rotation over 45 °, circular arm swing, successive activation: hip – shoulder – elbow – wrist; ball thrown with elbow above shoulder height - without pushing the ball)
0/1	Performance strength/speed	S/B	Performance strength/speed (using all of one´s capacities ore performing slower/ weaker than 70% of assessed maximum)
0/1	Situational efficiency/utilization	SIT	Situational efficiency (is the performance applicable in the real game/situation with peers)

Table 3: Descriptive parameters of motor abilities, skills and handball knowledge (initial; †liminal K-S d/p).

	N	X_1 - Mean	Min	Max	Range	SD	X_3-Skew	X_4 - Kurt
M5	79	1.59	1.23	1.75	0.42	0.09	-0.48	1.03
M20V	79	3.82	2.59	4.42	1.83	0.23	-1.32	8.85
MAGKUS	79	7.88	6.79	9.71	2.92	0.47	0.90	2.37
MAG20Y	79	4.76	4.33	5.75	1.43	0.23	1.36	4.49
MESRS	79	117.67	69.80	152.55	82.75	13.03	-0.06	2.07
MESMAX	79	53.23	39.60	65.27	25.67	5.67	-0.24	-0.32
RADAR6	79	67.25	50.10	86.07	35.97	7.21	0.22	0.13
RADARSS	79	73.41	57.53	91.87	34.33	6.11	-0.20	0.62
MRSPT6	79	57.32	10.00	75.00	65.00	8.84	-1.85	9.29
MPRSBP7	79	15.77	3.00	36.00	33.00	8.03	0.47	-0.55
MSSEL	79	113.78	50.00	241.00	191.00	36.46	1.31	2.71
MFLIP	79	85.51	15.00	114.33	99.33	17.31	-1.16	3.30
MFLPRR	79	70.14	40.00	99.67	59.67	12.55	0.13	-0.06
VL	80	2.37	0.00	5.50	5.50	1.19	-0.12	0.09
HDK	80	2.06	0.00	6.00	6.00	1.26	0.69	0.67
OU	80	2.73	0.00	6.00	6.00	1.13	0.14	0.64
SS	80	2.57	0.00	4.80	4.80	1.13	-0.53	0.32
LK†	80	2.27	0.00	5.00	5.00	0.82	0.28	0.93
DK	80	1.87	0.00	4.20	4.20	0.80	0.44	0.08
KN	80	2.41	0.40	5.00	4.60	1.00	-0.31	-0.22
FLD	80	1.85	0.00	4.00	4.00	0.87	-0.13	-0.10
FDL†	80	1.62	0.00	5.40	5.40	1.06	1.18	1.40

3 RESULTS AND DISCUSSION

Results in all variables assessing basic and specific abilities and skills were normally distributed (in standard use with appropriate reliability and homogeneity for different populations and samples). Liminal K-S d/p values for LK and FLD in initial measuring point were determined. Variables covering precision (variables with extensions:'_PR') were not normally distributed, therefore in later analyses Spearman correlations were used. The total average reliability measured by Cronbach's α for all analysed specific handball knowledge (VL-FDL) is 0.89 (0.86-0.90). The average homogeneity measure estimated by the average correlation between the particles for all analysed knowledge is 0.71 (0.67-0.75). It should be noticed that handball knowledge was assessed three times in order to determine reliability and homogeneity for heterogeneous youth sportive and student population after ending secondary school and included in university graduate kinesiology programme. Two measurements of specific knowledge were used for purposes of this research – at start and at the end of teaching&training program.

Table 4: Descriptive parameters for precision, ball velocity, and grades for shooting techniques (final).

	N	X_1 - Mean	Min	Max	Range	SD	X_3-Skew	X_4 - Kurt
OU	80	4.32	1.40	6.00	4.60	0.95	-0.08	-0.12
SS	80	4.28	2.80	6.00	3.20	0.90	0.34	-0.84
LK	80	4.36	1.40	6.00	4.60	0.96	-0.38	0.55
DK	80	3.69	1.20	6.00	4.80	1.14	-0.31	-0.52
KN	80	4.72	2.00	6.00	4.00	0.93	-0.73	0.08
OU_BR	78	75.47	31.90	89.80	57.90	8.48	-1.84	8.21
SS_BR	78	74.10	59.70	91.50	31.80	5.81	-0.15	0.41
LK_BR	78	67.41	54.40	79.70	25.30	5.89	-0.27	-0.48
DK_BR	74	61.80	42.30	75.40	33.10	7.03	-0.31	-0.35
KN_BR	74	62.05	41.70	79.80	38.10	7.34	-0.12	0.25
OU_PR	76	0.78	0.00	3.00	3.00	0.83	0.59	-0.86
SS_PR	78	1.00	0.00	3.00	3.00	0.95	0.46	-0.91
LK_PR	78	0.71	0.00	3.00	3.00	0.81	0.90	0.05
DK_PR	74	0.82	0.00	3.00	3.00	0.97	0.92	-0.24
KN_PR	74	1.09	0.00	3.00	3.00	0.95	0.29	-1.03

Table 5: Relations among basic and specific motor abilities and specific handball knowledge (summary and partial contributions; †liminal K-S d/p).

Summary	VL	HDK	OU	SS	LK†	DK	KN	FLD	FDL†
R	0.59	0.66	0.64	0.64	0.55	0.53	0.54	0.56	0.61
R^2	0.34	0.44	0.41	0.42	0.30	0.29	0.29	0.32	0.37
Adj R^2	0.21	0.32	0.29	0.30	0.16	0.14	0.15	0.18	0.24
F(13,63)	2.54	3.77	3.41	3.51	2.09	1.94	2.00	2.25	2.86
p	<0.01	<0.001	<0.001	<0.001	<0.03	<0.04	<0.04	<0.02	<0.001
Std.Err.ofEst	1.04	0.90	0.81	0.75	0.89	1.05	0.85	0.91	0.99
Parc(beta)	VL	HDK	OU	SS	LK	DK	KN	FLD	FDL
M5	0.01	0.18*	0.10	0.05	0.20*	-0.03	0.03	0.02	0.03
M20V	-0.02	-0.19*	0.00	-0.03	0.13	0.00	-0.10	-0.19	-0.06
MAGKUS	-0.05	0.00	-0.15	-0.18	-0.12	-0.38**	0.03	-0.30**	-0.26**
MAG20Y	-0.28**	-0.21*	0.00	-0.08	-0.28**	-0.06	-0.27**	-0.08	0.01
MESRS	-0.05	0.12	0.17	0.08	0.05	0.02	0.04	0.11	0.09
MESMAX	-0.03	-0.01	0.12	-0.02	0.09	-0.06	0.05	-0.03	0.16
RADAR6	0.50**	0.27*	0.39**	0.01	0.25	0.18	0.56**	0.23	0.47**
RADARSS	-0.11	0.04	0.10	0.37**	0.03	0.04	-0.30*	-0.12	-0.18
MRSPT6	0.07	0.07	-0.01	-0.16	-0.05	0.00	-0.04	-0.06	-0.04
MPRSBP7	-0.02	-0.14	-0.04	-0.28**	-0.12	-0.30**	-0.05	-0.23*	-0.19
MSSEL	0.06	0.25**	0.21**	0.22**	0.00	-0.01	-0.13	0.07	0.09
MFLIP	0.26**	0.05	0.08	-0.02	0.18	-0.01	0.09	-0.05	0.05
MFLPRR	-0.11	0.13	-0.20	0.05	0.24	-0.02	0.11	-0.06	-0.08

*Notice: Statistically significant contribution at level p<**0.05; * 0.10*

A series of regression analyses analysed the impact / contribution of basic and specific motor skills in explaining the total of the estimated levels of performance of specific handball motor skills, dribbling, catching and passing the ball, shooting techniques from different positions, and feinting. The correlation of the predictor set of variables and individual knowledge as the criterion variables (Table 5) is described by multiple correlation ranges from 0.53 to 0.66, respectively, and the coefficients of determination determine their common variability ranging from 29% to 44%. F values are at degrees of freedom df1 = 13, df2 = 63, statistically significant at the conclusion level to p <0.05. Among 13 predictor variables, with different individual contributions, those variables that have the most significant partial contributions to the explanation of individual criteria should be separated are:

(1) RADAR6, for dribbling the ball (VL), basic shot (OU), jump shot from the pivot position (KN) and feint to the right with pass to the left (FDL) (with certain reserves for HDK), then

Table 6: Relationship between grades of performance, ball velocity and precision of the shot (Spearman rank correlation, n = 74, *0.05).

velocity		OU_br	0.33*	SS_br	0.11	LK_br	0.37*	DK_br	0.13	KN_br	0.33*
grade	OU	0.55*	0.21	0.55*	-0.03	0.52*	0.24*	0.52*	-0.02	0.32*	0,02
	SS	0.44*	0.34*	0.37*	-0.19	0.41*	-0.04	0.40*	0.05	0.28*	0,05
	LK	0.37*	0.24*	0.41*	-0.08	0.33*	0.13	0.34*	-0.02	0.22*	0,21
	DK	0.36*	0.26*	0.19	-0.11	0.31*	0.07	0.30*	-0.14	0.19	0,11
	KN	0.25*	0.02	0.16	-0.12	0.23*	0.14	0.31*	-0.08	0.25*	0,31*
precision		0.33*	OU_pr	0.11	SS_pr	0.37*	LK_pr	0.13	DK_pr	0.33*	KN_pr

(2) MAGKUS, in particular for the feinting techniques (FLD, FDL) (but also the right-wing shooting technique, DK),
(3) MAG20Y, for techniques of dribbling the ball (VL), left wing shot (LK) and pivot position shot (KN) (with certain reserves and for catching and passing the ball technique, HDK),
(4) MSSEL for *catching and passing the ball in movement* (HDK), *stance shot* (OU) and *jump shot from backcourt shooting positions* (SS), and
(5) MPRSBP7 for *jump shots from backcourt shooting positions* (SS) and *right-wing position shots* (DK) (with certain reserves in *feint to left with passing to right* FLD)

After initial representations of less and more significant variables, other techniques of selecting relevant explanatory variables, beside stepwise regression methods, should be introduced (Bonferroni corrections). Many regressions by definition bring a lot of significant parameter estimates at the 5% level even if there is no relationship. Some of the F-values are very close to the critical value in case of the regressions. If not considered to be inclusive set of variables usually used to cover whole physical preparedness of team handball players, this experimental setup would be limitation of the study (multiple comparisons problem), together with certain heterogeneity of sample, and structure of their previous and extracurricular (often sportive club related) activity.

Further, there is the existence of certain statistically significant correlations (Table 6) between the speed, precision and technique of performing the shooting technique. Spearman's rank correlation was used because the results in precision by the default scoring system were not distributed according to normal distribution.

4 CONCLUSIONS

There is a statistically significant general and partial contribution of results in variables for the assessment of basic and specific motor abilities to the level of performed specific motor skills.

Building architecture of understanding relations among anthropometry, basic and specific motor abilities and skills represents a precondition for controllable, realistic perspective planning of success, both competitively and with regard to injuries prevention.

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