Kinesiologia Slovenica, 23, 2, 44–54 (2017), ISSN 1318-2269

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TACTICAL DEMANDS AND DEVELOPMENT OF TACTICAL SKILL IN FEMALE TEAM HANDBALL

TAKTIČNE ZAHTEVE IN RAZVOJ TAKTIČNIH SPOSOBNOSTI V ŽENSKEM EKIPNEM ROKOMETU

ABSTRACT

Team handball requires well-developed tactics-skill from all players. The influence of position-specific issues on the tactics-skill of female players is still unclear, although players on different positions differ regarding other performance factors. The effect of age and playing experience on tactics-skill for players of different positions has to be specified, since the recent discussion hints that there might be connections between these factors and handball-specific success. To substantiate position-specific demands, 652 female handball players (14 - 52 years, 153 - 190 cm, 43 - 119 kg) from German leagues at all levels were tested as part of a broader study concerning their tactics-skill using a video-based test.

Expertise has been measured using the players` biography. Additionally, constitutional, conditional, technical and psychological handball-relevant factors have been assessed. There are positional differences regarding tactics-skill and correlations between expertise and specialization concerning back players (e. g. half backs with $\rho \geq 0.409$), hinting that specialization might be a limiting performance factor for backs. Half backs display the best results followed by centre backs, wings, pivots and goalkeepers. When considering expertise gathered during youth, several different expertise-related factors per position correlate positively with tactics-skill. When testing for correlations between physical fitness, constitutional factors and tactics-skill, the correlations are negative on some positions (e. g. bodyfat for pivots with $\rho \leq -0.275$). This could mean that less fit players are not able to gain sufficient tactical experience. Consequently it might be helpful to base position-specific selection and training on scientific findings to make use of all players` full potential.

Key words: demands profile, tactics, positions, selection, fitness

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IZVLEČEK

Ekipni rokomet od vseh igralcev zahteva dobro razvite taktične sposobnosti. Vpliv igralnega mesta na taktične sposobnosti igralk je še vedno nejasen, čeprav se igralke na različnih mestih med seboj razlikujejo po drugih dejavnikih uspešnosti. Vpliv starosti in igralnih izkušenj na taktične sposobnosti igralk na različnih igralnih mestih je treba natačneje opredeliti, saj najnovejše razprave kažejo, da obstaja povezava med omenjenimi dejavniki in uspešnostjo v rokometu. Da bi lahko raziskali zahteve, ki so specifične za igralni položaj, smo v širše zasnovano študijo vključili 652 rokometašic (14–52 let, 153–190 cm, 43–119 kg) iz nemških rokometnih lig na vseh ravneh, kjer smo s pomočjo video-testa preučevali njihove taktične sposobnosti. Strokovnost smo merili na podlagi življenjepisov igralk. Poleg tega smo ocenili tudi tiste dejavnike v zvezi s telesno zgradbo, kondicijo, tehniko in psihološkim stanjem, ki so pomembni za rokomet. Pri taktičnih sposobnostih obstajajo razlike glede na igralni položaj, prav tako smo odkrili korelacijo med strokovnostjo in specializacijo pri zunanjih igralkah (npr. leva ali desna zunanja, $\rho \geq 0{,}409$), kar kaže na to, da je lahko specializacija omejujoč dejavnik pri uspešnosti zunanjih igralk. Leve ali desne zunanje igralke so imele najboljše rezultate, za njimi srednje zunanje, krila, krožne napadalke in vratarke. Ob upoštevanju strokovnega znanja, ki so ga pridobile v mladosti, je več različnih dejavnikov, povezanih s strokovnostjo in igralnim mestom, pozitivno koreliralo s taktično sposobnostjo. Ko smo testirali korelacije med telesno pripravljenostjo, dejavniki telesne zgradbe in taktično sposobnostjo, so bile te pri nekaterih igralnih mestih negativne (npr. telesna maščoba pri krožnih napadalkah, $\rho \leq -0{,}275$). To bi lahko pomenilo, da slabše telesno pripravljene igralke niso sposobne pridobiti dovolj taktičnih izkušenj. Zato je lahko v veliko pomoč, da tako selekcijo kot trening, ki sta prirejena igralnemu mestu, opremo na znanstvene izsledke, da bi tako izkoristili celoten potencial vseh igralk.

Ključne besede:

Acknowledgements

The authors wish to thank the CAU of Kiel and Professor Dr. M. Wegner as well as Andreas Jahn from the Ostfalia university of applied science for their support.

INTRODUCTION

Position-specific demands occur in play in team handball (Čavala, Trninić, Jasić & Tomljanović, 2013; Schorer, Cobley, Büsch, Bräutigam & Baker, 2009). At the same time, players on different playing positions differ regarding handball-relevant performance factors (Ghobadi, Razabi, Farzad, Bayati & Jeffreys, 2013). Studies have already been conducted in other team sports that point out positional differences between players of different positions. However, earlier studies have mostly focused on physical performance factors with few exceptions regarding psychological performance. (e. g. soccer, Hughes, Caudrelier, James, Redwood-Brown, Donnelly, Kirkbride et al., 2012, psychological factors; Le Gall, Carling, Williams & Reilly, 2008, constitution). Therefore it has to be researched whether similar differences occur in female team handball regarding tactics-skill and whether those differences are connected to success.

Tactical demands in team handball. Tactics-skill is limited by perception / observation, anticipation, reaction, orientation and sense of time (Galal el-Din, 2004). Tactical decisions follow certain sequences. According to Raab (2002 a), the first step is the gathering of information, then alternative actions are generated and then one alternative is chosen. Experienced players react faster and more effective, since during a competition, the situation is percepted and compared to previously experienced events. This process can be compared to the automatism following a key stimulus (Raab, 2002 b). The influence of conditional and technical factors can lead to misleading results when testing tactics directly in play. For the development of tactics-skill, youth is a crucial time slot (Matthys, 2012). It is therefore constructive to look at the career stages of a player to determine favouring factors for the development of tactics-skill. For example, the leagues played during youth can be such a factor.

Expertise. When investigating handball performance, the focus should be on the performance¸ of successful players. Success can be measured via expertise, since both are connected to the leagues a player competes in. According to Schorer (2007) the following factors can be used to measure expertise: efficiency and outstanding performance, duration and reproduction of excellent performance, high performance standards not only by accident, expertise through experience (ten-year-rule; Ericsson & Lehmann, 1996), time spent training, long preparation, striving for excellence and perfection, motivation, high-level competition experience. Ericsson & Lehmann (1996) postulate that expertise can be measured best by hard facts like competition performance. Sinuany-Stern (1988) uses participation in national leagues to measure expertise.

Specialization. The appropriate age for position specialization is not yet adequately researched. For accomplishment of high-level competitive results, it is crucial to specialize on time (Hecimovich, 2004). Disadvantages of early specialization like early drop out (Bon, Pori & Šibila, 2013; Hecimovich, 2004) and mistakes during talent- or position-selection due to later maturation of some players are taken into account (Matthys, 2012). At the same time other authors claim that it is necessary to specialize as early as possible to achieve the bestpossible adaption (Čavala et al., 2013 demanding early selection according to constitutional parameters) since players who are objected to early selection show better performance. Krüger, Pilat, Ueckert, Frech & Mooren (2013) state the need to research further into position specialization while selection according to physical parameters has been discussed controversely (Gonçalves, Rama & Figueiredo, 2012). Consequently, position-specific selection on basis of other parameters has to be investigated and factors influencing tacticsskill have to be specified. To quantify specialization, it is necessary to develop a suitable calculation method on the basis of the above-mentioned criteria. Since a

specialist should deviate from others (Ericsson & Smith, 1994), contrasts between positions have to be calculated. Deviations between positions will be calculated for tactics-skill.

It is to be expected that tactics-skill differs between players on the positions and correlates differently with expertise for players of the different positions. Furthermore it seems probable that some positions have to specialize concerning tactics-skill while others do not. Also it is likely that certain factors during youth training promote the development of tactics-skill. Exploratively, connections between conditional, constitutional, technical and psychological factors and tactics-skill will be tested. A model player concerning the tactics-skill required on each position will be calculated.

MATERIALS AND METHODS

Participants. 652 female players playing in German teams at all performance levels (194 players at elite level from 1st to 3rd Bundesliga, 319 players at subelite level from 4th to 7th league and 139 players at regional level from 8th down to 11th league) have been tested as part of a broader study. To be able to calculate highly significant correlations from lowest to highest performance level, all accessible players who had playing experience in German senior female handball (matches or tournaments) were included in the sample. For achieving completeness and not to miss out on any unexpected results, the goalkeepers were also included in the sample, although it is to be expected that goalkeepers need other tactical abilities than field players. Informed consent was obtained from all participants as well as approval of the local ethics committee. All measurements follow the standards of the Helsinki Declaration.

Measurements. As tactics-test the IVS-tactics-test® was used (Wegner, Leptien & Goede, 2010). Players watch a video-sequence with 45 demo-playing-scenes and have to decide fast about the most promising action which should follow the watched scene. Answers are rated from 0 to 2 points, the sum of all points is the final score. Reliability was given for the test (Wegner et al., 2010). The results of the goalkeepers have to be viewed with care since the situations shown in the video-sequences were field situations.

Additionally, conditional, constitutional, psychological and technical profiles of all players have been tested. The test battery consisted of several tests, which covered a wide range of physical handball relevant factors (Tab. 1).

Age, body height and body weight were asked from the players using questionnaires sent by email. Body fat percentage was measured using a calliper during the players` usual training. Calculations were done according to Withers, Whittingham & Norton (1987) via calculation of body density (BD), using measured skinfold-values (x in the equation below):

$$BD = 1{,}18562 - 0{,}08258 * \lg(\Sigma\ x\_Triceps, x\_Subscapular, x\ \_calf)\ [mm]$$

Equation 1: Body density.

$$\text{Body fat \%} = (4{,}95 / BD) - 4{,}5$$

Equation 2: Body fat percentage.

Expertise was measured by assessing the leagues a player has been previously playing in. Participants were asked to name all clubs they had played for during their career in order to calculate an individual expertise index on the scale of zero to twelve points for each player. International

Table 1: Test-battery with references to where similar tests have already been used.

Test	Factor and testing procedure
5 x 20m Sprint (photo sensor DCT/F03, Sportronic, Germany at start and finish, Hulka & Belka, 2013)	Cyclic velocity, endurance of velocity: Fastest and average time out of five attempts, slow running back to starting point and immediate start of next attempt.
Jump & Reach (Moss, Mcwhannel, Michalsik & Twist, 2013)	Jumping strength: Countermovement jump, jumping height measured as difference between reaching height when standing and when jumping, accomplished height marked with chalk on the players` fingers leaving marks on the wall, best of two attempts
Sit-ups (Hatzimanouil & Oxyzoglou, 2004)	Endurance of strength (abdominal muscles): Maximum number of sit-ups with feet on a small box
Maximum number of chin-ups with supported heels (Büsch, Schorer & Lotz, 2008)	Endurance of strength (arm muscles): Maximum number of chin-ups in angular hanging with supported heels (regional-level players would not have been able to do a number of free chin-ups sufficient for calculation)
Reaction-test with Basketball (Prätorius & Milani, 2008)	Reaction-speed: Participamts have to stop a basketball rolling down a ramp within the smallest possible rolling distance after an audio signal (mean of two attempts, measured with a tape measure), standing with their back to the ramp at the lower endof the ramp, the ball being released from the upper end.
Stand & Reach (Bös, 2001, Zapartidis et al., 2009 a, b)	Flexibility hamstrings / low back: Reaching down to feet or beyond while standing on a small box, distance between standing level and fingers measured with tape measure, positive distance beyond feet, negative above.
Throwing velocity with V-maxx throwing radar (EUROTronic technology, Germany)	Elasticity arm muscles / throwing strength: Throwing from a standing position 5m in front of the radar into the upper left corner of the goal, mean out of two attempts, figuring that throwing speed is related to strength (van den Tillaar, 2004; Zapartidis et al., 2009 a, b).
30m Sprint (Zapartidis et al., 2009 a, b) with split-times at 5 and 10m	Cyclic velocity, start velocity, acceleration: Fastest and average out of two attempts with slow running back to starting point and immediate start of next attempt.
Half Cooper Test* (6min. running, Bös, 2001)	Basic endurance: Number of elliptic rounds (74m in length, marked with shuttles in the training hall) within six minutes of running
Wall-passing (Letzelter, Letzelter & Scholl, 1988)	Ball-technique pass / catch: Time needed for 20 passes against a wall from a 4m distance
Slalom-dribbling with photo sensor DCT/F03, Sportronic, Germany (Letzelter et al., 1988)	Ball technique Dribbling: 30m parcours, time measured with photo sensors at start and finish
Tactics-test via video (Wegner, Leptien & Geode, 2010)	Tactical ability: IVS-video-test, 45 sequences, players have to solve match situations and receive points according to their answers
Skinfold-measurement (Whithers et al., 1987)	Body fat percentage: Measurement of three skinfolds (Equation 1, 2)
Achievement-Motives Scale, AMS (Elbe & Wenhold, 2005)	AMS: hope for success and fear of failure (15 questions with 0-3 points each), net hope (hope for success minus fear of failure) and total achievement motive (sum of hope for success and fear of failure)
Volitional Components Questionnaire, VCQ (Wenhold, Elbe & Beckmann, 2009)	VCQ: 0 to 3 points per question: for self-optimizing (29 questions), self-impediment (9 questions), lack of activation (13 questions) and loss of focus (9 questions)
Hakemp-Sport, action-/ state-orientation in sports, HOSP (Beckmann & Wenhold, 2009)	Hakemp-Sport: action-/ state-orientation after malperformance, while planning a task and while performing a task, 12 questions each with 0 to 1 points per question
Players biography, leagues played each past year	Players biography: Expertise points were given for each year played on a scale from 0 to 12; also, players were asked for age, body height and weight.

*Half Cooper test was used due to restricted time available in the training-halls.

experience was counted with twelve points, 1st Bundesliga with eleven points, 2nd Bundesliga with ten and so on down to lowest league with one point and "only training, no competitions" with zero points. The index was calculated as the arithmetic middle out of nine expertise-influencing elements, which match the criteria named by the literature (see above): Mean value of expertise

points out of the leagues played at senior level, expertise points in highest league played, mean value of leagues of current and previous season, points of most frequent league, sum of playing experience played overall in years scaled to 12 points (12 points being the value of the best player who had played the most years, all other players scaled accordingly), points for highest league played in youth, mean value of all leagues played in youth, sum of expertise points at senior level (scaled likewise, 12 being the value of the player who had collected most points, all others scaled accordingly), sum of expertise points during youth scaled to twelve (as done for senior level, see above).

Specialization was measured for each performance factor ("value" in the formula below) by calculating whether each player differed more from all other players (mean value of players in the formula below) or from all players on her position:

$$((\bar{X}_{allplayers} - value_{factor\ player\ position})^2 - (\bar{X}_{playersposition} - value_{factor\ player\ position})^2)^2$$

Formula 1: Specialization on a position.

Statistical analyses. Oneway ANOVA at global, elite, subelite and regional level was performed to investigate the variables per level in detail and prevent a confounding of results by performance. The criterion level for significance was set at $p<0.05$ and by trendsignificance at $p<0.10$. Effect size was evaluated with η^2 (Eta partial squared), where $0.01<\eta^2<0.06$ constitutes a small effect, $0.06<\eta^2<0.14$ constitutes a medium effect and $\eta^2>0.14$ constitutes a large effect (Cohen, 1988). If the Oneway ANOVA divides clearly between leagues for a factor on a position, it means that the factor is performance-relevant (being more fittingly developed at elite level, Letzelter et al., 1988). Correlations were calculated via Pearson, Spearman`s rho and Kendall's tau b as well as correlations between the calculated differences (see Equation 1) and the expertise at different playing levels with correlation levels >0.1 (weak), >0.3 (moderate) and >0.5 (strong). Linear regression is calculated for all constitutional factors to provide desired values for players on the different playing positions in 3rd Bundesliga or higher. Confidence interval is given with 0.95 ± 2.5 % for all tested factors (calculated after Rinne, 2008). Statistical analysis was performed with SPSS, version 22.0 (SPSS, Inc., Chicago, IL).

Hypotheses.

- Tactics-skill differs according to playing position;
- Tactics-skill correlates differently with expertise according to playing position;
- Specialization regarding tactics-skill correlates with expertise according to playing position;
- Specific parameters of expertise correlate with tactics-skill for one or more positions;
- Conditional, constitutional and technical parameters correlate negatively with tacticsskill for certain positions.

RESULTS

At global level, centre backs display the best value, while at elite level the highest values occur for half backs (Tab. 2). Significant differences can be found at regional performance level, namely between half backs and pivots (Tab. 2). Significant correlations between expertise and tactics-skill as well as significant separation between leagues can be found on all positions except centre back (Tab. 2). Expertise correlates positively with specialization for back players and negatively for all

other positions (Tab. 2). When testing for correlations between physical fitness, constitutional, technical and psychological factors and tactics-skill, good performance correlates with tactics-skill for several factors (tab. 4). When considering expertise gathered during youth or senior training, several different expertise factors per position correlate positively with tactics-skill per position (Tab. 4). Model players can be calculated with sufficient significance and effect-level using three groups (elite, subelite and regional level, see fig. 1).

Table 2: Descriptive statistics and differences between positions (Part A) and correlation levels between tactical ability and expertise and specialization-level and expertise (highest out of Pearson`s coefficient, Spearman`s Rho and Kendall`s Tau b) next to separation between leagues on the positions (Part B).

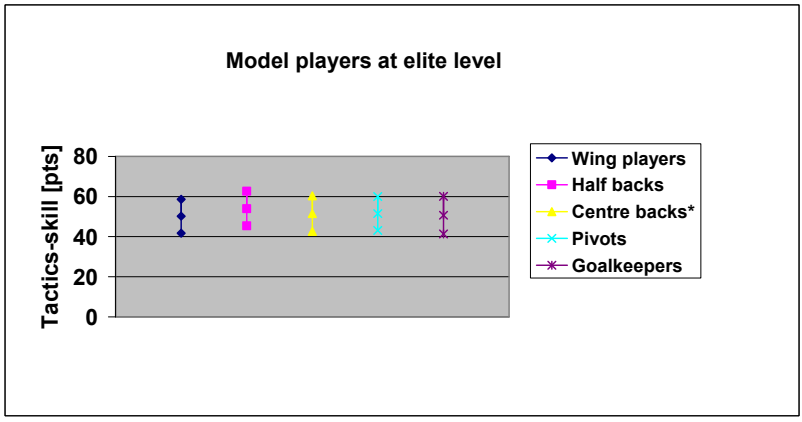
	Effect-size η^2	Wing players (197)	Half backs (169)	Centre backs (103)	Pivots (92)	Goalkeepers (91)	All positions (652)
Part A							
Tactics-result	.	47.72 ± 8.87	47.97 ± 9.68	49.65 ± 8.99	46.46 ± 9.34	46.99 ± 9.84	47.83 ± 9.32
Elite level	.	50.74 ± 8.57	53.47 ± 7.50	51.61 ± 9.54	50.20 ± 6.86	49.32 ± 9.16	51.22 ± 8.43
Subelite level	.	47.79 ± 8.73	48.44 ± 9.13	49.11 ± 7.94	48.28 ± 9.24	47.86 ± 8.24	48.25 ± 8.66
Regional level	0.077	43.48 ± 8.00	41.26 ± 8.90	47.29 ± 10.28	39.55 ± 8.51	38.42 ± 12.65	42.18 ± 9.38
Lowest level of expertise**	0.177*	42.11 ± 8.10	46.89 ± 7.06 [a]	47.33 ± 9.43	38.00 ± 7.73 [b]	47.75 ± 11.62	43.85 ± 8.70
Part B							
Correlation between tactical ability and expertise	.	0.317	0.404	.	0.546	0.309	.
Correlation between specialization and expertise	.	- 0.344	0.409	0.293	- 0.532	- 0.319	.
Separation between leagues	.	0.206	0.361	.	0.334	0.299	.

* by trend; ** EI ≤ 4.38, N = 61; [a] Significant difference to pivots; [b] Significant difference to half backs.

Table 4: Correlations between factors of playing experience and tactics-skill (highest out of Pearson`s coefficient, Spearman`s Rho and Kendall`s Tau b).

Significant correlations	Wing players Tactics-skill [pts]	Half backs Tactics-skill [pts]	Centre backs Tactics-skill [pts]	Pivots Tactics-skill [pts]	Goalkeepers Tactics-skill [pts]
Sum of years played					-0.191*
Years played on senior level				-0.292	
Years played during youth		0.192		0.230*	0.237
Expertise points per year	0.313	0.443		0.460	
Highest league senior	0.365	0.375		0.459	0.366
Current league	0.255	0.484		0.425	0.402
Previous league	0.391	0.449	0.198*	0.511	0.436
Most frequent league	0.287	0.378		0.492	0.380
Ranking over sum of expertise points senior	0.184	0.220	0.201*		
Mean league current / previous season	0.344	0.506	0.217*	0.484	0.435
Highest league youth	0.220	0.268		0.533	
Expertise points per year in youth	0.319	0.294		0.558	
Sum of expertise points senior			0.234		
Sum of expertise points youth	0.244	0.308		0.577	

* by trend



* by trend significance.

Figure 1: Model values calculated for players at elite level for tactics-skill.

DISCUSSION AND CONCLUSIONS

When considering descriptive statistics, back players show the best values at all performance levels. Differences between positions indicate that there are probably training deficits at regional level regarding pivots. Correlations and separation between leagues state a demand for well-developed tactics skill on all positions except centre backs, while wings, pivots and goalkeepers should improve to match the performance of the back players. If the correlation between specialization and expertise is negative, players on a position should probably improve to reach the performance of the leading positions. When considering the centre backs' values, it is evident that the players of this position display a homogeneously high tactics-skill at all performance levels, so correlations and separations are not likely to occur despite a strong demand for high tactics-skill for this position.

When considering connections between tactics-skill and other factors, it is evident that a good development of almost all conditional factors correlates with tactics-skill on all positions (Tab. 3). This could be caused by the fact that players with high physical fitness get to play on the positions where they can gain the best and most various tactical experiences. The same applies for technical factors, which also correlate with tactics-skill. Constitutional parameters also show a connection pointing in the same direction. Body weight correlates negatively with tactics-skill when looking at all players and specifically for the pivot-position. Also, percentage of body fat correlates negatively with tactics-skill for pivots. What might make it difficult for the players of the wing positions, pivots and goalkeepers to acquire tactical skill is the fact that sometimes position-specific selection during youth training is carried out quite early and (this also applies to senior level) according to physical fitness and conditional, technical or constitutional factors. Players who are physical fit and also quite tall get to play half back while others are selected for the wing-positions (Matthys, 2012), probably because they are small, inexperienced or new on the team (Michalsik et al., 2011), or they are selected to play as pivots and goalkeepers (heavy-built or overweight, weak running performance, technical deficits; Šibila, Pori & Imperl, 2008; Zapartidis et al., 2009 a). These proceedings should be discouraged, since the concerned players cannot acquire the missed tactics-skill later (Matthys, 2012). In play, wing players usually only need tactical skills concerning fastbreaks, while having clear view and planning the game is the task of the back players, especially centre backs organize the game (Zapartidis et al., 2009 a). The Pivots do have a view which differs from that of all other field players and the goalkeepers caused by their positioning within the opposing team's defence. This might lead to their weak results in the test as well as the fact that less fit players are not able to gain sufficient tactical experience as mentioned by Matthys (2012).

When testing biographical factors during youth and at senior level for correlation with tactic-sskill, different factors do correlate positively with tactics-skill for the positions, but there are also common factors during youth for some positions like active years, highest league and expertise points per year and in total during youth, which correlate with expertise for wings, half backs and pivots (Tab. 4). Experience at senior level like e. g. highest league, current performance level and sum and mean of expertise points are important for developing tactics skill for all positions with one exception. For centre backs it is notable that also when testing for correlations with senior-expertise factors, only the sum of expertise points at senior level and by trend the senior level expertise, previous and mean of current and previous league correlate with tactics-skill. For goalkeepers, youth factors do not seem to play the starring role as well but rather highest

league played at senior level, expertise points of most frequent league at senior level alongside current and previous season. Those factors also correlate with tactics-skill for wings, half backs and pivots, but not for centre backs. While tactics-skill is enhanced via playing experience in youth regardless of performance level for wings, half backs and pivots and via high-level senior-experience for centre backs and goalkeepers, the sheer sum of years a player has been playing at senior level regardless of performance level does not seem to be important on any position.

These findings could mean that the players' biography during youth might affect the development of tactical skills at least for wings, half backs and pivots. If tactical skills really develop during youth, specialization should not take place too soon to ensure that all young players can gain experience in various playing situations on all positions. The „Long term handball development model" (Matthys, 2012) recommends specializing with at the age of 16, whereas Čavala et al. (2013) recommend specialization with 13 to promote optimum development of conditional and constitutional factors. Here, criteria for selection have to be discussed. Constitutional parameters are seen controversially (Matthys, 2012; Visnapuu & Jürimäe, 2009; Zapartidis et al., 2009 b against early specialization and selection according to constitutional factors, for early specialization and selection according to constitutional factors Čavala et al., 2013) because youth players can change concerning those factors during puberty, then possibly fitting better into another position but lacking technical and tactical components. Since constitutional factors change during puberty and conditional factors are subject to training rather than selection since they can still be trained, selection should not be based on those factors. Tactical and technical ability are still developing during puberty as well, as the current study shows (in agreement with the findings of Matthys (2012). Therefore, psychological factors might probably be a better predicator than other performance factors, to a certain extent in female youth players, but even more so in adult female handball players since conditional and constitutional factors are *"poor markers for sport-selecting strategies"* (Gonçalves, Rama & Figueiredo, 2012, p. 392). Motivation is proposed as predicator by Gonçalves et al. (2012), but there might be other suitable factors.

In this sample, half backs and centre backs do display the best tactics-skill followed by wing players, pivots and goalkeepers. Distinguished differences between half backs and pivots are only prevalent in the lower leagues, probably caused by training deficits of the pivots and might therefore not be desirable. This also becomes apparent in the negative correlation between specialization and expertise for pivots, but also wings and goalkeepers. Therefore wing players, pivots and goalkeepers should be trained to match the level of the back players. Training deficits should not lead to positional selection. Model player results can be used for scouting and performance diagnostics whereas half backs do display the highest need for tactics-skill of all positions.

During the selection process it has to be considered that the development of tactics-skill at young age is not clear. At the same time youth players get selected according to conditional and constitutional parameters, which can lead to mistakes in position-specific selection (Matthys, 2012). The development of handball-relevant factors during puberty therefore has to be researched to gain knowledge on which factors could be a better predicator than constitutional or conditional factors. Psychological factors and cognition might play a role in talent selection since biological factors have downsides when being used as predicators (Gonçalves et al., 2012). Tactical training for all positions should be applied to all players up to the age of at least 16 (as indicated by current findings, but also according to Matthys, 2012). Early specialization before the age of 16 and selection on the basis of constitutional and conditional factors during early youth training has to be discouraged (Gonçalves et al., 2012; Matthys, 2012). In the present study

it is evident that the development of tactical skills for young female German players is connected to playing experiences made during youth training at the age of 13 and older and specialization therefore should take place shortly before the transition to senior level to allow various playing experiences on different positions for the young players. This confirms the results of Matthys (2012) for Belgian male youth players. It is nevertheless still questionable whether the time frame for special tactics training is the same for boys and girls since puberty starts at a different point. The differences between girls and boys have to be clarified further. Bon, Pori & Šibila (2013) state that in Slovenia quite young girls already play at senior level, but also drop out quite early while for boys, this does not happen to that extent. Consequently, the time frame for specialization and preferred values per position have to be discussed separately for both genders.

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