

Current state of development of basic physical parameters of Canadian-American National Hockey League (NHL) ice hockey players between 2015 and 2020 with regard to game position

MARTIN SIGMUND¹, DAVID PRYCL², IVA DOSTÁLOVÁ³

^{1,2,3}BALUO Application Centre, Faculty of Physical Culture, Palacký University Olomouc, Olomouc, CZECH REPUBLIC.

Published online: July 31, 2023

(Accepted for publication July 15, 2023)

DOI:10.7752/jpes.2023.07207

Abstract:

Physical parameters represent an important part of the structure of sports performance and significantly contribute to the overall performance of an ice hockey player. Basic physical parameters are also an essential part of a comprehensive player assessment both during the initial NHL draft and in further stages of a professional career. For an objective assessment, it is desirable to know the current condition of development of monitored somatic parameters with regard to the sports discipline, performance level, and gaming position. The study aimed to analyse and present the level of development of basic physical characteristics [Body Height (BH) and Body Weight (BW)] in current ice hockey players in the Canadian-American NHL, also with respect to various gaming positions. Another aim was to compare the results with relevant data of elite ice hockey players around the world. The data of 970 ice hockey players (age range: 18–42 years; 100 % male) from NHL (2019/2020 season) were analyzed [Goalkeepers ($N = 87$); Defenders ($N = 303$); Forwards ($N = 580$)]. Statistical data processing was performed using a single factor ANOVA and Fisher's (LSD) post-hoc test. The level of statistical significance was tested at a level of $p \leq 0.05$; $p \leq 0.01$. Effect Size was expressed according to Cohen's d . Current levels of monitored parameters of NHL players represent the values: BH = 185.8 ± 5.5 cm, BW = 90.0 ± 6.9 kg. Significant differences among positions were found for the BH (Goalkeepers > Defenders > Forwards), BW (Defenders > Goalkeepers > Forwards). The observed values represent the current level of basic physical parameters in professional ice hockey players in the NHL and can be considered reference values in this specific population group.

Keywords: body height, body weight, male, elite sport, NHL

Introduction

Monitoring the development of somatic and morphological parameters has an irreplaceable place in the field of individual health assessment, as well as in the field of elite sports. An individual's sporting performance is influenced by a number of interrelated factors. Important determinants of an individual's sports performance include basic somatic characteristics (Stanula et al., 2013). Each sport requires a different level of development of physical parameters that help shape the possible high competitive performance of the athlete. At the same time, the necessary level of development of body parameters is being developed, also with regard to the dynamics of changes and development of sports specialization and specific demands on physical parameters. Individual sports have their own somatic specifics and requirements with regard to specialization, age, gender, playing status, etc. In our case, we deal with the development of basic somatic parameters in current top ice hockey players from the best competition in the world.

Ice hockey is a team sport that requires a specific proportion of different physical and physiological prerequisites to achieve an elite level of performance. It is therefore a complex sport that is influenced by many factors. A fundamental influence is the high level of development of somatic and morphological parameters, the level of aerobic and anaerobic energy coverage, postural stability and its control at the central level, the ability to develop the maximum concentric force of the lower limbs, functional joint range and flexibility in general, and the ability to implement the game with a disc in high speeds while dealing with specific unpredictable situations that are typical for ice hockey (Burr et al., 2008; Burr et al., 2015; Heller et al., 2019; Kutáč & Sigmund, 2015; McArdle, Katch, & Katch, 2010; Neuls et al., 2023; Peterson et al., 2015; Peterson et al., 2016; Peyer et al., 2011; Potteiger et al., 2010; Rocznio et al., 2013; Stanula et al., 2014). These factors apply to both offensive and defensive strategies, which are designed by coaches to maximize the chance of scoring a goal while minimizing the chance of conceding a goal as much as possible. Ice hockey is considered one of the fastest collective games in the world. It is a tough game that sometimes requires intense physical contact with the opponent, an aggressive approach, and maximum strength during the substitution interval on the ice surface. A single season and the time for post-match regeneration is reduced, which entails high demands on the physical, technical, but also tactical side of performance (Bukač, 2005; Rosenberg et al., 2020). The complex of somatic

and morphological parameters represents an important factor affecting the performance of players at the elite level (Tanner & Gore, 2013; Tarter et al., 2009). Ice hockey players are drafted by professional National Hockey League (NHL) clubs around the age of 18-19 (Gledhill & Jamnik, 2007). Their physical development, especially increasing the amount of body weight, then continues until the age of 25. During this period, on average, a professional ice hockey player increases his body weight by 5 kg (Montgomery, 2006). To reach the elite level in ice hockey, it is necessary to meet the basic physical requirements, such as body height and body weight, as well as the optimal ratio of individual body composition parameters as well as the overall body constitution (Delisle-Houde et al., 2019; Chiarlitti et al., 2018; Kutáč et al., 2017; Rocznik et al., 2016). During adolescence, these parameters are the main predictor of further physical development and, due to the playing position, predict the possible application in the future at the highest level (Sigmund, Kohn, & Sigmundová, 2016; Vescovi, Murray, & Van Heest, 2006).

In the context of the above, we formulated the following research question: “What is the specific level of development of basic somatic parameters in current professional ice hockey players in the Canadian-American NHL?”

The aim of this paper was to analyse and present the level of development of basic somatic characteristics in current ice hockey players in the Canadian-American NHL, also with respect to various gaming positions. Another aim was to compare the results with relevant data according to the data of the NHL 2015 year.

Material and methods

Subjects

The present study analyses available basic physical data of current players in the Canadian-American NHL. The nature of the survey was descriptive-comparative (Thomas, Nelson, & Silverman, 2015). The observed values of the monitored morphological parameters in adult ice hockey players in the Canadian-American NHL were analysed in 2020. A total of 970 personal player cards were processed (100% male). The present data represent the values of current professional ice hockey players in the NHL. The average age of the monitored NHL players (2019/2020 season) was 26.3 years (SD = 4.19; range 18–42 years). In addition, individual values of the monitored parameters were assigned to the subsets according to the respective gaming position [Goalkeepers, $N = 87$ (28.4±4.74 years); Defenders, $N = 303$ (26.4±4.15 years); Forwards, $N = 580$ (25.9±3.99 years)]. The analysed data were based on relevant sources of all current teams active in the Canadian-American NHL ($N = 31$). The analytical survey included players of nationalities from Canada (42%), USA (27%), Sweden (9.3%), Russia (5.7%), Finland (4.5%), Czech Republic (4.1%), Switzerland (1.4%), Denmark (1.4%), Germany (0.9%), Austria (0.7%), Slovakia (0.7%), Latvia (0.5%), France (0.5%), United Kingdom (0.3%), Ukraine (0.2%), Netherlands (0.2%) and Slovenia (0.2%) (QuantHockey, 2020).

To convert the values to metric units, we used the data from a conversion table (Malina, Bouchard, & Bar-Or, 2004). In our case, we worked with the following conversions: 1 foot = 30.48 cm; 1 inch = 2.54 cm; 1 pound = 0.454 kg. Comparison of data of NHL players ($n = 970$) with the data of the NHL ice hockey players from 2014/2015 season ($N = 751$) (Sigmund, Kohn, & Sigmundová, 2016).

Statistical analysis

The data was analysed were using the Statistica v. 10.0 (Statistica, Tulsa, USA). Statistical values were calculated for all variables, verifying distribution normality. Parametric as well as non-parametric statistical tests were used. The Shapiro-Wilk test was used to assess normality. For testing the significance of the differences, a one-factor analysis of variance (ANOVA) with subsequent Fisher's LSD post-hoc test were performed. The level of statistical significance was tested at $p \leq 0.05$ and $p \leq 0.01$. Effect Size was expressed in d values, where d is Cohen's coefficient for effect size defined as a difference between two means divided by a standard deviation for the data. The most frequent assessment of effect size d is 0.2 – small effect, 0.5 – moderate effect and 0.8 – large effect (Thomas, Nelson, & Silverman, 2015).

Results

The results section presents the outcomes of an analytical survey and specifically defines the values of the monitored morphological parameters of current NHL players. Tables 1 and 2 show the average values of the monitored morphological parameters of the entire sample ($n = 970$), also with respect to players' gaming positions. The mean values of body height, body weight, and BMI of current ice hockey players of the Canadian-American NHL are 185.8±5.5 cm and 90.0±6.9 kg. In terms of gaming positions, we revealed the highest value of body height in ice hockey goalkeepers, followed by defenders and forwards. The differences in body height values with respect to gaming positions range between 2.1 and 4.5 cm. A comparison of body height of goalkeepers and forwards showed a difference of 4.5 cm, which can be considered significant ($p < 0.001$; $d = 0.85$). The difference interval in body weight values with respect to gaming positions is 0.7–2.2 kg. The highest values of body weight were observed in ice hockey defenders. Body weight of goalkeepers in comparison with forwards is not significantly higher. The difference in body weight between defenders and forwards is 2.2 kg, which can be considered statistically significant, but with a lower value of the effect size ($p < 0.001$; $d = 0.33$) (Table 1). Table 2 also presents the results of a comparison of the five-year development of the observed parameters of NHL players with regard to playing status.

Table 1.

Body height and body weight and statistical comparison of differences and effect size of current ice hockey players of NHL – goalkeepers, defenders, forwards

Body height (cm)	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>	<i>Comp.</i>	Δ	<i>p</i>	<i>d</i>
All players	970	185,8	5,5	163,1	205,7				
Goalkeepers	87	189,2	4,7	180,2	200,7	G – D	2,4	<0,001	0,46
Defenders	303	186,8	5,3	173,1	205,7	G – F	4,5	<0,001	0,85
Forwards	580	184,7	5,4	163,1	198,1	D – F	2,1	<0,001	0,39
Body weight (kg)									
All players	970	90,0	6,9	72,1	116,0				
Goalkeepers	87	90,7	6,9	76,0	109,0	G – D	0,7	0,383	0,11
Defenders	303	91,4	6,5	73,1	116,0	G – F	1,5	0,059	0,22
Forwards	580	89,2	6,9	72,1	111,0	D – F	2,2	<0,001	0,33

Note: *Min.* – minimum; *Max.* – maximum; *Comp.* – comparison; G – Goalkeepers; D – Defenders; F – Forwards; Δ – difference of means; *p* – statistical significance; *d* – effect size (Cohen)

Table 2.

Body height and body weight and statistical comparison of differences and effect size of current ice hockey players of NHL – goalkeepers, defenders, forwards (2020 vs. 2015)

Body height (cm)	<i>n</i>	NHL 2020 (<i>n</i> = 970)			NHL2015 (<i>n</i> = 751)			Δ	<i>p</i>	<i>d</i>
		<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>				
All players	970	185,8	5,5	751	186,0	5,3	-0,2	0,447	0,04	
Goalkeepers	87	189,2	4,7	67	188,3	4,4	0,9	0,228	0,20	
Defenders	303	186,8	5,3	237	187,4	5,2	-0,6	0,189	0,11	
Forwards	580	184,7	5,4	447	184,9	5,2	-0,2	0,550	0,04	
Body weight (kg)										
All players	970	90,0	6,9	751	91,7	6,9	-1,7	<0,001	0,25	
Goalkeepers	87	90,7	6,9	67	90,7	6,7	0	1,000	0,00	
Defenders	303	91,4	6,5	237	93,0	6,5	-1,6	0,005	0,25	
Forwards	580	89,2	6,9	447	90,5	7,0	-1,3	0,003	0,19	

Note: *Min.* – minimum; *Max.* – maximum; *Comp.* – comparison; G – Goalkeepers; D – Defenders; F – Forwards; Δ – difference of means; *p* – statistical significance; *d* – effect size (Cohen)

Discussion

In recent decades, the physical and physiological profile of ice hockey players has changed significantly, even with regard to individual playing positions (Quinney et al., 2008). For example, compared to players active between 1920 and 1930, players of the Montreal Canadians team weighted 17 kg more and were 10 cm taller. Their BMI increased by an average of 2.3 kg/m² (Montgomery, 2006). Furthermore, ice hockey players experienced a progressive increase in body weight and height between 1980 and 1991. In 1980, approximately 40% of players weighed less than 85 kg, and 71% of players were shorter than 180 cm. In contrast to 1991, only 25% of the players weighed less than 85 kg, and 85% of the players were already taller than 185 cm. During this period, however, there were no significant differences in the amount of the fat component, which remained constant at 13% (Cox et al., 1995). The requirements of the most prestigious hockey league, i.e., the NHL, for basic somatic parameters for body height are at the level of 186 cm, and for body weight, the interval is between 91-94 kg (Burr et al., 2008; Montgomery, 2006; Quinney et al., 2008). Above all, there is currently a trend of decreasing body weight. Sigmund et al. (2014) analysed data regarding the basic somatic characteristics of hockey players from a total of 36 countries. They took into account the level of game performance according to the ranking of the International Ice Hockey Federation (IIHF) and game position (Sigmund et al., 2014). Ice hockey players from the highest performance category "A" are characterized by the highest values of the monitored parameters. The lower values were found in players of the second performance category "B", and the lowest values were found in players of the lowest performance level "C". The same trend of higher values is also observed in relation to game status (Sigmund et al., 2014; Sigmund, Sigmundová, & Kvintová, 2015).

If we focus on the development during the five years between 2015 and 2020, there are certain changes in the level of monitored somatic parameters of Canadian-American NHL players. The average body height values for all players remain almost unchanged and hover around 186 cm. However, there was an overall significant reduction in body weight from 91.7 kg to 90.0 kg ($p < 0.001$) (Table 2). The observed reduction in body weight among NHL players can be attributed to the overall change in the concept of the game, where ice hockey at the NHL level is increasingly faster, and the emphasis is placed on the development of abilities and skills in the agility mode. At the same time, it can be assumed that the players are more athletic, and there is also a reduction in the representation of body fat. If we analyse the trends in the monitored parameters for individual playing

positions, the body height of hockey goalkeepers increases insignificantly by 0.9 cm. This confirms the trend of recent years when the tallest players in the NHL are goaltenders. At the same time, there was no change in body weight values for hockey goalkeepers. This is maintained at an average value of 90.7 kg (Table 2). From a game point of view, it has its indisputable advantage if the goalkeeper takes up as much space as possible, thus significantly reducing the reception of the goal and the scoring of the opponent. In hockey defenders, between 2015 and 2020, an insignificant decrease in average body height and a simultaneous significant decrease in body weight by 1.6 kg ($p < 0.005$) were found. A similar trend was also found in hockey forwards, i.e., insignificant reduction in body height, but significant reduction in body weight by 1.3 kg ($p < 0.003$) (Table 2). The findings generally correspond to the current concept of ice hockey at the NHL level and are thus also reflected in changes in the monitored somatic parameters. Overall, however, the trend for body height along the axis remained Goalkeepers > Defenders > Forwards, and for body weight along the axis, Defenders > Goalkeepers > Forwards.

Conclusions

The presented study focused on monitoring the development of basic somatic parameters in current ice hockey players in the Canadian-American NHL. The main goal was to find out the specific values of body height and body weight in the monitored players, also with regard to the playing position. At the same time, we tried to capture the possible trend of development and changes in the monitored parameters in the context of 2015 and 2020. We present the processed data of 970 players of the mentioned competition. In terms of body height of current NHL players, the average value was found to be 185.8 cm. With respect to playing position, the highest values were found for hockey goalkeepers, then for defenders, and the lowest values were found for forwards. The average body weight of NHL players is 90.0 kg. With regard to playing position, the highest values were found for hockey defenders, followed by goalkeepers, and the lowest values were found for forwards. The comparison with 2015 data of NHL players shows a non-significant decrease in body height but a significant decrease in body weight of 1.7 kg. This trend of reduced body weight may reflect the dynamics of ice hockey development at the NHL level. The reduction in weight can be related to a lower concentration on the power elements of the game and enables the development of modern game prerequisites in the agility mode with the maximum development of game skills. With regard to the playing positions, a trend was found in increasing the body height values of goalkeepers. At the same time, only goalkeepers' body weight remained unchanged. The presented values represent the current level of basic physical parameters for professional ice hockey players in the NHL and, at the same time, point to the trend of changes in the context of five years with the simultaneous consideration of playing positions. The data can be considered as current reference values in this specific population group and have their theoretical and practical significance for further work.

Acknowledgements

This study was supported by the research project of Science and Technology Park – BALUO Application Centre of Faculty of Physical Culture, Palacký University Olomouc.

Conflicts of interest

The authors report no conflict of interest.

References

- Bukač, L. (2005). *Intellect, Learning, Skills & Coaching in Ice Hockey* [in Czech]. Praha: Olympia.
- Burr, J. F., Jamnik, R. K., Baker, J., Macpherson, A., Gledhill, N., & McGuire, E. J. (2008). Relationship of physical fitness test results and hockey playing potential in elite-level ice hockey players. *Journal of Strength and Conditioning Research*, 22, 1535–1543.
- Burr, J. F., Slys, J. T., Boulter, M. S., & Warburton, D. E. R. (2015). Influence of active recovery on cardiovascular function during ice hockey. *Sports Medicine – Open*, 1, Article 27.
- Cox, M. H., Miles, D. S., Verde, T. J., & Rhodes, E. C. (1995). Applied physiology of ice hockey. *Sports Medicine*, 19(3), 184–201.
- Delisle-Houde, P., Reid, R. E. R., Insogna, J. A., Chiarlitti, N. A., & Andersen, R. E. (2019). Seasonal changes in physiological responses and body composition during a competitive season in male and female elite collegiate ice hockey players. *Journal of Strength and Conditioning Research*, 33(8), 2162–2169.
- Gledhill, N., & Jamnik, V. (2007). *Detailed Assessment Protocols For NHL Entry Draft Players*. Toronto: York University.
- Heller, J., Vodicka, P., & Janek, M. (2019). Anaerobic performance in 30s Wingate test as one of the possible criteria for selection Czech hockey players into National Hockey League. *Physical Activity Review*, 7, 57–62.
- Chiarlitti, N. A., Delisle-Houde, P., Reid, R. E. R., Kennedy, C., & Andersen, R. E. (2018). Importance of body composition in the National Hockey League combine physiological assessments. *Journal of Strength and Conditioning Research*, 32(11), 3135–3142.
- Kutáč P., & Sigmund, M. (2015). A comparison of somatic variables of elite ice hockey players from the Czech ELH and Russian KHL. *Journal of Human Kinetics*, 45, 129–137.

- Kutáč, P., Sigmund, M., & Botek, M. (2017). Changes in selected morphological characteristics in elite ice hockey players during an eight-week conditioning program. *Journal of Physical Education and Sport*, 17(3), 2059–2066.
- McArdle, W. D., Katch, F. I., & Katch, V. L. (2010). *Exercise Physiology: Nutrition, Energy, and Human Performance*. Baltimore (MD): Lippincott Williams & Wilkins.
- Montgomery, D. L. (2006). Physiological profile of professional hockey players – a longitudinal study. *Applied Physiology, Nutrition and Metabolism*, 31, 181–185.
- Neuls, F., Botek, M., Krejčí, J., & Sigmund, M. (2023). Comparison of selected performance-associated parameters after off-season and two-month training preparation in professional Czech ice hockey players. *Acta Gymnica*, 53, 1–8.
- Peterson, B. J., Fitzgerald, J. S., Dietz, C. C., Ziegler, K. S., Baker, S. E., & Snyder, E. M. (2016). Off-ice anaerobic power does not predict on-ice repeated shift performance in hockey. *Journal of Strength and Conditioning Research*, 30(6), 2375–2381.
- Peterson, B. J., Fitzgerald, J. S., Dietz, C. C., Ziegler, K. S., Ingraham, S. J., Baker, S. E., & Snyder, E. M. (2015). Aerobic capacity is associated with improved repeated shift performance in hockey. *Journal of Strength and Conditioning Research*, 29(6), 1465–1472.
- Peyer, K. L., Pivarnik, J. M., Eisenmann, J. C., & Vorkapich, M. (2011). Physiological characteristics of national collegiate athletic association division i ice hockey players and their relation to game performance. *Journal of Strength and Conditioning Research*, 25(5), 1183–1192.
- Potteiger, J. A., Smith, D. L., Maier, M. L., & Foster, T. S. (2010). Relationship between body composition, leg strength, anaerobic power, and on-ice skating performance in division i men's hockey athletes. *Journal of Strength and Conditioning Research*, 24(7), 1755–1762.
- QuantHockey, (2020). http://www.quanthockey.com/TS/TS_PlayerNationalities.php
- Quinney, H. A., Dewart, R., Game, A., Snyder, G., Warburton, D., & Gordon, B. (2008). A 26 year physiological description of a National Hockey League team. *Applied Physiology, Nutrition and Metabolism*, 33, 753–760.
- Roczniok, R., Maszczyk, A., Stanula, A., Czuba, M., Pietraszewski, P., Kantika, J., & Starzyński, M. (2013). Physiological and physical profiles and on-ice performance approach to predict talent in male youth ice hockey players during draft to hockey team. *Isokinetics & Exercise Science*, 21, 121–127.
- Roczniok, R., Stanula, A., Maszczyk, A., Mostowik, A., Kowalczyk, M., FidosCzuba, O., & Zajac, A. (2016). Physiological, physical and on-ice performance criteria for selection of elite ice hockey teams. *Biology of Sport*, 33(1), 43–48.
- Rosenberg, S. I., Baker, H. P., Rizzi, A., Terry, M. A., Tjong, V. K. (2020). Frequency of overtime and consecutive games and their impact on injury rate in the National Hockey League (NHL). *Physician and Sportmedicine*, 1, 100–1005.
- Sigmund, M., Riegerová, J., Sigmundová, D., & Dostálová, I. (2014). Analysis of the basic morphological characteristics of current ice hockey players from around the world in relation to level of performance according to ranking of International Ice Hockey Federation [in Czech]. *Česká antropologie*, 64(2), 34–39.
- Sigmund, M., Sigmundová, D., & Kvintová, J. (2015). Basic physical profile of current Czech elite male ice hockey players - reference values. *Life Science Journal*, 12(2), 9–13.
- Sigmund, M., Kohn, S., & Sigmundová, D. (2016). Assessment of basic physical parameters of current Canadian-American National Hockey League (NHL) ice hockey players. *Acta Gymnica*, 46(1), 30–36.
- Stanula A, Roczniok R, Gabrys T, Szmatlan-Gabrys U, Maszczyk A, & Pietraszewski P. (2013). Relations between BMI, body mass and height, and sports competence among participants of the 2010 winter Olympic Games: Does sport metabolic demand differentiate? *Percept Mot Skills*, 117(3), 1–18.
- Stanula, A., Roczniok, R., Maszczyk, A., Pietraszewski, P., & Zajac, A. (2014). The role of aerobic capacity in high-intensity intermittent efforts in ice-hockey. *Biology of Sport*, 31, 193–199.
- Tanner, R., & Gore, Ch. (2013). *Physiological Tests for Elite Athletes* (2nd ed.). Champaign, IL: Human Kinetics.
- Tarter, B. C., Kirisci, L., Tarter, R. E., Weatherbee, S., Jamnik, V., McGuire, E. J., & Gledhill, N. (2009). Use of aggregate fitness indicators to predict transition into the National Hockey League. *Journal of Strength and Conditioning Research*, 23(6), 1828–1832.
- Thomas, J. R., Nelson, J. K., & Silverman, S. J. (2015). *Research methods in physical activity* (7th ed.). Champaign, IL: Human Kinetics.
- Vescovi, J. D., Murray, T. M., & Van Heest, J. L. (2006). Position performance profiling of elite ice hockey players. *International Journal of Sports Physiology and Performance*, 1, 84–94.