Original Article

Impact of power plays´ efficiency on ice hockey match result and team standings

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Abstract:
        The main aim of this research was to determine the impact of the game, in which is participating a team
that has numerical superiority, on the match results and team standings at the 2017 IIHF Ice Hockey U18 World
Championship. We studied 31 matches. In order to compare differences in power plays´ occurrence and number
of scored goals in power plays of winning and losing teams we used the Chi-Square Test. Spearman´s Rank-
Order Correlation (R) was used to determine the relationship between the team standings at the World
Championship and efficiency of power plays, as well as the goals scored in power plays. The level of statistical
significance was set at 5 %. We found out significant relationships between the number of scored goals in power
plays and the team standing at the tournament (R = 0.696; p ≤ 0.05). However, there was no significant
relationship between the final standings at the tournament and efficiency of using power plays (R = 0.503, p >
0.05). At the 5 % significance level, we did not confirm any statistically significant difference in the number of
power plays between winning team (121) and defeated team (131) (X^2 = 0.397; p > 0.05). We noticed a similar
situation also in number of scored goals in power plays (X^2 = 3.429; p > 0.05), although the winners scored 27
goals and the losers 15 goals. The relationship between the match result and the success rate of power plays was
statistically significant (X^2 = 5.468; p ≤ 0.05).
Key words: ice hockey, power play, final score, final team standings, IIHF Ice Hockey U18 World
Championship

Introduction

        According to Tóth (2014), power play is a time-bound game of a team, which has numerical
predominance and has one or two more forwards than the defending team of opponent. On average, in ice
hockey is occurring a higher number of power plays in one match than it was 10 years ago. Currently it is on
average from 5 to 6 times more in just one match. Altogether it is 10 to 12 minutes of the match, what represents
approximately 17 to 20 % of the total match time. Tóth & Paľov (2013) states that the analysis of the game
points out to the fact that on average, the best teams need three power plays to score a goal. A power play is such
a game situation, in which is number of players on ice in a ratio of 5-4, 5-3 and 4-3 or 6-5, 6-4 and 6-3. The sixth
player can´t come to the ice until the goalkeeper of his team is withdrawn by coach and goes to the player´s
bench. This kind of ice hockey situation occurs usually before the end of the match, when there is an
unfavourable result of the short-handed team.
        Thomas (2007) analysed 4 708 matches in the National Hockey League (NHL) altogether. He studied
how was the distribution of the scored goals in power plays according to the every minute of the match. Also
states that during first minutes of first period in power plays is scored a lower number of goals when comparing
to the remaining match minutes. This situation occurs mainly at the first minute of the match, as it is very rare
when a team which enters the match is penalized at the beginning of the first period. During first minutes of the
second and third period affects the number of goals unfavourably the face off in the center circle. Saarinen et al.
(2006) examined the number of scored goals during the power plays at the 2005 Ice Hockey World
Championship (Vienna) and at the Winter Olympic Games 2006 (Torino). Research has show that the
percentage of successful power plays shows an upward trend. At the Winter Olympic Games 2006 (Torino) were
33.5 % of goals scored in power play. However, at the World Championship 2001, were in power plays scored
11 % less goals. The quality of game performance is influenced by many factors, which includes among other
things also the player´s physical performance that can influence and already affects the performance of young
players (Šiška & Kováčiková 2017).

Material & Methods

        The aim of our research was to determine the frequency of power plays and their impact on the
particular match as well as team standings at the 2017 IIHF Ice Hockey U18 World Championship.
        From our set goal emerged these tasks:

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1. To find out the frequency and number, time characteristics and success rate of all power plays in matches at the 2017 IIHF Ice Hockey U18 World Championship.

2. To find out the differences in power plays number in each period of matches and time intervals of periods.

3. To find out the difference between the number of power plays and number of scored goals of winning and losing team.

4. To determine the impact of success rate in power plays on the match result.

5. To determine the relationship between power plays´ success rate and teams standing at the 2017 IIHF Ice Hockey U18 World Championship.

In our research was used the ex-post facto research. We watched and studied all 31 matches at the 2017 IIHF Ice Hockey U18 World Championship. Power plays were divided into three groups, i.e. one team has a one-, two- or three-player advantage.

To obtain data we used statistical databases of the International Ice Hockey Federation (IIHF). The data were obtained from the official statistics of the tournament (http://www.iihf.com/). In order to compare differences in power plays´ occurrence and number of scored goals of winning and losing team in power plays and in temporal occurrence of power plays was used the Chi-Square Test. To determine the relationship between team standings at the World Championship and the success rate of power plays, as well as the goals scored in power plays, was used Spearman´s Rank-Order Correlation (R). The level of statistical significance was set at 5%. To determine a substantive significance was used Cohen´s „d" (effect size). It was used by evaluation of the effect size (Sigmundová & Fromel 2005).

Results

At the 2017 Ice Hockey U18 World Championship we monitored the following types of power plays: 5-4, 5-3 and 4-3. Overall, there were 252 power plays during matches, of which 42 were successful (16.7 %) and 210 were unsuccessful (83.3 %). The 5-4 power play occurred 238 times, what represents 94.4 % of total number of power plays, of which 39 (16.4 %) were successful and 199 were unsuccessful (83.6 %) (Fig.1). The 5-3 power play occurred in 31 matches 13 times (5.2 % of the total number), of which 3 were successful (23.1 %) and 10 were unsuccessful (76.9 %). The 4-3 power play was recorded once (representing 0.4 % of the total number of power plays) and was not successful.
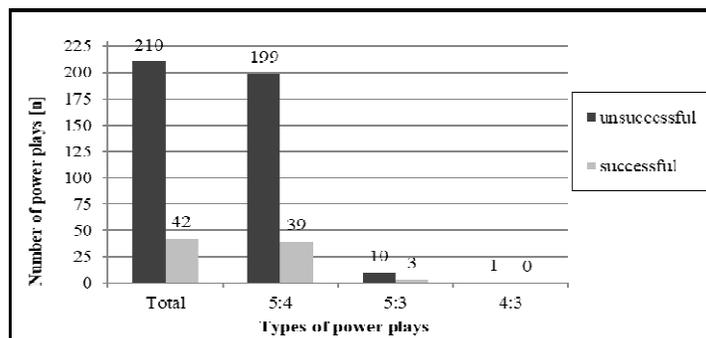

Fig. 1   Number of successful and unsuccessful power plays according to the type of power play

In Fig. 2 is given the total percentage success rate of power plays´ utilization (16.67 %). The 5-4 power play was successful in 16.39 %. The highest success rate was recorded in the 5-3 power plays (23.08 %). The 4-3 power play occurred at the 2017 IIHF Ice Hockey U18 World Championship only once and wasn´t successful.
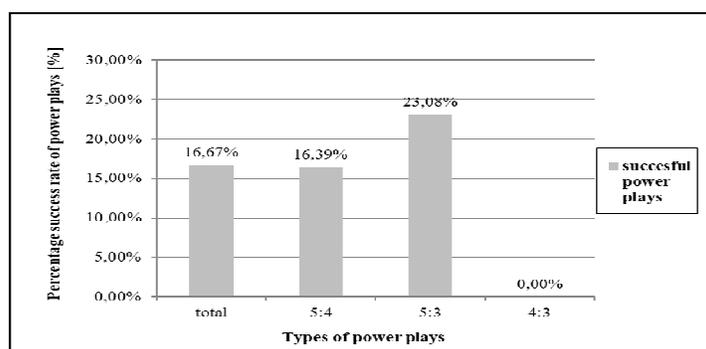

Fig. 2. Percentage success rate of successful power plays according to the type of power play

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The highest succesful rate of using power plays at the 2017 IIHF Ice Hockey U18 World Championship had team of Finland (29.03 %). The lowest successful rate had team of Belarus (3.70 %). The average successful rate of using power plays considering all teams attending at the tournament was 16.67 %.
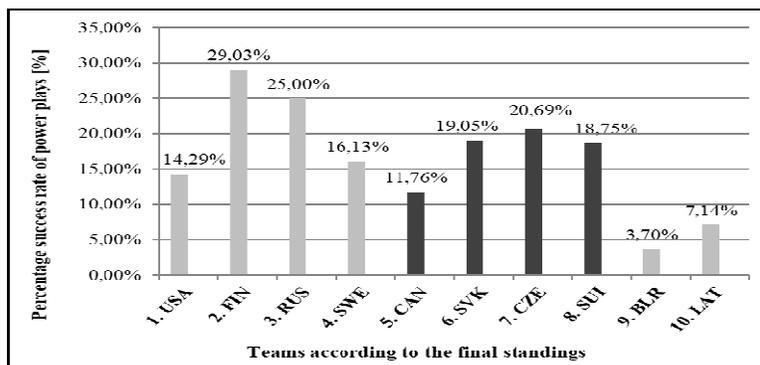

Fig. 3. Priemerná percentuálna úspešnosť družstiev v presilových hrách podľa celkového umiestnenia

Teams of Slovakia, the Czech Republic and Switzerland had a higher success rate in the use of power plays than the teams of USA and Sweden, which ranked higher than them (Fig. 3).

The frequency of power plays in individual intervals of the periods are in Table 3. The number of penalties in the first minutes of the match and at the beginning of the second period was 27 penalties. From 26 to 30 minutes was recorded 25 penalties and from 11 to 15 minute 23 penalties. In the second period of matches at 2017 IIHF Ice Hockey U18 World Championship we monitored the highest number of penalties (100 times). In the total number of power plays and 5-4 power plays was the lowest number of power plays recorded in the third period.

Table 1 Overall occurrence of power plays according to the time intervals of periods and types of power plays

	1st PERIOD				2nd PERIOD				3rd PERIOD				OT	Total
Time interval [min.]	0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	∑
Number of PP [n]	27	14	23	18	27	25	27	21	19	15	18	18	0	252
Total number of PP [n]	82				100				70				0	252

Table 2 Occurrence of power plays according to the time intervals of periods and types of power plays 5-4

	1st PERIOD				2nd PERIOD				3rd PERIOD				OT	5-4
Time interval [min.]	0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	∑
Number of PP [n]	26	14	23	15	26	24	26	19	16	14	17	18	0	238
Total number of PP [n]	78				95				65				0	238

Table 3 Occurrence of power plays according to the time intervals of periods and types of power plays 5-3

	1st PERIOD				2nd PERIOD				3rd PERIOD				OT	5-3
Time interval [min.]	0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	∑
Number of PP [n]	1	0	0	2	1	1	1	2	3	1	0	1	0	13
Total number of PP [n]	3				5				5				0	13

Table 4 Difference in number of power plays in terms of the time intervals in the 1st periods

TIME OCCURRENCE OF POWER PLAYS IN 1ST PERIODS

Time intervals [min.]	Real occurrence [R] of played power plays [n]	Expected occurrence [E] of played power plays	R – E	(R - E)²	(R - E)²/E

	[n]				
0-5	27	20.5	6.50	42.25	2.06
6-10	14	20.5	- 6.50	42.25	2.06
11-15	23	20.5	2.50	6.25	0.30
16-20	18	20.5	- 2.50	6.25	0.30
			p = 0.193 n.s.		$X^2 = 4.732$

Table 5 Difference in number of power plays in terms of the time intervals in the 2nd periods

TIME OCCURRENCE OF POWER PLAYS IN 2ND PERIODS

Time intervals [min.]	Real occurrence [R] of played power plays [n]	Expected occurrence [E] of played power plays [n]	R - E	$(R - E)^2$	$(R - E)^2/E$
21-25	27	25	2	4	0.16
26-30	25	25	0	0	0.00
31-35	27	25	2	4	0.16
36-40	21	25	- 4	16	0.64
			p = 0.811 n.s.		$X^2 = 0.96$

Table 6 Difference in number of power plays in terms of the time intervals in 3rd periods

TIME OCCURRENCE OF POWER PLAYS IN 3RD PERIODS

Time intervals [min.]	Real occurrence [R] of played power plays [n]	Expected occurrence [E] of played power plays [n]	R - E	$(R - E)^2$	$(R - E)^2/E$
41-45	19	17.5	1.50	2.25	0.13
46-50	15	17.5	- 2.50	6.25	0.36
51-55	18	17.5	0.50	0.25	0.01
56-60	18	17.5	0.50	0.25	0.01
			p = 0.916 n.s.		$X^2 = 0.514$

Using the Chi-Square Test, we did not find any statistical significance in the number of power plays in terms of the time intervals in neither of the match periods. By the means of Chi-Square Test, we did not find any statistically significant difference in the number of power plays in the individual match periods, although e.g. the difference in number of power plays between the second (100) and third period (70) represents 30 power plays. Using the Chi-Square Test, we did not find any statistically significant difference in the number of power plays in particular match periods as well, though e.g. the difference in the number of between the second period (100) and third period (70) represents 30 power plays. If we consider the level of substantive significance (Cohen´s „d" – 0.357), then from the substantive significance point of view was the effect between second and third period small.

Table 7. Difference in the number of power plays in particular match periods

TIME OCCURRENCE OF POWER PLAYS

Matches´ periods	Real occurrence [R] of played power plays [n]	Expected occurrence [E] of played power plays [n]	R - E	$(R - E)^2$	$(R - E)^2/E$
1st PERIOD	82	84	- 2	4	0.04
2nd PERIOD	100	84	16	256	3.04
3rd PERIOD	70	84	- 14	196	2.33
			p = 0.066 n.s.		$X^2 = 5.429$

We did not confirm any statistically significant difference in number of power plays of winners (121) and defeated teams (131) ($X^2 = 0.397$; $p > 0.05$). A similar situation is occurring also in the number of scored goals in power plays. The winning teams scored 27 goals and defeated teams just 15 goals. The statistical significance of differences was not confirmed ($X^2 = 3.429$; $p > 0.05$).

Table 8. Difference in the number of power plays and goals scored by winners and losing teams in the match

NUMBER OF POWER PLAYS

Teams	Real occurrence [R] of played power plays [n]	Expected occurrence [E] of played power plays [n]	R - E	$(R - E)^2$	$(R - E)^2/E$
Winning team	121	126	- 5	25	0.20
Losing team	131	126	5	25	0.20
			p = 0.529 n.s.		$X^2 = 0.397$

NUMBER OF GOALS SCORED IN POWER PLAYS

Teams	Real occurrence [R] of played power plays [n]	Expected occurrence [E] of played power plays [n]	R - E	$(R - E)^2$	$(R - E)^2/E$
Winning team	27	21	6	36	1.71
Losing team	15	21	- 6	36	1.71
			p = 0.064 n.s.		$X^2 = 3.429$

The relationship between the success rate of power plays and the match result expressed by victory or loss was statistically significant (X^2 = 5.468; p ≤ 0.05). The winners of matches played 22.1 % successful and 77.69 % unsuccessful power plays. Defeated teams had 11.36 % successful and 88.64 % unsuccessful power plays (Table 9).

Table 9. Relationship between the match result and success rate of power plays

RELATIONSHIP BETWEEN THE MATCH RESULT AND SUCCESS RATE OF POWER PLAYS

Teams	Successful power plays [%]	Unsuccessful power plays [%]	Number of power plays [n]
Winning team	27 (22.31 %)	94 (77.69 %)	121
Losing team	15 (11.36 %)	117 (88.64 %)	132
	42	211	253
X^2 = 5.468 p ≤ 0,05			p = 0.019

Comparison of teams´ final standings at the 2017 IIHF Ice Hockey U18 World Championship using the power plays is shown in the Table 10. Teams of the USA, Sweden and Canada took places in the first half of the U18 World Championship table. Teams of the Czech Republic and Slovakia were placed in the bottom of the table, but their standings on the basis of power plays´ success rate was on the 3rd, or more precisely 4th place. The relationship between the final standings at the tournament and efficiency of using power plays is not statistically significant (R = 0.503, p > 0.05), although the value of correlation coefficient indicates a moderate relationship.

Table 10. The power plays´ success rate in relation to the final standings at the 2017 IIHF Ice Hockey U18 World Championship

POSITION	TEAM	SUCCESS RATE AND STANDINGS IN POWER PLAYS	STANDINGS
1.	USA – United States of America	14.29 % (7)	different
2.	FIN – Finland	29.03 % (1)	similar
3.	RUS – Russia	25.00 % (2)	similar
4.	SWE – Sweden	16.13 % (6)	different
5.	CAN – Canada	11.76 % (8)	different
6.	SVK – Slovakia	19.05 % (4)	different
7.	CZE – Czech Republic	20.69 % (3)	different
8.	SUI – Switzerland	18.75 % (5)	different
9.	BLR – Belarus	3.70 % (10)	similar
10.	LAT – Latvia	7.14 % (9)	similar
	p = 0.138; p > 0.05	R = 0.503	

Discussion

In our study, we tried to find out whether there is a relationship between the number of power plays and match result. The relationship between the number of power plays and march result at the 5 % level of statistical significance was not confirmed. Kohút (2016) came to similar conclusions, when analysing the influence of power plays´ success rate on the final match result at the tournament Winter Olympic Games 2014 (Sochi).

The relationship between the power plays´ success rate and match result, which is expressed by victory or loss is statistically significant (X^2 = 5.468; p ≤ 0.05). The success rate of power plays has an impact on the match result, which implies that the power play is an important factor that can influence the match result and therefore should coaches pay sufficient attention to it in the training process.

The total success rate of power plays in the last three IIHF Ice Hockey U18 World Championships has a tendency to range from 16 % up to 19 % (2017 IIHF Ice Hockey U18 World Championship – 16.67 %; 2016 IIHF Ice Hockey U18 World Championship – 19.72 %; 2015 IIHF Ice Hockey U18 World Championship – 18.17 %), which means that one out of every 6 goals is scored during power play. When considering the success rate, it is obvious that it is becoming increasingly difficult to be successful in power play as well.

The highest success rate in using power plays had the team of Finland (29.03 %), but it was not enough for them to win the 2017 IIHF Ice Hockey U18 World Championship and get the title, since they lost the final match against the USA. The success rate of using power plays of USA team was almost half lower (14.29 %) than that of Finland team, but despite this fact, the USA became the world champion. This situation was also

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confirmed by our research. We assume that there were also some other factors and not just successful power plays, which influenced the final standings of the USA team at the 2017 IIHF Ice Hockey U18 World Championship. The lowest success rate of power plays during this tournament had the team of Belarus (3.70 %), but eventually they saved themselves from loss and the descending team was the one of Latvia, which was in power plays almost twice as successful as Belarus.

The occurrence of power plays in particular time intervals of periods showed that the highest number of penalties occurred during first minutes of the match (0-5) and at the beginning of the second period (21-25), in both cases it was 27 penalties in total. When comparing the particular periods of matches, the highest number of penalties (power plays) was recorded in the second period, in the total number of power plays and in the number of the 5-4 power play as well. It is likely that this is a consequence of the fact that players can be at the beginning of the match and at the beginning of the second period too motivated, or else less concentrated. The number

of power plays from the intervals point of view was not statistically significant in neither period. In the total number of power plays and in the number of the 5-4 power play was the lowest number recorded in the third period.

When comparing the final standings of the teams at the 2017 IIHF Ice Hockey U18 World Championship with the standings according to the percentage success rate of particular teams in using the opportunity of power plays, statistically significant relationship was not found, even though the value of correlation coefficient points to mean dependence. Zdrha (2012) did a similar research, however at different level of performance and in different age group, in which he made the analysis of the extra league teams ice hockey of Czech Republic and their power plays in the 2010/2011 season. The success rate of power plays ranged from 21.4 % to 12.4 %. Zdrha came to the conclusion that the impact of power play on the overall team standings in the extra league of 2010/2011 season is classified as interval of high dependence. We could assume that in long-term competitions (competitions in particular countries) has the success rate of power play probably a greater influence on team standings in long-term competition than on standings at World Championship. It can have something to do with the game strategy and the number of matches as well. The case with the USA team from the 2017 IIHF Ice Hockey U18 World Championship can serve as an example. The USA won this tournament, but with their success rate of power plays ended up in 7th place.

The above mentioned is confirmed also by Szabó (2014), who studied in his research how the success rate of power plays influences the junior teams´ standings in the final standings of Slovak Extra League. Out of the sample comprised of 12 teams was between the success rate of power plays and team standings confirmed a very close relationship.

The success rate of power plays depends probably on many factors, some of them are rooted in the training process (selection of appropriate methodical forms, current fitness) and others in deformational factors and in the ability of ice hockey players to deal with these deformational factors – such as current mental state of player, the importance of the , the importance of the tournament. Among other factors are also coordination of individual players and coaching concept.

Conclusions

Based on the results, we recommend:
1. To pay attention to player´s concentration since the beginning of the match.
2. To pay appropriate attention to power plays in the training process.
3. To pay attention to the fact that impact of power plays on team standings in competition is of greater importance in long-term competitions than in short-term tournaments (IIHF Ice Hockey World Championship, Winter Olympic Games).
4. To pay attention to the fact that in competition team standings, mainly short-term, are often involved also other factors than power plays, e.g. players´ concentration, their motivation and activity cohesiveness.

Acknowledgements

References

IIHF – *International Ice Hockey Federation [Medzinárodná federácia ľadového hokeja]* [online]. Založenie 1908. Zürich: International Ice Hockey Federation [cit. 2017-11-29]. Dostupné z: http://www.iihf.com/

IIHF, 2015. *IIHF Official rule book 2014-2018* [online]. 2. vydanie. Zürich: International Ice Hockey Federation, s. 1-148. July 2015 [cit. 2017-11-20]. Dostupné z:
http://www.iihf.com/fileadmin/user_upload/PDF/Sport/IIHF_Official_Rule_Book_2014-18_Web_V6.pdf

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JPES ®   www.efsupit.ro

Kohút, M., (2015). *Vplyv úspešnosti presilových hier na konečný výsledok zápasu v ľadovom hokeji seniorov*. Bratislava. Bakalárska práca. Univerzita Komenského v Bratislave, Fakulta telesnej výchovy a športu, Katedra športových hier.

Saarinen, M., (2006). Analýza gólov: Odborný metodický list SZĽH [Goal analysis]. Preložil I. TÓTH a I. ANDREJKOVIČ. *Ľadový hokej, 6*(3), 39-48. ISSN 1335-9983.

Sigmundová, D., & Frömel, K., (2005). *Využití koeficintu Effect size pro posouzení významnosti rozdílů.* In: Sborník příspěvků mezinárodního semináře Pedagogické kinantropologie. Ostrava: KTV PF OU.

Šiška, M., & Kováčiková, Z., (2017). Effect of the off-season training on the physical profile in U18 elite male ice hockey players. *Journal of Physical Education and Sport*, *17*(3), 1120-1124. ISSN 2247-8051.

Szabó, P., (2014). *Účinnosť využívania presilových hier vo vzťahu k výsledku zápasu v ľadovom hokeji.* Bratislava. Bakalárska práca. Univerzita Komenského v Bratislave, Fakulta telesnej výchovy a športu, Katedra športových hier.

Thomas, A. C., (2007). Inter-arrival times of goals in ice hockey. *Journal of Quantitative Analysis in Sports, 3*(3), 1-13. ISSN 1559-0410.

Tóth, I., & Paľov, R. (2013). Úspešnosť hry v početnej prevahe o jedného hráča v hokejovom družstve HC '05 Banská Bystrica. *Telesná výchova & šport, 23*(2), 34-38. ISSN 1335-2245.

Tóth, I., (2014). Využitie prípravných hier pri zdokonaľovaní presilovej hry v ľadovom hokeji. *Telesná výchova & šport, 24*(3), 34-37. ISSN 1335-2245.

Zdrha, L., (2012). *Analýza přesilových her extraligových mužstev ledního hokeje v České republice ze sezóny 2010/2011*. Plzeň. Bakalárska práca. Západočeská univerzita, Fakulta pedagogická.