INNOVATIVE CONDITIONING TRAINING METHODS DURING PRE SEASON PREPARATION OF SLOVAK NATIONAL ICE HOCKEY PLAYERS FROM U18 ICE HOCKEY PROJECT

BRŰNN DAVID – SÝKORA JOZEF – PUPIŠ MARTIN – ŠVANTNER ROMAN – MORAVČÍK JURAJ
Department of Physical Education and Sports, Faculty of Arts, Matej Bel University in Banská Bystrica, Slovakia
david.brunn@umb.sk

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ABSTRACT

Pre season period is one of the most important part of the macrocycle in ice hockey. Therefore main purpose of this study was to apply innovative training protocol during pre season period. Eight national team ice hockey players from under 18 hockey project of slovak ice hockey federation participated in 10 weeks training program divided into 3 microcycles per 3 weeks with 1 deload microcycle. First three weeks were targeted on improving eccentric strength (10 training sessions per week), Second 3 weeks were targeted on maximal strength with energy system development and last microcycle was targeted on improving explosive strength and high intensity working capacity. During the program, had been used innovative training tools like Vert, Vertimax and isokinetic ergobike. For complex diagnostics were used FMS, isokinetic ergobike, Bench press, Back squat, Squat jump, Counter-movement jump, grip strength and sprints on 5 and 10 meters. Results showed, that players significantly improved in all tests with low to moderate effect sizes ($p < 0.05$, $r = 0.17 – 0.49$) and in Bench press we achieved higher statistical significance ($p < 0.01$, $r = 0.23$). Used training program periodization seems to be efficient way for pre season preparation.

INTRODUCTION

Ice hockey, according Nightingale (2014), is a highly complex sport requiring multiple fitness components. It is a high intensity, intermittent full-contact sport of anaerobic endurance (Spiering, 2003). According to Behm (2005), Bracko (2001) and Burr (2008), the key components for successful play in Ice Hockey are strength, speed, power, acceleration, aerobic endurance, balance, and agility. As it is in others sports, also in Ice Hockey can divide season macrocycle into particular cycles. From the strength and conditioning view, Nightingale (2014) divided Ice Hockey macrocyle into three main phases. These are preparatory (aerobic, strength, maximal strength, power), maintenance (maintain strength, aerobic and power) and recovery phase (off-season). Next, author also divided preparatory phase into general strength (Jun), maximum strength and unload (july), maximum power and again unload (august). Although Nigthingale (2014) collected information from researchers and coaches, he was still just demonstrating periodized training program for Ice Hockey and he did not do any physical tests. Therefore we decided to test his findings. As in our study, Nightingale (2014) was also focused to athletes, who have reached the adolescence phase of physical maturation. According to Lloyd and Oliver (2012) is this phase the “window of opportunity” for training the significant components of ice hockey. It is also well

known fact, that it doesn´t matter if adolescents or adults, individual athletes will respond differently to any given training program (Stone, 2007).
While Sýkora (2017) is adding that the specificity of conditions in ice-hockey brought a lot of polemizing about validity and reliability on off ice testing, from our scientific experiences we know, that there is a big correlation between off ice tests and performance on ice.
With this theoretical backround behind, the aim of our study was to find out if our chosen periodization model will improve overall fitness after pre season preparation period in elite ice hockey players.

METHODS

Eight national team ice hockey players from under 18 hockey project of slovak ice hockey federation participated on special innovative pre season training program. Training program consisted of 10 weeks long cycle divided into 3 microcycles per 3 weeks with one deload recovery cycle after 6 weeks. Each microcycle was oriented for developing different fitness abilities which are determining and highly affecting ice hockey sport performance. First three weeks were targeted on improving eccentric strength by eccentric hypertrophy trainings when players completed 10 trainings per week (2x upper body pull, 2x push, 2x lower body pull, 2x push, 1 core training, 1 recovery training. Primary distinction was in performed tempo of exercises which was 4:0:1 seconds (eccentric phase, explosive, concentric phase). Second three weeks were targeted on maximal strength training with tempo 2:1:1 seconds with added ESD (energy system development) to the end of each workout where players performed several maximum intensity intervals of complex exercises such as sprints, bicycle ergometer etc. (work to rest ratio 1:2). During these weeks players completed 10 trainings units per week (same as first 3 weeks but inverse relation when it comes about sets and reps). After 6 weeks followed 1 recovery deload week with minimum training units and light intensity activities. Last 3 weeks of training program were targeted on improving explosive strength with combination of HIIT (High intensity interval training) due to their similar energetic demands on players body. Players completed 6 training units per week (Contrast explosive strength 2x, Tabata 2x, Core 2x) with additional trainings of ice hockey skills (Less number due to higher demands on CNS and energy recovery). During whole program traditional tools had been used like Barbells, Dumbells, Prowler, sledge, parachute etc. Additionaly some progressive tools had been used for individualizing training for each player. These tools were Vert, Vertimax and isokinetic ergobike. VERT is a wearable miniature inertial measurement unit (IMU), with a very high precision 3X gyroscope and high precision high rate 3X accelerometer. Vertimax is leading vertical jump and speed training system designed for multi-point leg and arm loading on-platform.
For complex diagnostic of initial and post-program state of players FMS diagnostic was used for evaluation of functional movement ranges of motion. For laterality test isokinetic ergobike was used. Based on the initial state each player recieved his own correcting guide for eliminating dysbalances, weaknesses etc. incorporated into their warm up routines. For maximal strength and relative strength the Bench press (diagnostic series), Parallel squat (diagnostic series) tests were used measured via Fitrodyne device. Fitrodyne is device working on a principle of registration location, speed of movement and known weight of the barbell. Thanks to above mentioned parameters device can succesfuly measure peak force and power. Grip strength was

tested by dynamometer. Explosive strength was measured via Myotest device by Squat-jump test and counter movement jump test. Myotest is 2D accelerometer with a 500Hz frequency sensoring ability. Finally starting speed ability was measured by Microgate Polifemo photocells during 5 metres and 10 metres running tests. Microgate Polifemo photocells work as a coaxial optical system. For data evaluation we used Figures and Tables due to better interpretation. The main method used was case study method when we evaluate every player individualy. Statistical methods such as Wilcoxon signed rank test and effect size were calculated for comparing sample results. For data interpretation causal and relation analysis were used, synthesis, induction and deduction. Conclusions were created in order to improve practical strength training in ice hockey. During data evaluating quantitative methods such as percentage, central tendency variables (aritmetic mean, standard deviation) were used. For statistical significance and effect size calculation Microsoft Excel and SPSS software were used. This research is part of VEGA 1/0414/15.

RESULTS AND DISCUSSION

For results interpretation we are using Tables and Figures. Evaluation was made on every single test independent showed by % improvement followed by overall evaluation supported by statistical tests and effect size calculation, when we compared initial stateand post program state of players.

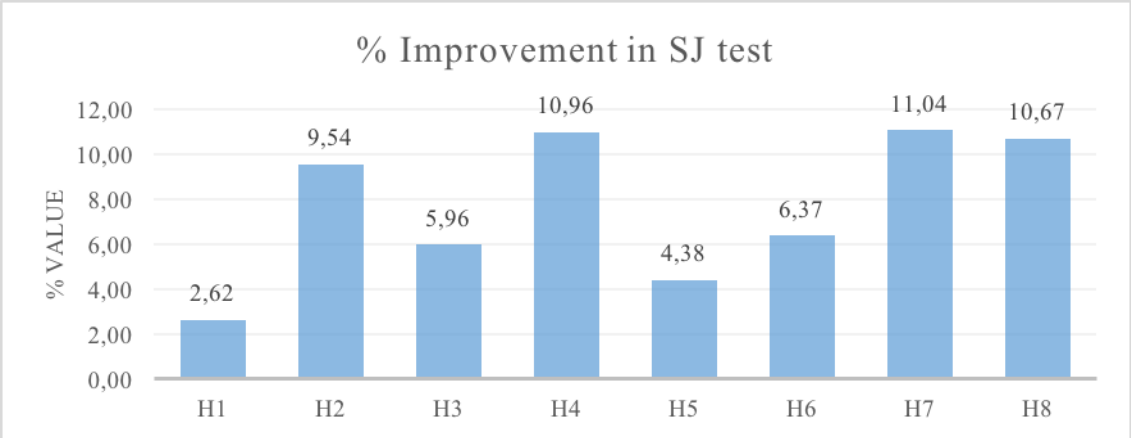

Figure 1 Squat jump test improvement of players

In squat jump test all players achieved significant improvement when the lowest improvement was 2.62 % and highest achieved was 11.04 %. As a sample, players improved average about 7.69 ± 3.29 % which is satisfying result.

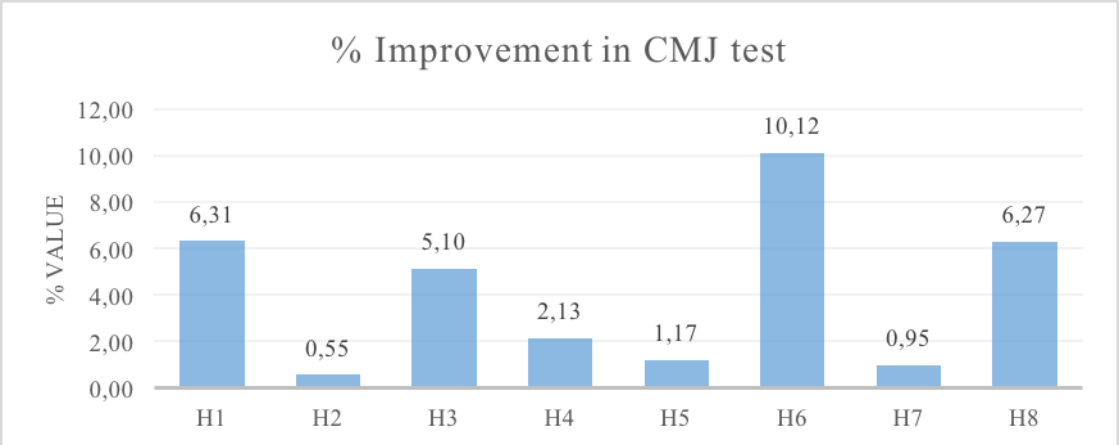

Figure 2 Counter movement jump improvement of players

In counter movement jump test we tracked average improvement about 4.08 ± 3.42 % in sample, minimal improvement was 0.55 % and highest was 10.12 %.

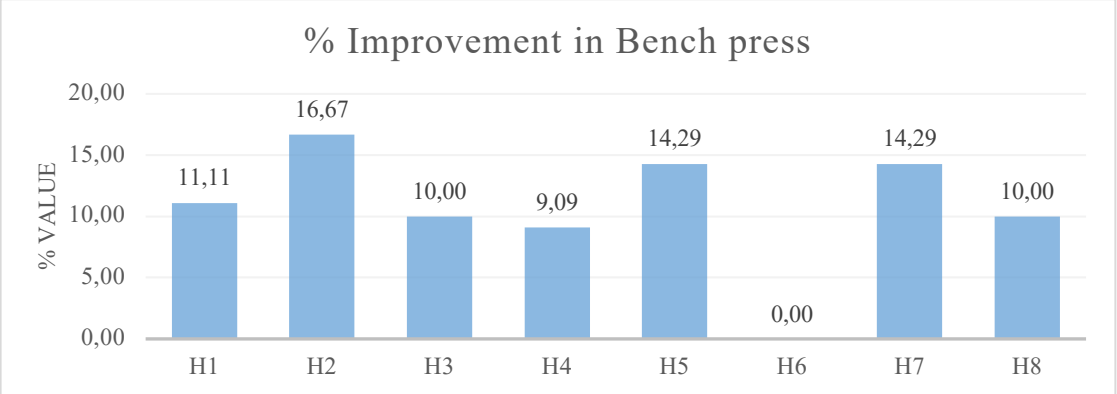

Figure 3 Bench press improvement of players

Bench press results brought improvement in 7 from 8 players, mostly about 16.67 % and one player didn´t improved at all. Average sample values moved average about 10.68 ± 5.06 %.

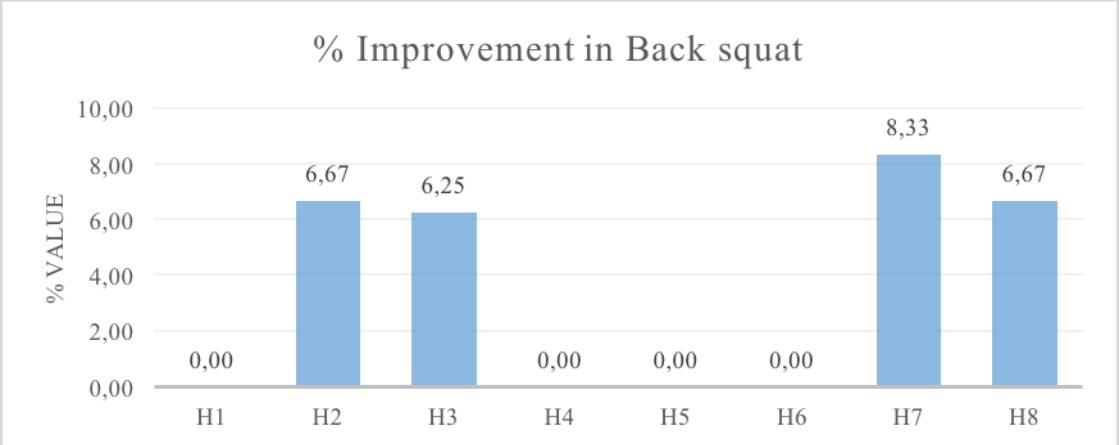

Figure 4 Back squat improvement of players

Figure 4 represents difference between initial and final results in heavy paralel back squat test, when only 4 players improved from 6.25 to 8.33 %. Average value moved about 3.49 ± 3.78 %.

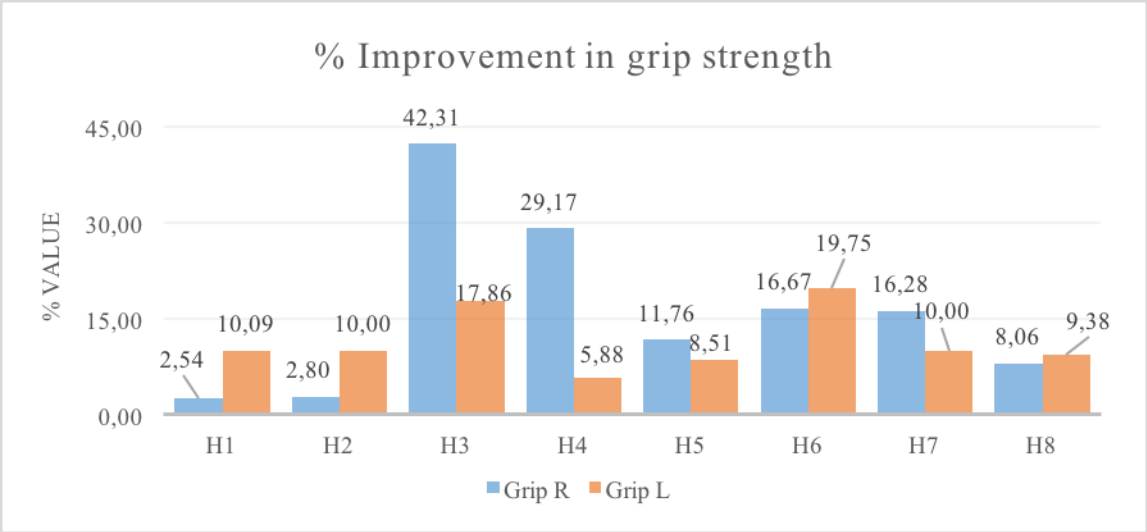

Figure 5 Right and left hand grip strength improvement of players

Figure 5 is showing results of grip dynamometer test, when in right hand players improved in average about 16.20 ± 13.64 % and in left hand it was 11.43 ± 4.78 %. Biggest improvement in right hand was 42.31 % and lowest was 2.54 %. In left hand biggest was 19.75 % and lowest was 5.88 %.

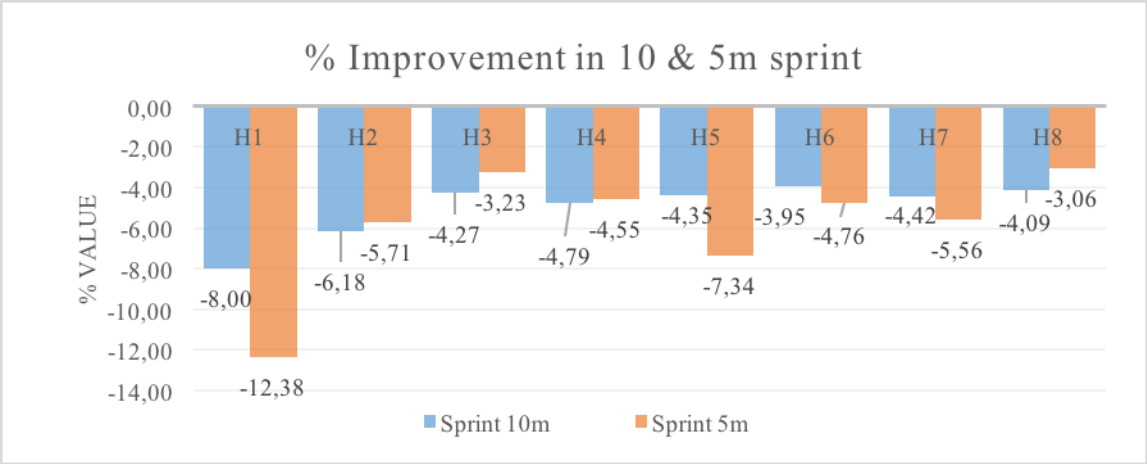

Figure 6 Starting speed tests results of players

Figure 6 represents results of 5 & 10 metres agility test, when players improved (decreased time) in 5m sprint average about 5.82 ± 2.99 % and in 10 metres test average about 5.01 ± 1.40 %. In 5 metres test biggest improvement achieved 8 % value and lowest 3.95 %. In 10 metres test biggest improvement was 12.38% and lowest 3.06 %.

Including all above mentioned results and after calculating normality of sample, we calculated also statistical significance and effect size values. Since in all of our tests there was not completed condition of normality, for statistical significance test we used Wilcoxon signed ranked test for determining significant differences of average values and simultaneously with that we calculated effect size (r) for Wilcoxon signed rank test. Our findings are presented in Figure 7

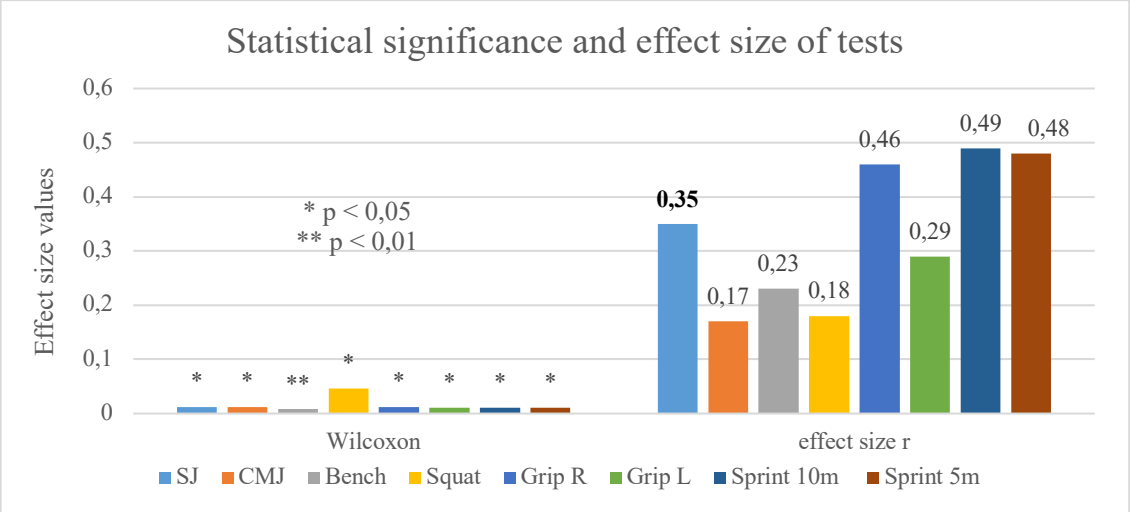

Figure 7 Statistical and effect size results

Figure 7 is showing that all of our test brought significant improvement with low effect size effect in CMJ test, Bench press and Back squat tests which might be caused by low number of respondends.

DISCUSSION

According to improving explosive ability results from CMJ tests are matching with initial predictions of coaches. From the Back squat test, since max. rep squat was not the main purpose for improvement coaches found stagnation in some players as trivial. Grip strength of players rapidly increased also thanks to many unorthodox tools used in training process (Fat grips). From 5 and 10 m sprint, we are finding these results as crucial because starting speed ability is one of the key ability in elite ice hockey sport performance.
Because of low number of respondends, these test can not be surely evaluated as reliable although our training program showed improvement. On the other hand we recorded significant improvement with moderate effect size effect in all other tests (SJ test, grip strength test and starting speed ability tests)
and so these results we can consider as reliable and not affected by statistical or other factors.
Our program caused significant changes in grip strength, explosive strength followed by starting
speed ability and so we can recommend this preseason program to other ice hockey coaches, who are working with elite ice hockey players. Training process targeted on eccentric hypertrophy, maximal strength and finishing specific task training such as explosive strength training and metabolic conditioning seems to be good way how to prepare high level ice hockey player for season. We recomend explore and apply our research on bigger sample for conclusions confirmation.

CONCLUSION

When it comes about periodization, Baker (1994) examined the effect of manipulating volume and intensity on strength and power in experienced male athletes. In his article it says, that there is considerable debate about most effective way to structure strength

training in terms of manipulation of volume and intensity. He divided his research sample into three groups, which differed in strength training periodization. First was nonperiodized, they trained in traditional way by Berger and O'Shea. Second included linear periodization, suggested by many authors like (Voroboyev, 1978, Mateyev, 1972, Stone, 1981). Third one was based on undulating periodized training method advocated by Poliquin (1988). Baker's (1994) results indicate that during short-term training with previously trained athletes, no differences in maximal strength were seen when training volume and relative intensity were equated. As a comparison of these findings, our research showed, that 10 weeks pre season training program (3 weeks eccentric strength, 3 weeks maximal strength, 1 deload week and 3 weeks explosive strength) brought significant improvements with low to moderate effect sizes in elite slovak players of national team project U18. Although authors are still in disagreement when it comes about pre season training periodization, our research brought different perspective and succesful model of training program. Eccentric strength, Maximal strength and explosive strength training microcycles respectively seem to be efficient way how to organize pre season period in elite ice hockey. (Supported by Energy System Development, HIIT, coordination and individual mobility work). Despite the success of our research we recommend to apply this program to wider sample for its later validation.

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