The Differences Between the Chosen Situational Parameters of Bowling in Croatian Students

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ABSTRACT
The aim of this study was to determine the differences between the chosen situational parameters of bowling, which is a part of physical education classes for Croatian students.

The subject sample consisted of 32 male and 38 female 1st and 2nd year students of professional studies at the Croatian College of Slavonski Brod.

The variable sample included 5 tests of situational parameters in bowling: miss/blunder (MISS), full (FULL), cleaning (CLEA), combination/total (COMB) and speed of rolling the ball/release (ROLL).

Statistically significant gender differentiation was determined by t-test for independent samples in the variables FULL, COMB and ROLL, which indicates that male students were somewhat more efficient in bowling than female students.

It is the authors' assumption that the difference in efficiency is conditioned by gender differences in strength which is also manifested in the speed of the ball release.

INTRODUCTION

Bowling is defined as a sports discipline in which a ball is used to hit and knock down as many pins as possible. Bowling is dominated by the motor ability of precision and it is therefore classified as a mono-structural sport with internal, closed movement structure which is repeated in cycles.

Bowling is about the manifestation of precision by rolling a released ball. The overall result depends on technical and tactical readiness and bowler's ability to control his/her body movements during shot performance.

The playing styles are basically divided into „full", „cleaning" and „combination". A miss is a shot in which the ball, after the performed shot, misses all the pins.

Bowling is a very popular competitive sport in Croatia, with prominent international achievements both in male and female competition (Bowlers of the Croatian women's junior national team have been world team champions and record holders for three consecutive years, Croatian junior bowlers are also perennial champions, Croatian senior female bowlers won a team bronze medal in 2013, Croatian male and female bowlers are among the best ranked players on the world bowling list, etc.).

Apart from being a competitive activity, bowling is also available as a recreation form for all age groups, even the elderly (Tan, Aziz and Chuan, 2000; De Van and Tanaka, 2007) and it is often a part of physical education classes for students at universities (Sivrić, Milić and Plejić, 2011).

Previous studies mainly analysed anthropometric characteristics and motor abilities (Thomas, Schlinker and Over, 1996; Sivrić et al., 2011), as well as psychological characteristics of male and female bowlers (Sindik, 2008, 2010). The application of this physical activity as a recreation form and its positive impact on the health status of the elderly has also been a subject of interest of some researchers (Tan et al., 2000, 2001).

Even though bowling as an organised recreational activity is often used in Croatian universities, the impact of this activity on the anthropological status dimensions of students is unknown. Furthermore, there have been no studies that analyse the differences between male and female students in efficiency in different bowling disciplines.

Therefore, the aim of this study was to determine the gender differences in the chosen situational parameters of bowling in Croatian students.

METHOD

The sample of 70 subjects included 32 male and 38 female 1st and 2nd year students of professional studies at the Croatian College of Slavonski Brod.

The variable sample included 5 tests of situational parameters in bowling: miss/blunder (MISS), full (FULL), cleaning (CLEA), combination/total (COMB) and speed of rolling the ball/release (ROLL). All the situational parameters were measured using a TREND 2000 Compact GB bowling lane and were obtained by the total average score in two games. The game is played in 120 throws on four lanes, i.e. 15 full + 15 cleaning in each lane.

MISS (miss, blunder) is the shot in which the ball, after one shot, misses all the pins. Every shot missed is registered in an „individual score sheet", according to its ordinal number with a mark.

FULL (full) is played when all nine (9) pins (line-up) are set up for each shot. Each knocked-down pin has the same value one (1), i.e. the number of pins knocked down by full shot gives the value of the roll result. The roll result on full can be from zero (0) to nine (9) knocked-down pins. There are 60 throws on full during a game, i.e. 15 per lane.

CLEA (cleaning) starts with the first throw on full. The second and the consequent throws are played into the position of pins that remained after the first throw on full. After the first line-up being knocked down, all nine pins are set up again and the throw on full is played as the first shot. Each shot is scored as the number of knocked-down pins, i.e. pins knocked down by cleaning give the value of the roll result.

The roll result on cleaning can be from zero (0) to nine (9) knocked-down pins. There are 60 throws on cleaning during a game, i.e. 15 per lane.

COMB (combination, total) in one series of throws (15 throws) the first half is done on full and the second (15 throws) is done on cleaning. There are 120 throws in combination during a game, i.e. 30 per lane.

ROLL (speed of throwing the ball) is the speed in which the ball moves after the release, i.e. delivering the ball onto the lane. The speed of the ball is measured by sensors on the lane. Methods of data analysis included the calculation of descriptive statistical parameters: mean (M), standard deviation (SD), coefficient of variability (V), measure of asymmetry (Skew), and measure of distribution kurtosis (Kurt). The testing of distribution normality was performed by the Kolmogorov-Smirnov test.

Due to different measuring units of the analysed variables and for the purpose of simpler results interpretation, the coefficient of variability, whose value represents the ratio between standard deviation and mean, was calculated.

T-test for independent samples was used to determine if there was a statistically significant difference between male and female students in each variable. The data was analysed by the STATISTICA 11.0 software package.

RESULTS AND DISCUSSION
Basic statistical parameters were calculated by descriptive statistics and distribution normality was tested by the Kolmogorov-Smirnov (KS) test and it was confirmed that there was no statistically significant difference of the results distribution of the variables in relation to the theoretically normal results distributions. The results are presented in Table 1. Given that the sample includes entities of both genders, this fact was taken into consideration during the interpretation of the obtained results. The means obtained met the expectations, whereas the variances and the standard deviations were relatively high due to high heterogeneity of the sample. Lower variability between the entities in the FULL and COMB variables, a phenomenon which is interesting in itself, leads to the conclusion that male and female students differ less in throws on full and the overall score, than in other variables.

Table 1 Descriptive indicators of the measuring variables

Variables	M	SD	V	Skew	Kurt	MAXD
MISS	11.36	4.68	0.40	0.58	0,38	0.10
FULL	340.34	22.81	0.10	-0.36	-0.70	0.08
CLEA	136.23	18.94	0.10	-0.17	1.64	0.06
COMB	377.17	35.88	0.10	-0.62	0.18	0.11
ROLL	26.43	3.94	0.20	0.01	-0.27	0.06

KS=0.16

Table legend: M-mean, SD-standard deviation, V-coefficient of variability (ratio of standard deviation and mean), Skew-measure of distribution asymmetry, Kurt-measure of distribution kurtosis, KS-critical value of the Kolmogorov-Smirnov test

Situational parameters of bowling according to gender, means, and standard deviations, as well as the results of the analysis of variance are presented in Table 2. The table clearly shows that the male students are somewhat more precise and have a somewhat stronger release which results in greater speed of the ball, whereas the standard deviations are equal, except in the COMB variable in which the female students vary much more in the overall score, with a smaller mean than the male students, which leads to the conclusion that male students are a more heterogeneous group than the female students in terms of the overall score during a bowling game.

Table 2 Descriptive indicators and the analysis of variance of situational parameters of bowling according to gender

Variables	M_M	SD_M	M_F	SD_F	p
MISS	10.84	4.24	11.79	5.03	0.052
FULL	342.09	21.92	338.87	23.73	0.042
CLEA	142.97	16.54	130.55	19.16	0.327
COMB	387.28	30.8	368.66	37.99	0.016
ROLL	28.37	3.55	24.8	3.52	0.000

Table legend: M-mean, SD-standard deviation, p-level of statistical significance

It is noticeable that male and female students differed with statistical significance in the FULL, COMB and ROLL variables, which indicates that the male students are somewhat more efficient in bowling than the female students and that they have greater speed of release.

Given that precision should not be determined by gender (Thomas et al., 1996; Sindik, 2010), it is assumed that in initial phases of bowling learning the greatest proportion of variance of specific precision is conditioned by strength of male and female students, and that this is the reason why male students are somewhat more precise than female students.

CONCLUSION
There is a statistically significant difference between three of the five analysed situational variables of bowling.

Correct technique performance with a 2.8 kg ball requires greater strength. Male and female students differ most in the speed of rolling the ball and cleaning, thus, it can be assumed that the difference is caused by gender differences in strength.

Precision is not defined by gender and it depends on acquisition of movement technique (approach, ball delivery, ball release, ball spin).

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