International Journal of Sport Culture and Science
September 2020 : 8(3)
ISSN : 2148-1148
Doi : 10.14486/IntJSCS.2020.604

Dynamics of the Physical Fitness Status in Students of the "Tourism" Specialized Field during a Trans-Season Stage*

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Type: Research Article (Received: 18.06.2020 – Accepted: 24.10.2020)

Abstract

The research aimed to study dynamics of the physical fitness status in students of the "Tourism" specialized field during a trans-season stage. Totally 100 university students studying "Tourism" as a business service were involved into the physical fitness testing (48 males and 52 females). A half of the participants studied in the Classic University and another half − in the Sport University. Monthly testing was conducted seven times from September to March using a complex test Kontreks–2. The scoring system consists of eleven indicators: five of them are biomedical: age, body weight, blood pressure, heart rate, reducing pulse; a six – motor: flexibility, speed, dynamic power, power, speed and overall endurance. Linear regression was used with a purpose to study trends of the physical fitness during the trans-season stage. Two-ways ANOVA was used to determine differences between samples. One-way ANOVA with repeated measures was used to evaluate test-retest reliability (ICC=0.094). A significant superiority of students from the Sport University vs. Classic University was noticed during the seven months preparation stage (17.6%, p<0.001) that is important in managing of the sport and healthy active tourism. Despite of this absolute difference, dynamics of these results was rather similar in these two universities (61.3%).

Keywords: Students, Physical Fitness, Tourism, Testing, Modelling

Introduction

Bachelors and Masters of the "Tourism" specialty field are prepared in universities of different types according similar programs (Working Program, 2016). A special place in these high schools occupies sport universities. The "Tourism" specialty is a business service one, and physical education courses are standard for this specialty as well, as for all the others specialities of non-sport types because the physical fitness is obligator for all modern students and contemporary people in general. Universities of sports have a special possibility not only in the physical fitness preparation, but also to add for the "Tourism" students' skills, which are necessary in sport and healthy active tourism (Academic Program, 2016).

Recently health and physical readiness of children and youth have sharply deteriorated (Sahoo et al., 2015). In particular, this is due to the crisis in the national physical education system, which does not meet modern requirements. Physical training sessions do not provide the volume of motor activity necessary for a young person; they are insufficiently taken into account individual interests and needs of students (Bozkus, 2014; Al-Khudairy et al., 2017; Liposek et al., 2019: 89).

Problems of physical education of student youth were studied by many scientists. It was noted that a serious obstacle to physical improvement of the student youth is the fall of interest in the traditional forms of physical education. Therefore, the organization and content of physical education in higher educational schools need to be updated (Mcdavid et al., 2019: 147).

Due to the expansion of the market of educational services and emergence of new specializations, increase a number of students who differ from the majority by the small volume of motor activity, arose the question about the study of an optimal system of educational activities that takes into account the features of different groups of students (Kharchenko et al., 2019: 194).

Validity and reliability of the physical fitness test are very necessary especially in testing of students' youth during a long time repeated testing. A quantitative measure of the test-retest reliability is intraclass correlation coefficient used effectively in different fields of sciences. Though much researches' attention has been directed at assessing the correlation coefficient under range restriction, the assessment of reliability under range restriction has been largely ignored (Fife et al., 2012: 862; Faragas et al. 2015). These articles use item response theory to simulate dichotomous item-level data to assess the robustness of test-retest under varying selection ratios.

Almehrizi (2013: 438) presented a general form of ICC and extends its use to estimate internal consistency reliability for nonlinear scale scores (used for relative decisions). He also examines this estimator of reliability using different score scales with real data sets of both dichotomously scored and poly-tomously scored items. Different score scales show different estimates of reliability. The effects of transformation functions on reliability of different score scales were also explored. Fitness testing is used frequently in many areas of physical activity, but the reliability of these measurements under real-world, practical conditions is unknown. Therefore, it is necessary to evaluate the reliability of specific fitness tests using the methods and different time periods used in the context of real-world sport and occupational management (Burnstein et al., 2011: 505; Ishiiet et al., 2015: 1254). A special interest is focused on the long period of time regarding test reliability in the physical education area because trans-seasons terms and academic years.

The theme of the use of sport and health tourism as a component of physical education of student's youth was disclosed in research works. However, not enough attention is paid to the formation of a system of perennial sport and health tourism during the whole period of study at higher education schools. Only integrated use of sports and health tourism as a component of physical education can positively influence the solution of the problem of strengthening of health, optimization of volumes of motive activity, formation of positive motivations to the tourism activities, after graduation etc. (Kukhtiy et al., 2011: 295).

Skaliy et al. (2009: 20) showed that hiking tourism has positive influence on the physical fitness of young people. They studied physical conditions of students in the course of increased physical activity in the mountain hiking tourism. The dynamics of the physical state of students during many days hiking made possible to accept the research hypothesis regarding significant improvement of the physical readiness. For the comprehensive assessment of the functional capacity of the cardiovascular system and physical qualities of the examined in the tourism practice, the test-complexes as scoring systems were useful. Kontreks–2 is a complex diagnostic system, which is recommended for current hospital and pedagogical control. It can help to determine not only the level but also the structure of physical training. It is characterized by simplicity and reliability; it can be used for individual and inter-control during the independent activities of physical exercises (Dushanin et al., 1985).

Hypothesis. The physical fitness preparation of the "Tourism" specialty field students in the Sport University and Classic University has significant different parameters during the trans-season stage.

Purpose. The research aimed to study dynamics of the physical fitness status in students of the "Tourism" specialized field during a trans-season stage.

Research tasks: (1) to compare results of the physical fitness preparation in the Sport University and Classic University during a seven months stage; (2) to study and compare trends in the physical fitness preparation in these universities during the stage; (3) to determine reliability of testing of the physical fitness preparation using Kontreks−2 complex of tests during the universities' physical education courses; (4) to compare distribution of students on the physical fitness levels regarding the studied universities.

Material and Method

Research design

The matter of the research was to compare results of the physical fitness preparation of the students studied "Tourism" as a business specialty in the Sport University and Classic University. The dynamics of the physical fitness status in students of these two universities have been determined using mathematical original modelling has been designed.

Study participants

Totally 100 university students studying "Tourism" as a business service were involved into the physical fitness testing. They were 48 males with body mass 68.3±8.4 kg (*M*±*SD*) and body length 173.9±4.8 cm; 52 females (body mass 57.6±6.7 kg, body length 165.1±5.4 cm). A half of the participants studied in the classic university (Ivan Franko National University of Lviv, n^{UF} = 50) and another half − in the sport university (Lviv State University of Physical Culture

named after Ivan Bobersky, n^{UB} = 50). There were 24 males and 26 females in both university' groups. This study was approved in advance by the local Bioethical Commission of Lviv State University of Physical Culture. All the participants voluntarily provided written informed consent before participating. The procedures followed were in accordance with the ethical standards of the Ethical Committee on human experimentation (Regulation, 2018).

Procedure

All the students were in good physical shape, and they participated in the university lessons of physical fitness according the common programs (Academic program, 2016; Working program, 2020). Monthly testing was conducted seven times from September to March using a complex test Kontreks–2 (Dushanin et al., 1985). The scoring system consists of eleven indicators: five of them are biomedical: age, body weight, blood pressure, heart rate, reducing pulse; and six – motor: flexibility, speed, dynamic power, speed, power and overall endurance. Negative scores of indicators were replaced with zeros. Levels of the physical fitness were evaluated regarding a sum score of all the indicators using the scale as follows: 50 points or fewer was recognised as low physical fitness level, 51–90 points – as lower than average, 91–160 points – average, 161–250 points – higher than average, 251 or more points – as a high level (Viktorov, 1990). Students of both genders were evaluated using the same scale of total points because in the complex of the tests gender's specific features have been taken into account. The testing was conducted afternoon on the first week of month at the sport venue of the universities.

Statistical analysis

Distribution of scores in the samples was determined in the frames of statistical hypothesis by Kolmagorov – Smirnov method (Smirnov et al., 1948).

Linear regression was used with a purpose to study trends of the physical fitness during the trans-season stage. The coefficient of linear regression (b) was determined using the formula derived as followed:

$$b = 6\frac{\frac{2}{N+1}\sum_{i=1}^{N} i\bar{x}_i - \sum_{i=1}^{N}\bar{x}_i}{N(N-1)}, \quad \text{(Eq 1)}$$

where $\bar{x}_i$ is mean value of a group in a month, N is a number of trials, i.e. months.

The significance of the slope coefficient was determined using the t–Student distribution with ($N - 2$) degrees of freedom (Zanevskyy et al., 2017):

$$t = b / \sqrt{\frac{12\sum_{i=1}^{N}(y_i - \bar{x}_i)^2}{N(N^2-1)(N-2)}}, \quad \text{(Eq 2)}$$

where y_i is the approximation linear function.

Accuracy of this approximation was determined by using the coefficient of determination as followed:

$$R^2 = \frac{\sum_{j=1}^{k}\left(y_j - \bar{x}_T\right)^2}{\sum_{j=1}^{k}\left(\bar{x}_j - \bar{x}_T\right)^2}, \quad \text{(Eq 3)}$$

where $\bar{x}_T$ is a total mean score during the study.

Dynamics of relative changing of test-retest results during the study period was evaluated using relative parameters of the total score:

$$\xi = \frac{x}{\bar{x}} - 1, \quad \text{(Eq 4)}$$

where x is a total test score of a sample, $\bar{x}$ – an average total score during the study stage (Zanevskyy et al., 2020).

The relative difference in score dynamics between UB and UF students was calculated with formula as follows:

$$\delta\xi = \frac{1}{N}\sum_{i=1}^{N}\left|\xi_i^{UB} - \xi_i^{UF}\right|, \quad \text{(Eq 5)}$$

where ξ_i^{UB} and ξ_i^{UF} are relative parameters of the total scores correspondingly for the groups studied, $N = 7$ is a number of test-retest treaties. Because $\sum_{i=N}^{N}\xi_i^{UB} = \sum_{i=N}^{N}\xi_i^{UF} = 0$, $\delta\xi$ is a difference relative to one (or 100%).

Theoretically a maximal difference was calculated by formula as follows:

$$\delta\xi_{max} = \frac{1}{N}\left[\sum_{i=1}^{N}\left|\xi_i^{UB}\right| + \sum_{i=1}^{N}\left|\xi_i^{UF}\right|\right]. \quad \text{(Eq 6)}$$

Taking into account (Eq 5), corresponding parameter of difference was determined by formula as follows:

$$k_{dif} = \frac{\sum_{i=1}^{N}\left|\xi_i^{UB} - \xi_i^{UF}\right|}{\sum_{i=1}^{N}\left|\xi_i^{UB}\right| + \sum_{i=1}^{N}\left|\xi_i^{UF}\right|}, \quad \text{(Eq 7)}$$

where $0 \le k_{dif} \le 1$ (Table A).

A parameter of similarity was determined by formula as follows:

$$k_{sim} = \left(1 - k_{dif}\right)100\%. \quad \text{(Eq 8)}$$

A quantitative measure of difference between UB and UF physical fitness scores was determined using the coefficient of difference calculated by the formula as follows (Zanevskyy et al., 2019):

$$\delta x_{dif} = \frac{\bar{x}^{UB} - \bar{x}^{UF}}{\bar{x}^{UB} + \bar{x}^{UF}}200\%. \quad \text{(Eq 9)}$$

A quantity measure of test-retest results was determined with the expression as follows:

$$\delta x_{dyn} = \frac{x_{i-1} - x_i}{x_{i-1}}100\%. \quad \text{(Eq 10)}$$

Two-ways ANOVA was used to determine differences between UB and UF samples. One-way ANOVA with repeated measures was used to evaluate differences in results between means of monthly testing and relative parts of variation between subjects and interaction between test-retest and interpersonal variation. This one-way ANOVA design was realised in three problems, i.e. for the UB sample, for the UF sample, and for the total sample. Pearson correlation between test-retest scores was applied with a purpose to substantiate ANOVA with repeated measures (Zanevskyy et al., 2016). Trans-season correlation was studied using Pearson pared linear coefficient (r), and corresponding significance of this correlation was determined using t-Student statistics as follows:

$$t = |r|\sqrt{(n-2)/(1-r^2)}. \quad \text{(Eq 11)}$$

Variation of scores in the samples was evaluated using the coefficient of variation (Suni et al., 1996):

$$V = \frac{SD}{M}100\%, \quad \text{(Eq 12)}$$

where SD: standard deviation, M: arithmetic mean. If $V < 10\%$, variation is small, 10−20% − moderate, and $V > 20\%$ − great.

Trans-season means score reliability was evaluated in the frames of the intraclass correlation coefficient using the formula by Shrout et al. (1979):

$$ICC(1,N) = \frac{MS_B - MS_W}{MS_B}, \quad \text{(Eq 13)}$$

where N is a number of trials (seven months), MS_B is mean square of scores between persons (students' samples), and MS_W − within persons. The evaluation scale was used with levels as follow: ICC>0.95 (excellent reliability), 0.91−0.95 (good), 0.81−0.90 (moderate), 0.71−0.80 (acceptable), 0.61−0.70 (questionable), and 0.60 or smaller (unacceptable).

Calculations were done using Statistica software package analysis (Dell Inc., 2017).

Findings

Because the hypothesis regarding normality of test results was accepted ($KS-D$=0.068−0.163, p=0.069−0.748), parametric statistics was used for treating of score results (Table 1). During the study, test scores in the UB group were significantly greater than in the UF (δx_{dif} = 12.4 – 25.1%, $p < 0.001$).

Students of the UB group showed a weak positive trend (b>0 with an average increase in the results) during the stage contrary to the students of the UF group which showed a slight negative trend (b<0 with an average decrease in the results). Both of the trends in the UB and UF groups were evaluated as non-significant: p^{UB}=0.996, p^{UF}=0.755 (Table 2).

A character of changing of the test scores during this seven months period for males and females was rather similar between them (Figure 1). During the first four months (September – December) the results of the UB and UF groups remained approximately constant. In January test results felt down near a quarter, and during February – March they returned up near to the autumn level. All the time, UB students had greater results than UF students: about 20% (Eq 9). Variation of the results insight the UB and UF groups was rather high (Eq 12): V=23.7−37.8%.

Table 1. Statistics of the test-retest scores (upper: n^{UB} = 50, lower: n^{UF} = 50) groups

Statistics*	Sep	Oct	Nov	Dec	Jan	Feb	Mar
M	144.3	148.6	153.9	162.3	134.6	140.7	156.0
	127.4	124.0	127.1	125.3	119.3	118.3	130.9
m	7.7	6.0	6.8	7.9	5.9	6.4	6.9
	5.6	4.8	5.1	4.6	4.2	4.1	4.4
Max	324.2	288.3	300.6	336.3	229.1	247.0	296.3
	245.8	231.4	220.0	227.8	191.0	189.7	215.6
Min	63.3	87.1	71.0	67.1	51.0	60.6	61.7
	72.2	73.0	69.4	63.6	71.5	61.9	70.0
KS-D	0.119	0.163	0.103	0.106	0.068	0.093	0.092
	0.105	0.125	0.129	0.130	0.113	0.132	0.094
p(KS-D)	0.244	0.482	0.144	0.083	0.602	0.748	0.215
	0.502	0.173	0.592	0.089	0.069	0.076	0.490
V%	37.8	28.4	31.2	34.3	31.0	32.1	31.4
	31.2	27.2	28.6	26.0	25.1	24.6	23.7
δx%	12.4	18.1	19.1	25.7	12.1	17.3	17.5
ξ	-0.0293	-0.0002	0.0355	0.0917	-0.0945	-0.0530	0.0499
	0.0224	-0.0050	0.0201	0.0054	-0.0429	-0.0508	0.0509

*Note: *M* − arithmetic mean, *m* − standard mean error, *KS-D* − Kolmagorov – Smirnov parameter, *p(KS-D)* − significance, *V* − coefficient of variance, *δx* − coefficient of difference between groups, *ξ* − relative difference in scores between UB and UF groups.

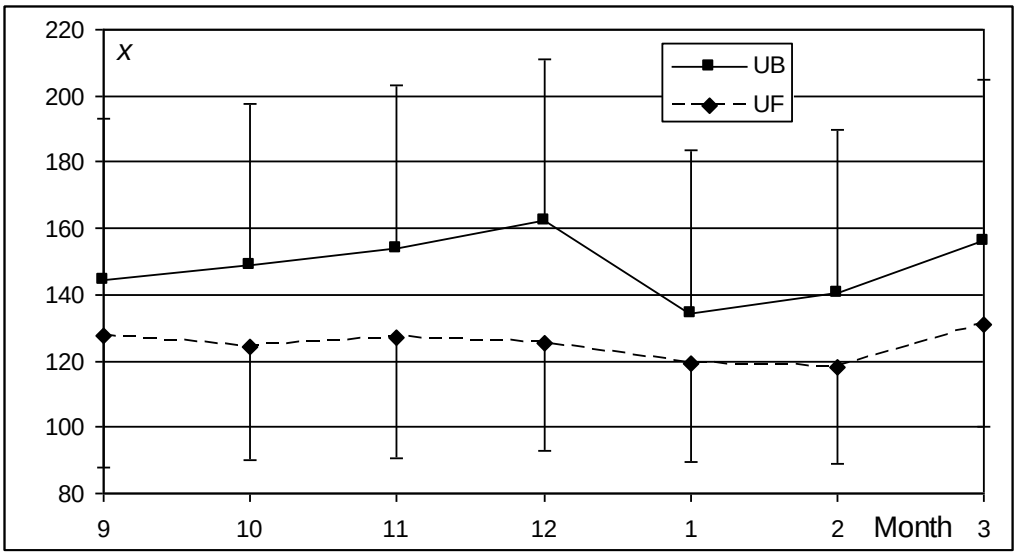

Figure 1. Graphs of the test scores during seven months: UB (*M* + *SD*) and UF (*M* − *SD*); 9 − Sep., 10 − Oct., 11 − Nov., 12 − Dec., 1 − Jan., 2 − Feb., 3 − March

Despite of significant difference between groups, in the mean scores taken place in the monthly tests, the dynamics of the results during the whole stage of study was rather similar (see Figure 1). Quantified measures of difference and similarity of the dynamics were determined regarding relative difference in scores between UB and UF groups (Figure 2). Corresponding coefficients were calculated using Eqs 7,8: k_{diff} = 0.387, k_{sim} = 61.3%.

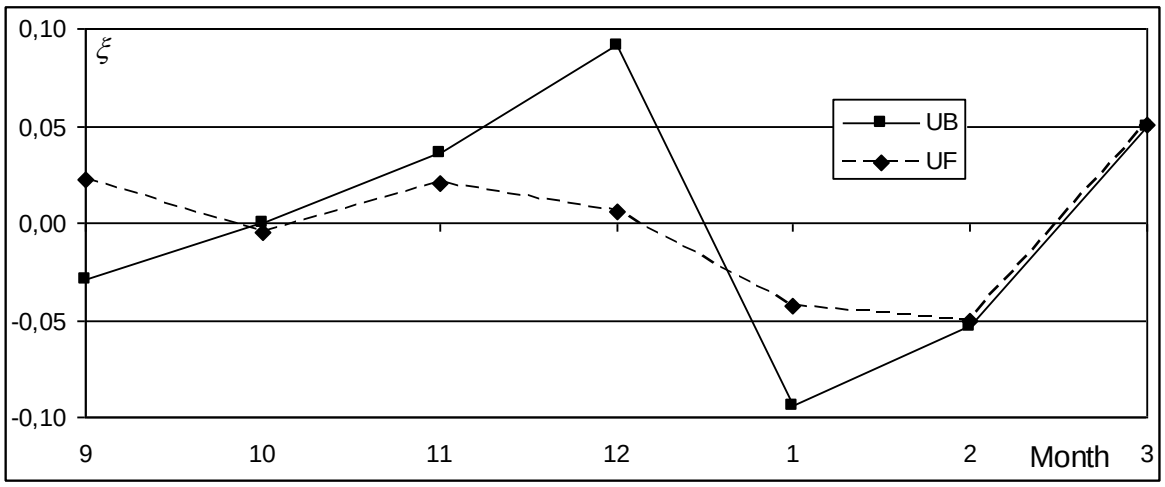

Figure 2. Relative test scores during seven months.

Significant differences between UB and UF groups were noticed: 17.6% (Eq. 9), $p < 0.001$. Test-retest differences were evaluated as significant ($p = 0.021$). A great variation within these samples was noticed too; corresponding part in the total variation was derived as 89.8% (Table 3). Similarity of trends in scores between groups during the study was determined by the coefficient of changes in dynamics equal 38.7% (Eq. 7).

Table 2. Linear trends in the physical fitness status

Sample	*a**	*b*	R^2	*t*	*p*
UB	148.6	0.0103	0.003	0.005	0.996
UF	125.8	−0.3064	0.021	0.330	0.755

*Note: *a* is a constant of the linear regression, *b* − coefficient of regression (Eq 1), *t* − Student parameter (Eq 2), R^2 − coefficient of determination (Eq 3).

Strong and high level significant correlation was noticed between all the seven months test-retest trans-season trials: in the UB group ($r = 0.385−0.951$, $p < 0.006$) and in the UF group ($r = 0.589−0.868$, $p < 0.001$, Table 4).

Because significant correlation was found between this monthly testing, one-way ANOVA of repeated measures was applied for study a trans-season reliability of the physical fitness testing (Table 5). Taking into account significant differences regarding groups, the investigation of trans-season reliability were undertaken separately in the UB and UF samples.

Table 3. Two-ways ANOVA results

Source of variation	*SS*	*df*	*MS*	*F*	*p*	*F(0.05, df)*	*Q,%*
Between samples	101004	1	101004	58.48	0.000	3.86	7.7
Test-retest	25878	6	4313	2.50	0.021	2.11	2.0
Interaction	7661	6	1277	0.74	0.618	2.11	0.6
Within samples	1184749	686	1727				89.7

Total	1319292	699	2860.8	100.0

*Note: *SS* is sum of squares, *df* − degree of freedom, *F* – Fisher – Snedecor statistics, *Q* – relative part of the total variation.

Significant trans-season reliability on the excellent (UF) and good (UB) levels was found for the samples ($ICC > 0.94$, $p < 0.001$). Both of the groups showed high trans-season reliability during the seven months testing (Eq 13).

Table 4. Pearson correlation coefficient: UB \ UF groups

Month	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Sep	−	0.868	0.748	0.786	0.673	0.626	0.754
Oct	0.824	−	0.798	0.853	0.789	0.717	0.832
Nov	0.816	0.891	−	0.764	0.604	0.589^{+}	0.687
Dec	0.704	0.845	0.863	−	0.778	0.713	0.825
Jan	0.385*	0.593	0.684	0.728	−	0.803	0.831
Feb	0.392	0.670	0.692	0.731	0.851	−	0.796
Mar	0.478	0.691	0.758	0.807	0.865	0.951	−

Note: *t = 2.889, t(0.01,48) = 2.682; $^{+}$t = 5.048, t(0.001,48) = 3.505

The results of testing were evaluated on five levels of the physical fitness. Relative numbers of the subjects were plotted vs. corresponding levels (Table 6). Totally majority of the results (61.9%) were on the average physical fitness preparation, and there were no students on the low level. Eleven results (1.6%) appeared on the high level, and all of them were in the UB group. In average, students of the UB group clearly showed better results than students of the UF group.

Table 5. Intraclass correlation reliability

Sample	MS_B	MS_W	*ICC*	*Q%*	*p*
UB	12356	746	0.940	73.0	<0.001
UF	6097	301	0.951	76.8	<0.001

Trans-season reliability was evaluated regarding trends in numbers of subjects on the physical fitness levels. With a purpose to meet mathematical conditions of the chi-squared method regarding a minimum numbers of subjects' results in cells of the research table, a number of levels were reduced from five to three. 'Low' and 'Lower than average' levels were united together, as well as 'High' and 'Higher than average' levels were united, too.

Deviations from mean values in three middle levels were calculated for seven tests taken during the study period with (6−1)(2−1) degree of freedom: chi-squared = 46.02, $p < 0.001$.

Discussion and Conclusion

The study of long time stage dynamics for the physical fitness was a reasonable problem of the modern state of the theory and methods of physical education. While short-term high intensity functional training effects have been established, fitness improvements from program participation exceeding 16 weeks are unknown. Cosgrove et al. (2019: 203) examined the effectiveness of participation in high intensity functional training through CrossFit. During 2013–

2014, fitness performance testing was incorporated into an ongoing university CrossFit program with 0–27 months of the high intensity functional training experience (grouped into 0–6 months and 7+ months). Participants completed three separate days of assessments across 10 fitness domains before and after participating in the program for six months that was near seven months period of the present research.

Table 6. Distribution of test's results on the physical fitness level during the study stage

Sample	Low	Lower than average	Average	Higher than average	High	Total
UB	0	36	186	117	11	350
UF	0	53	247	50	0	350
Total	0	89	433	167	11	700

The purpose of the research (to study dynamics of the physical fitness status in students of "Tourism" specialized field), was undertaken on the example of the first year bachelors studying "Tourism" speciality. This approach was conveniently agreed with results of the analysis of the student's body physical conditions in the course of increased physical activity during mountain hiking tourist undertaken by Skaliy et al. (2009).

As a key method of achieving the aim of this research was a complex test Kontreks−2, which was used for evaluation the physical fitness of the tourist students. The results appeared with good accordance with results of previous studies taken by Tymoshenko et al. (2011). Sport and health tourism is a promising and generally accessible means of physical education of a youth. It is considered an important factor in comprehensive development of student youth, moral and physical rehabilitation, education of national consciousness and involvement in systematic activities of physical exercises.

Advances of the complex test Kontreks−2 in evaluation of physical fitness of students have age restrictions regarding adolescents younger than nineteen years old. Then, another specialised for teenagers test should be used, e.g. "Field-based fitness assessment in young people: the ALPHA health-related fitness test battery for children and adolescents". The battery include selected fitness tests: the 20 m shuttle run test to assess cardio respiratory fitness; the handgrip strength and standing broad jump to assess musculoskeletal fitness, and body mass index, skin fold thickness and waist circumference to assess body composition (Ortega et al., 2015: 533; Ruiz et al., 2011: 518; Ortega et al., 2005).

Accurate measures of youth fitness require researchers and practitioners. Evidence of validity and reliability are essential before results of youth fitness tests can be used to make sound decisions. Mahar et al. (2008: 126) proposed practical guidelines for valid and reliable youth fitness testing. They described a three-stage paradigm for validation research and provided guidance for conducting and understanding norm-referenced and criterion-referenced validity and reliability research. Advice is provided on how to administer fitness tests and how to use fitness test results in ways that promote reliability and validity in practice. Users of fitness tests are cautioned that interpretation and use of fitness tests involve important educational, pedagogical, and psychological consequences. Confidence in youth fitness test results and the decisions that are made based on these scores depend upon careful test design and administration that incorporate a

sound understanding of the principles of validity and reliability (Trost et al., 2002: 350; Haddock et al., 2016).

In addition, most of reliability tests are conducted over a short period of time, but the reliability properties may be very different over the months to years in which they are routinely used in the field. Therefore, the purpose of our study was to evaluate some typical fitness tests for reliability within the environment and using the methods and timeframe that will be used in the field. Reliability was acceptable (ICC > 0.6) over an 18-month time period for all pair wise comparisons and all time points together for the push-up, vertical jump, and pull-up assessments. The Harvard step test and 60-second jump test had poor reliability (ICC < 0.6) between baseline and other time points. When we excluded the baseline data and calculated the ICC for 6-month, 12-month, and 18-month time points, both the Harvard step test and 60-second jump test demonstrated acceptable reliability. Dynamic balance was unreliable in all contexts. Limit-of-agreement analysis demonstrated considerable intra-individual variability for some tests and a learning effect by administrators on others (Falk et al., 2019). The trans-season test Kontreks−2 in this research showed rather good reliability (ICC>0.95) relatively other tests used for the evaluation of the physical fitness (Petersen et al., 2015).

Because considerable and significant difference between groups was noticed just after beginning a bachelor course (in September: δx_{dif} = 12.4%, $p < 0.001$) and grew up during all the period of study, it is reasonable to conclude that entrants to the Sport University had a better physical fitness preparation than entrants to the Classic University. This phenomenon shows advantages of the sport universities in preparation of specialists of the sport and healthy tourism.

Considerable (δx_{dyn} = −11.7%) and significant ($p < 0.001$) decrease of the physical fitness test results in both study groups in January may be explained with traditional winter holidays and examinations between winter and summer semesters. This phenomenon needs a special study and should be problem of future researches.

A quantitative comparison of the physical fitness results in the “Tourism” specialized field showed significant superiority of students from the Sport University vs. Classic University during a seven months preparation stage (δx_{dif} = 17.6%, $p < 0.001$). Despite of this absolute difference, dynamics of changing these results are rather similar in these two universities (61.3%). Significant decrease in results was noticed on the fifth month of the stage (in January δx_{dyn} = −11.7%). Because this decrease, the whole trends in results during the stage of preparation was about zero: UB (δx_{dyn} = 0.03%, p = 0.996) and UF (δx_{dyn} = −0.98%, p = 0.755).

Totally majority of the results (61.9%) showed an average physical fitness preparation, and there were no students on the low level. Eleven results (1.6%) appeared on the high level, and all of them were in the UB group. In average, students of the UB group clearly showed better results than students of the UF group.

Study groups showed high trans-season reliability during the seven months of testing. Significant trans-season reliability was evaluated as excellent (ICC_{UF} = 0.951) and good (ICC_{UB} = 0.940, $p <$ 0.001). Therefore, developed model and methods could be recommended for sport researchers and teachers and could be accepted in the practice of physical education in the high school.

Acknowledgement
The work was conducted and supported in the frames of the scientific and research plan of Lviv State University of Physical Culture during 2016 – 2019 years.

Conflict of Interest
The authors declare that there is no conflict of interest regarding this research.

*The research was partly presented on the 4th International Internet Conference on Information Technologies in Physical Culture and Sports in Kharkiv, Ukraine (2020).

REFERENCES

Academic program at the bachelor level for the speciality 242 “Tourism” (2016). Lviv State University of Physical Culture. Retrieved from http://ldufk.edu.ua/files/Nauka/zvit/bakal%20z%20turizmu%20obsl..pdf (accessed May 11, 2020).

Al-Khudairy L, Loveman E, Colquitt JL, Mead E, Johnson RE, Fraser H et al. (2017). Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. Cochrane Database Systematic Reviews, 6: CD012691. https://doi.org/10.1002/14651858.CD012691 (accessed May 11, 2020).

Almehrizi RS (2013). Coefficient Alpha and reliability of scale scores. Applied Psychological Measurement, 3(6): 438-459. https://doi.org/10.1177/0146621613484983 (accessed May 11, 2020).

Bozkus, T. (2014). A Research on Identifying the Need for Distance Education for National Athletes Who Study in School of Physical Education and Sport. TOJDE, 15, 282-290.

Burnstein BD, Steele RJ, Shrier I (2011). Reliability of fitness tests using methods and time periods common in sport and occupational management. Journal of athletic training, 46(5): 505–513. https://doi.org/10.4085/1062-6050-46.5.505 (accessed May 11, 2020).

Cosgrove SJ, Crawford DA, Heinrich KM (2019). Multiple Fitness Improvements Found after 6-Months of High Intensity Functional Training. Sports (Basel, Switzerland), 7(9): 203. https://doi.org/10.3390/sports7090203 (accessed May 11, 2020).

Dell Inc. (2017). Electronic Statistics Textbook. Round-Rock, Texas: StatSoft Statistica; Available from: http://www.statsoft.com/Products/STATISTICA-Features (accessed May 11, 2020).

Dushanin SA, Pirogova EA, Ivashchenko LYa (1985). Self-control of the physical state. Kiev: Zdorov’ya.

Falk NJH, Kennedy MD (2019). The multimodal nature of high-intensity functional training: potential applications to improve sport performance. Sports (Basel). Jan 29; 7(2). pii: E33. https://doi.org/10.3390/sports7020033(accessed May 11, 2020).

Faragas S, Radu LE, Vanvu GI (2015). The Level of Physical Activity of University Students. Procedia − Social and Behavioral Sciences, 197: 1454-1457. https://doi.org/10.1016/j.sbspro.2015.07.094 (accessed May 11, 2020).

Fife DA., Mendoza JL, Terry R (2012). The assessment of reliability under range restriction: a comparison of α, ω, and test–retest reliability for dichotomous data. Educational and Psychological Measurement, 72(5): 862-888. https://doi.org/10.1177/0013164411430225 (accessed May 11, 2020).

Haddock CK, Poston WS, Heinrich KM, Jahnke SA, Jitnarin N (2016). The Benefits of High-Intensity Functional Training Fitness Programs for Military Personnel. Military Medicine, 181(11): e1508-e1514. https://doi.org/10.7205/MILMED-D-15-00503 (accessed May 11, 2020).

Ishii K, Shibata A, Adachi M, Nanoue K, Oka K (2015). Gender and grade differences in objectively measured physical activity and sedentary behavior patterns among Japanese children and adolescents: a cross-sectional study. BMC Public Health, 15(1): 1254-1262. https://doi.org/10.1186/s12889-015-2607-3 (accessed May 11, 2020)

Kharchenko R, Khomenko S, Krasilov A, Rybalko P (2019). Methodology of teaching discipline "Physical Education" in a higher education institution. Pedagogical sciences: theory, history, innovative technologies, 5(89): 183-194. https://doi.org/10.24139/2312-5993/2019.05/183-194 (accessed May 11, 2020).

Kukhtiy AO, Labartkava KV (2011). Influence of hiking on functional state of the students' constitution (for the example of "Tourism" specialty). Scientific journal of National Pedagogical University named after MP Dragomanov. Series No 15. "Scientific and Pedagogical Problems of Physical Culture / Physical Culture and Sports", 13: 290-295.

Liposek S, Planinsec J, Leskosek B, Pajtler A (2019). Physical activity of university students and its relation to physical fitness and academic success. Annales Kinesiologiae, 9(2): 89-104. https://doi.org/10.35469/ak.2018.171 (accessed May 11, 2020).

Mahar MT, Rowe DA (2008). Practical guidelines for valid and reliable youth fitness testing. Measurement in Physical Education and Exercise Science, 12(3): 126-145. https://doi.org/10.1080/10913670802216106 (accessed May 11, 2020).

Mcdavid L, McDonough MH, Wong J, Snyder FJ, Ruiz Y, Blankenship BB (2019). Associations between participation in a Physical Activity-Based Positive Youth Development Program and Academic Outcomes. Journal of Adolescence, 77: 147-151. https://doi.org/10.1016/j.adolescence.2019.10.012. (accessed May 11, 2020).

Ortega FB, Artero EG, Ruiz J, Vicente-Rodriguez G, Bergman P, Hagstromer M et al. (2005). Reliability of health-related physical fitness tests in European adolescents. The HELENA Study. International journal of obesity, 32(Suppl. 5): S49-57. https://doi.org/10.1038/ijo.2008.183 (accessed May 11, 2020).

Ortega FB, Cadenas-Sanchez C, Sanchez-Delgado G, Mora-Gonzalez J, Martinez-Tellez B, Artero EG et al. (2015). Systematic review and proposal of a field-based physical fitness-test battery in preschool children: the PREFIT battery. Sports Medicine, 45(4): 533-555. https://doi.org/10.1007/s40279-014-0281-8 (accessed May 11, 2020).

Petersen N, Thieschafer L, Ploutz-Snyder L, Damann V, Mester J (2015). Reliability of a new test battery for fitness assessment of the European Astronaut corps. Extreme physiology & medicine, 4: 12. https://doi.org/10.1186/s13728-015-0032-y (accessed May 11, 2020).

Regulation of the Bioethical Commission (2018). Lviv State University of Physical Culture. https://www.ldufk.edu.ua/files/tekst_fail/dokumenty%20LDUFK/polozhennja%20pro%20bioet%200420.pdf (accessed May 11, 2020).

Ruiz JR, Castro-Pinero J, Espana-Romero V, Artero EG, Ortega FB, Cuenca MM et al. (2011). British Journal of Sports Medicine, 45(6): 518-524. https://doi.org/10.1136/bjsm.2010.075341 (accessed May 11, 2020).

Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS (2015). Childhood obesity: causes and consequences. Journal of family medicine and primary care, 4(2): 187–192. https://doi.org/10.4103/2249-4863.154628 (accessed May 11, 2020).

Shrout PE, Fleiss JL (1979). Intraclass correlations: Uses in assessing rater reliability. Psychological Bulletin, 8(2): 420–428. https://doi.org/10.1037/0033-2909.86.2.420 (accessed May 11, 2020).

Skaliy A, Skaliy T, Muszkieta R, Kalosza A, Żukow W (2009). Analysis of the physical conditions of the body of students in the course of increased physical activity during mountain hiking rated tourist. Current challenges of tourism and recreation to the health. Ed.: R. Muszkieta. Bydgoszcz. Publishing House: Wyższa Szkoła Gospodarki: 20-126.

Smirnov N (1948). Table for estimating the goodness of fit of empirical distributions. Annals of Mathematical Statistics, 19(2): 279–281. doi:10.1214/aoms/1177730256 (accessed May 11, 2020).

Suni JH, Oja P, Laukkanen RT, Miilunpalo SI, Pasanen ME, Vuori IM et al. (1996). Health-related fitness test battery for adults: aspects of reliability. Archive of Physical Medicine and Rehabilitation, 77(4): 399-405. https://doi.org/10.1016/s0003-9993(96)90092-1 (accessed May 11, 2020).

Trost SG, Pate RR, Sallis JF, Freedson PS, Taylor WC, Dowda M et al. (2002). Age and gender differences in objectively measured physical activity in youth. Medicine and Science in Sports and Exercise, 34:(2): 350–355. doi: 10.1097/00005768-200202000-00025 (accessed May 11, 2020).

Tymoshenko LO, Labartkava KV (2011). Tourism in shaping the health of individuals as an integrated medical and pedagogical problem. Scientific journal of National Pedagogical University named after MP Dragomanov. Series No 15. "Scientific and Pedagogical Problems of Physical Culture / Physical Culture and Sports", 13: 618 – 621.

Viktorov FV (1990). A method of the express control for the human level of the physical state (KONTREKS–2). Theory and practice of physical culture, No 1: 26-28.

Working program of the academic subject "Physical Education" (2020). Ivan Franko National University, Lviv. Retrieved from https://geography.lnu.edu.ua/wp-content/uploads/2020/02/phiz-vuhov-tour.pdf (accessed May 11, 2020).

Zanevskyy IP, Labartkava KV (2020). Trans-season reliability of the physical fitness testing in students of the "Tourism" speciality. Theory and Methods of Physical Education, 20(2): 95-101. https://doi.org/10.17309/tmfv.2020.2.05 (accessed May 11, 2020).

Zanevskyy I, Zanevska L (2016). Models of intra- and interclass correlation test mean-score reliability. Journal of Testing and Evaluation, 44(5): 1853-1861. https://doi.org/10.1520/JTE 20140363 (accessed May 11, 2020).

Zanevskyy I, Zanevska L (2017). Intraclass Correlation Test-Score Reliability of a Single Trial. Journal of Testing and Evaluation, 45(3): 1073-1080. https://doi.org/10.1520/JTE20150485 (accessed May 11, 2020).

Zanevskyy I, Zanevska L (2019). Validity of the Dickson index regarding primary school physical education. Human Movement, 20(2): 44–49. https://doi.org/10.5114/hm.2019.81021 (accessed May 11, 2020).

Appendix

Table A. Nomenclature

Symbol	Description
a	Constant of linear regression
b	Coefficient of linear regression
df	Degree of freedom
F	Fisher – Snedecor statistics
ICC	Intraclass correlation coefficient
$ANOVA$	Analysis of variance
$KS-D$	Kolmagorov – Smirnov parameter
M	Arithmetic mean
MS_B	Mean square of scores between persons
MS_W	Mean square of scores within persons
SD	Standard Deviation
SS	Sum of squares
N	Number of trials
Q	Relative part of the total variation
R^2	Coefficient of determination
UB	Sport University
UF	Classic University
V	Variation coefficient
k_{dif}	Parameter of difference
k_{sim}	Parameter of similarity
m	Standard mean error
n	Number of students
p	Significance
r	Pearson correlation coefficient
t	Student statistics
x	Test points
$\overline{x}$	Sample mean
$\overline{x}_T$	Total mean
y	Linear approximation function
δx_{dif}	Relative measure of groups' difference in scores
δx_{dyn}	Relative measure of test-retest difference in scores
ξ	Relative parameters of the total score