

# Adaptation and application of the inventory of Physical Activity Objectives (IPAO) among Ukrainian university students under war conditions

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

## Abstract

### Background and Study Aim

Physical activity supports students' physical health, psychological balance, and adaptability to changing conditions. Motivation for participation depends on behavioral, social, and emotional factors that influence the consistency of engagement. Various motivational models and assessment methods are used in physical education and recreation, but their application under wartime conditions presents special practical interest. This study examined motivational and behavioral aspects of physical activity among students from Eastern and Western Ukraine using an adapted Inventory of Physical Activity Objectives (IPAO).

### Material and Methods

The sample included 89 university students from Eastern (n = 53) and Western Ukraine (n = 36): 49 men (55.1%) and 40 women (44.9%). Data were collected through an online questionnaire in Google Forms; participation was voluntary and anonymous. The adapted IPAO included three scales: Behavioral Indicators of Physical Activity (BIPA), Goals of Physical Activity (GPA), and Level of Motivation and Commitment to Motor Improvement (LMCMI). The reliability of the scales was acceptable (Cronbach's  $\alpha = 0.73$ ). Factor analysis confirmed construct validity (KMO = 0.727,  $p < 0.001$ ). Statistical analysis was performed in Python 3.11 using parametric and nonparametric tests, as well as K-Means cluster analysis.

### Results

The adapted IPAO showed satisfactory internal consistency (Cronbach's  $\alpha = 0.73$ , CI = 0.616–0.815). Factor analysis revealed a three-factor structure explaining 71.4% of the total variance. Spearman's correlation analysis indicated significant positive relationships among BIPA, GPA, and LMCMI ( $\rho = 0.56$ – $0.70$ ,  $p < 0.01$ ), confirming coherence between behavioral, goal-oriented, and motivational aspects. Regional comparison revealed statistically significant differences on the BIPA scale (Mann–Whitney  $U = 702.5$ ,  $p = 0.0346$ ), whereas GPA and LMCMI showed no significant differences ( $p > 0.05$ ). Gender analysis revealed no significant differences. K-Means cluster analysis identified three motivation profiles: self-developing (high scores), adaptive (moderate scores), and passive (low scores), representing varying levels of engagement in physical activity.

### Conclusions

The adapted IPAO demonstrated acceptable reliability and construct validity among Ukrainian students. The results showed that motivational and behavioral components form an integrated structure linking attitudes, goals, and engagement in motor activity. The identified motivation profiles reflect diverse attitudes toward physical activity during wartime and can inform pedagogical and recreational programs to support students' psychophysical well-being.

### Keywords:

IPAO, recreational, motivational, behavioral, Ukraine, war

## Introduction

Physical activity contributes to both physical and mental health, supports adaptive capacity, and promotes overall well-being. In contemporary society, it serves as a means of maintaining health, fostering social interaction, and achieving personal fulfillment. Motivation to engage in physical activity is a complex construct encompassing behavioral, cognitive, and emotional components shaped by

cultural, educational, and social contexts. During wartime, when stress levels are high and daily routines are disrupted, motivation and behavior related to physical activity become especially significant, reflecting individual attitudes as well as the social and psychological resilience of young people.

Modern theoretical approaches to studying motivation in physical activity are largely based on the Self-Determination Theory (SDT) proposed by Ryan and Deci [1]. In a systematic review, Teixeira et al. [2] demonstrated that intrinsic motivation

and autonomous regulation are key determinants of sustained participation in physical activity. They emphasized that maintaining motivation depends on satisfying three basic psychological needs – autonomy, competence, and relatedness – which together form the foundation for long-term engagement in active behavior.

Further development of this research direction was provided by Fernández-Espínola et al. [3], who expanded the Self-Determination Theory by adding the “need for novelty” component. They found that seeking new experiences strengthens intrinsic motivation and positively influences the intention to remain physically active. These results broaden the traditional view of motivational determinants by incorporating creative and self-developmental dimensions of physical activity.

Lipowski and Ussorowska [4] contributed to the practical application of these theoretical concepts by introducing the Inventory of Physical Activity Objectives (IPAO). This tool assesses personal goals and motivational types underlying physical activity, including achievement orientation, social interaction, and personal growth. The authors confirmed that the questionnaire’s structure reflects a hierarchical system of motivational goals, where intrinsic factors show a stronger association with continued participation.

Overall, the analysis of key studies indicates that motivation for physical activity is a multidimensional system combining internal, social, and cognitive elements. Its examination requires comprehensive tools such as the IPAO, which can capture both universal and culturally specific features of motivation.

Recent studies confirm that war and crisis conditions significantly affect students’ mental and physical health. Pavlova et al. [5] found that the combined effects of the COVID-19 pandemic and the armed conflict in Ukraine increased anxiety, reduced well-being, and lowered academic motivation among students.

Rak et al. [6] reported a decline in physical activity levels among adolescents and university students during wartime, linked to limited access to sports facilities and higher psycho-emotional stress. Similar results were obtained by Polyvianaia et al. [5], who observed a high prevalence of PTSD, anxiety, and depression symptoms among Ukrainian students twenty months after the full-scale invasion.

Potop et al. [7] showed that physical activity can act as a compensatory factor in coping with stress and maintaining health, especially when comparing students from Eastern and Western Ukraine. Korda et al. [8] emphasized that mental well-being is closely related to academic performance and participation in physical activity.

A systematic review by Limone et al. [9] highlighted the role of regular physical activity in

reducing anxiety during the pandemic and war. Xu et al. [10] similarly found that coping strategies and physical activity contributed to the psychological resilience of Ukrainians during the first months of the conflict.

For comparison, Ma et al. [11] reported that higher physical fitness levels among students were associated with a lower risk of mental disorders, while Chudzicka-Czupała et al. [12] identified differences in well-being and coping strategies between Polish and Ukrainian students.

Together, these findings suggest that under wartime and uncertain conditions, physical activity serves not only a recreational function but also a psychological one, supporting resilience and adaptation among students.

The Inventory of Physical Activity Objectives (IPAO), developed by Lipowski and Zaleski [4], is a validated instrument for studying motivational goals related to physical activity. It enables the identification and quantitative assessment of individual priorities in physical culture and sport, covering both intrinsic motives (self-development, enjoyment, health) and extrinsic ones (social recognition, appearance). The IPAO includes three main scales: Behavioral Indicators of Physical Activity (BIPA), Goals of Physical Activity (GPA), and Level of Motivation and Commitment to Motor Improvement (LMCMI). Together, these scales reflect behavioral, goal-oriented, and motivational aspects of engagement in physical activity.

In international research, IPAO is widely applied to analyze motivation and value orientations across different cultural and social contexts. Guo et al. [13] showed that socio-cultural factors significantly affect commitment to exercise among young men in Poland and China, confirming the universality and cross-cultural applicability of the instrument.

Kotarska et al. [14] demonstrated a relationship between self-assessed physical fitness and the motivational value of physical goals among individuals engaged in various activities, including fitness, football, martial arts, and wheelchair rugby. Their findings confirmed that the IPAO effectively distinguishes between intrinsic and extrinsic orientations depending on the type of sport.

Kamionka et al. [15] adapted the IPAO to examine how parental goals and attitudes influence the physical activity of middle-aged children. The results indicated intergenerational transmission of motivational patterns and highlighted the importance of family context in forming activity behaviors.

Li et al. [16] used the IPAO in a predictive model exploring the links between extrinsic motivation, body image, and eating attitudes among young people during the COVID-19 pandemic. The study showed that motivational profiles measured by the IPAO are closely associated with psychological well-being and healthy self-regulation.

Overall, contemporary research confirms the strong psychometric properties and flexibility of the IPAO, supporting its adaptation for use among Ukrainian university students, where analyzing personal, social, and cultural determinants of physical activity is especially relevant.

The armed conflict in Ukraine has profoundly affected daily life, mental health, and physical activity, especially among university students. Periods of isolation, displacement, and security threats have disrupted established forms of recreation and sport, limiting access to facilities and group activities. Studies have shown that these conditions are accompanied by increased stress and anxiety levels and reduced overall well-being among students [5, 8, 17].

Despite these challenges, physical activity remains a key resource for psychological resilience and social interaction. Potop et al. [7] found that regular exercise helps students sustain a sense of control, emotional balance, and adaptability under uncertainty.

This study focuses on comparing students from Eastern and Western Ukraine, who experience differing security conditions. The eastern regions, located closer to the front line, are exposed to greater psychological stress, while the western regions offer relative stability and better opportunities for restoring educational and sports activities. Such comparison helps identify differences in motivational orientations and participation patterns, reflecting the influence of environmental factors on students' behavior and psychophysiological responses.

In this context, physical activity can be viewed not only as recreation but also as a mechanism of adaptation and psychological stability during crisis conditions.

Previous research indicates that students' physical activity is closely linked to their psychological state, social environment, and academic setting. During periods of instability and elevated stress, it serves as a means of maintaining both health and emotional stability, as well as facilitating social adaptation [5, 7, 8]. However, regional differences in threat levels and access to recreational resources continue to shape distinct motivational patterns and participation behaviors. These aspects require detailed analysis that accounts for cultural and psychological factors influencing goal setting and activity-related behavior.

The aim of this study was to assess the motivational and behavioral aspects of physical activity among students from Eastern and Western Ukraine using an adapted version of the Inventory of Physical Activity Objectives (IPAO).

## Materials and Methods

### *Participants*

The study included 89 university students from

Eastern (n = 53) and Western Ukraine (n = 36), comprising 49 men (55.1%) and 40 women (44.9%). The regional distribution reflected differences in sociocultural and security conditions during the armed conflict. Students from the eastern regions lived near the front line, while those from the west studied in relatively safe environments.

All participants were enrolled in university programs that included courses in Physical Education, Sport Recreation, or Health and Fitness Activities. Data were collected through an online questionnaire created in Google Forms. Participation was voluntary and anonymous. Before completing the form, each respondent provided consent for participation and for the use of their data exclusively for scientific purposes.

### *Ethical Considerations*

The study complied with the ethical principles of the Declaration of Helsinki. Participation was voluntary and anonymous. Before completing the questionnaire, all respondents provided informed consent for participation and for the use of their data solely for scientific purposes.

### *Research Design*

The study used a descriptive cross-sectional design to examine the motivational and behavioral aspects of students' physical activity during wartime. The main objective was to compare students from universities in Eastern and Western Ukraine, who were exposed to different social and security conditions. Motivation and engagement in physical activity were assessed using an adapted version of the Inventory of Physical Activity Objectives (IPAO) questionnaire.

### *Instruments and Procedure*

#### *Adaptation of the IPAO Questionnaire*

To assess the motivational and behavioral aspects of physical activity, an adapted Ukrainian version of the Inventory of Physical Activity Objectives (IPAO), originally developed by Lipowski and Zaleski [18], was used. The original instrument includes three scales: Behavioral Indicators of Physical Activity (BIPA), Goals of Physical Activity (GPA), and Level of Motivation and Commitment to Motor Improvement (LMCMI), which together reflect the behavioral, goal-oriented, and motivational components of physical activity.

During adaptation for the Ukrainian student sample, the original structure and psychometric properties of the questionnaire were maintained. The first scale (BIPA) contains five statements describing socio-behavioral aspects of physical activity, such as family attitudes toward sport, access to exercise opportunities, and interest in sports events. The second scale (GPA) was reduced from 13 to 8 items to ensure cultural and contextual relevance while preserving key goals such as maintaining health,

improving fitness, fostering social interaction, and supporting aesthetic and recreational motives. The third scale (LMCMI) consists of 18 statements assessing intrinsic motivation, persistence, and commitment to achieving physical activity goals.

During the adaptation of the GPA scale, five items were excluded as they were less relevant for Ukrainian students under wartime conditions:

1. *Being physically active and fit according to fashion* – this motive lost relevance in wartime, when priorities shifted from appearance and social norms toward maintaining health and emotional stability.
2. *Boosting confidence, gaining appreciation from others* – excluded due to overlap with the LMCMI scale, which already measures self-efficacy and internal confidence; external recognition is less characteristic under chronic stress.
3. *Pleasure from physical activity* – not treated as an independent goal during high psychological tension; this aspect was integrated into indicators of intrinsic motivation.
4. *Escape from everyday life* – became less applicable, as physical activity is viewed as a means of adaptation rather than avoidance.
5. *Other (open-ended)* – excluded because it does

not allow quantitative analysis and limits comparability across samples.

The decision to exclude specific items from the Goals of Physical Activity (GPA) scale was made by an expert panel that included specialists in physical activity psychology, pedagogy, and sports medicine. During expert evaluation, the cultural relevance of each item and its consistency with the current social context were discussed, considering the effects of the armed conflict on students’ daily activities and motivational priorities. The final version of the scale was approved by consensus, preserving the construct validity and internal consistency of the original Inventory of Physical Activity Objectives (IPAQ).

The questionnaire translation followed a bidirectional procedure, including forward and backward translation, with the participation of experts in physical activity psychology and linguistics. After linguistic adaptation, expert content evaluation was conducted to ensure semantic equivalence between the original and Ukrainian versions.

The adapted Ukrainian version of the Inventory of Physical Activity Objectives (IPAQ) includes (Table 1):

**Table 1.** The adapted Ukrainian version of the Inventory of Physical Activity Objectives (IPAQ).

<b>Behavioral Indicators of Physical Activity (BIPA)</b>						
<b>Please rate how much the following behavioral statements apply to you:</b>						
<b>1 – does not apply at all ← 1 2 3 4 5 → applies very much</b>						
<b>Nº</b>	<b>Item</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
1	My family (and friends) have a positive attitude toward sports.					
2	At my workplace, people also have a positive attitude toward sports.					
3	I have the opportunity to engage in physical activity (access to fitness clubs or natural environments).					
4	I am interested in sports television programs, radio shows, or online broadcasts.					
5	I participate in sports events (tournaments, matches, etc.) as a spectator.					
<b>Goals of Physical Activity (GPA)</b>						
<b>Please indicate how important the following goals of engaging in physical activity are for you:</b>						
<b>1 – not important at all ← 1 2 3 4 5 → very important</b>						
<b>Nº</b>	<b>Goal</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
6	Health (maintaining normal levels of blood pressure, cholesterol, body weight, etc.)					
7	Physical fitness, being “in shape.”					
8	Company of other people.					
9	A beautiful, well-toned body (appearance, body sculpting, and strength).					
10	Well-being.					
11	Satisfaction of the need for activity.					
12	Promoting physical activity as an example for others.					
13	Another goal that is important to you (not listed above).					

Table 1. Continued

Level of Motivation and Commitment to Motor Improvement (LMCMI) Considering your most important goal of physical activity from the list above, please rate how true each of the following statements is for you: 1 – strongly disagree ← 1 2 3 4 5 → strongly agree						
Nº	Statement	1	2	3	4	5
14	I am deeply convinced that I will achieve this goal.					
15	I devote all my free time to achieving this goal.					
16	I enjoy making efforts to achieve this goal.					
17	If for some reason this goal were not achieved, I would feel a significant loss.					
18	I am confident that my efforts will be fruitful in achieving the goal.					
19	I have other goals that I strive for as strongly as this one.					
20	I put a lot of energy into achieving this goal.					
21	When I am not working toward this goal, I feel that I am wasting time.					
22	I do not get tired when I work on this goal for a long time.					
23	I am confident that I will achieve this goal within the planned timeframe.					
24	I have other goals that bring me as much satisfaction as this one.					
25	Other matters easily distract me when I am working toward this goal.					
26	This goal is worth significant personal effort.					
27	I worry that I will not fully achieve this goal.					
28	This goal strongly motivates me to take action.					
29	Obstacles and problems prevent me from achieving this goal.					
30	Without this goal, my life would be meaningless and disorganized.					
31	I get up early in the morning if I need to do something related to this goal.					

1. Behavioral Indicators of Physical Activity (BIPA) – 5 items assessing perceptions of physical activity in the immediate environment and participation in sports or recreational activities.
2. Goals of Physical Activity (GPA) – 8 items measuring the importance of motives related to health, physical fitness, appearance, and social interaction.
3. Level of Motivation and Commitment to Motor Improvement (LMCMI) – 18 items reflecting persistence, confidence, and intrinsic engagement in achieving physical activity goals.

Responses were rated on a five-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”).

The reliability of the adapted questionnaire was confirmed by Cronbach’s alpha = 0.73, KMO = 0.727, and Bartlett’s test  $p < 0.001$ , indicating satisfactory internal consistency and construct validity. Data were collected online via Google Forms. All participants received identical instructions

to ensure procedural consistency. The average completion time was about 10 minutes. The data were exported in CSV format and processed using Python 3.11 with the pandas, SciPy, and scikit-learn libraries.

#### Statistical analysis

Statistical analysis was conducted in several stages. First, the reliability of the scales was assessed using Cronbach’s alpha. The factor structure was then verified through the KMO measure and Bartlett’s test. Spearman’s correlation analysis was applied to examine relationships among the scales. Regional comparisons were carried out using the Mann–Whitney U test and t-test, followed by an analysis of gender differences. Finally, cluster analysis of students’ motivational profiles was performed using the K-Means method.

## Results

To evaluate the internal consistency of the scales in the adapted Ukrainian version of the Inventory of Physical Activity Objectives (IPAO), Cronbach’s alpha was calculated (Table 2).

**Table 2.** Reliability of the Inventory of Physical Activity Objectives (IPAO)

Metric	Item	Value
Cronbach's Alpha		0.73
95% CI (min)		0.616
95% CI (max)		0.815
Alpha if item deleted	17	0.699
Alpha if item deleted	18	0.535
Alpha if item deleted	19	0.769

The Cronbach's alpha value of 0.73 indicates satisfactory reliability of the instrument. The 95% confidence interval [0.616–0.815] confirms the stability of its internal structure. The item-level analysis showed that deleting item 19 slightly increased internal consistency ( $\alpha = 0.769$ ), whereas removing item 18 led to a considerable decrease ( $\alpha = 0.535$ ). Overall, these results confirm that the adapted IPAO demonstrates acceptable internal consistency and is suitable for assessing motivational aspects of physical activity among Ukrainian students.

To assess the construct validity of the adapted questionnaire, factor analysis was performed using the principal component method. The results are presented in Table 3.

**Table 3.** Results of the factor analysis of the Inventory of Physical Activity Objectives (IPAO)

(a) Explained variance		
Factor	Proportion of Variance	Cumulative Variance
1	0.267 (26.7%)	0.267 (26.7%)
2	0.261 (26.1%)	0.527 (52.7%)
3	0.187 (18.7%)	0.714 (71.4%)
Total explained variance: 71.4%		
(b) Rotated factor loadings		
Item	Factor 1	Factor 2
17	0.623	0.374
18	0.472	0.484
19	0.435	0.639

The sampling adequacy test produced satisfactory results: the Kaiser–Meyer–Olkin (KMO) value was 0.727, exceeding the minimum acceptable threshold of 0.6, and Bartlett's test of sphericity was significant ( $\chi^2 = 121.935$ ,  $p < 0.001$ ), confirming the suitability of the data for factor analysis. Based on scree plot inspection and cumulative explained variance, three factors were identified, jointly explaining 71.4% of the total variance. The first factor accounted for 26.7%, the second for 26.1%, and the third for 18.7% of the variance. These results confirm the construct validity of the instrument and the correspondence of the identified factors to the theoretically expected components of the motivational structure of physical activity.

To examine the relationships between the questionnaire subscales, Spearman's correlation analysis was performed. The results are shown in Table 4.

**Table 4.** Spearman's Correlation Coefficients Between the BIPA, GPA, and LMCMI Scales

	17	18	19
17	1.0	0.56	0.62
18	0.56	1.0	0.70
19	0.62	0.70	1.0

Note. 17 – BIPA; 18 – GPA; 19 – LMCMI

The results revealed moderate to strong positive correlations among the three scales, with coefficients ranging from  $\rho = 0.56$  to  $\rho = 0.70$ . The strongest association was observed between scales 18 and 19 ( $\rho = 0.70$ ), indicating close conceptual alignment in the motivational components of physical activity. These findings confirm the internal consistency and convergent validity of the subscales in the adapted IPAO and support the coherence of the overall motivational construct.

The analysis confirmed the reliability and validity of the adapted Ukrainian version of the Inventory of Physical Activity Objectives (IPAO). The Cronbach's alpha coefficient ( $\alpha = 0.73$ ) indicated satisfactory internal consistency, reflecting stability and coherence among the questionnaire items. Factor analysis identified a three-factor structure explaining 71.4% of the total variance. The KMO value of 0.727 and the significant Bartlett's test result ( $\chi^2 = 121.935$ ,  $p < 0.001$ ) confirmed the adequacy of the data for factor analysis and supported the construct validity of the model, which includes three components: Behavioral Indicators of Physical Activity (BIPA), Goals of Physical Activity (GPA), and Level of Motivation and Commitment to Motor Improvement (LMCMI).

Correlation analysis revealed moderate to strong positive relationships among the three scales ( $\rho = 0.56$ – $0.70$ ), confirming internal consistency and convergent validity. The choice of parametric and nonparametric tests was based on the distribution characteristics of the scales.

Regional comparisons revealed significant differences between students from Eastern and Western Ukraine on the BIPA scale ( $U = 702.5$ ,  $p = 0.0346$ ), indicating stronger behavioral engagement in one of the groups. No significant differences were observed for the GPA ( $U = 862.0$ ,  $p = 0.4431$ ) or LMCMI ( $t = -1.668$ ,  $p = 0.100$ ) scales, suggesting similar motivational orientations and intrinsic involvement across regions. Gender analysis also showed no significant differences for any of the three scales, indicating that the motivational structure of physical activity was consistent among male and female students.

Taken together, these findings confirm that the adapted IPAO demonstrates satisfactory psychometric properties and effectively measures different levels of motivation for physical activity among Ukrainian students. Under wartime conditions, when physical activity serves not only as a means of maintaining health but also as a behavioral coping resource, the instrument provides meaningful insights into individual differences in motivation, goal orientation, and engagement in physical activity.

To examine regional differences in motivational indicators, a comparative analysis was performed between students from Eastern and Western Ukraine. Based on the normality test results, the Mann–Whitney U test was applied to the Behavioral Indicators of Physical Activity (BIPA) and Goals of Physical Activity (GPA) scales, while the independent t-test was used for the Level of Motivation and Commitment to Motor Improvement (LMCMI) scale. The detailed results are shown in Table 5.

The results revealed significant regional differences on the BIPA scale ( $U = 702.5$ ,  $p = 0.0346$ ), indicating stronger behavioral engagement in physical activity among students from one of the regions. No significant differences were found for the GPA ( $U = 862.0$ ,  $p = 0.4431$ ) or LMCMI ( $t = -1.668$ ,  $p = 0.100$ ) scales. These findings suggest that, although motivational orientations are largely similar, students from Eastern and Western Ukraine differ in the intensity and behavioral expression of their participation in physical activity.

To assess the influence of gender on motivational characteristics of physical activity, differences between male and female students were analyzed across the three scales of the adapted Inventory of

Physical Activity Objectives (IPAO). The results are summarized in Table 6.

According to the data distribution, the Mann–Whitney U test was applied to the BIPA and GPA scales, while the independent t-test was used for the LMCMI scale. The results showed no statistically significant gender differences for any of the three scales: BIPA ( $U = 872.5$ ,  $p = 0.3742$ ), GPA ( $U = 759.5$ ,  $p = 0.0689$ ), and LMCMI ( $t = -1.057$ ,  $p = 0.2934$ ). These findings indicate similar motivational orientations and levels of engagement in physical activity among male and female students, suggesting that gender was not a determining factor in the motivational structure of physical activity in this sample.

To identify typological differences in students' motivational structure, a cluster analysis was conducted using the K-Means method based on the three scales of the adapted Inventory of Physical Activity Objectives (IPAO): BIPA, GPA, and LMCMI. The analysis revealed an optimal division of the sample into three clusters, representing distinct motivation profiles toward physical activity (Table 7).

The first cluster was characterized by high mean scores across all scales (BIPA = 23.66, GPA = 37.00, LMCMI = 77.07) and reflected a self-developing type of motivation, marked by intrinsic involvement, persistence, and well-defined goals. The second cluster (BIPA = 19.51, GPA = 33.38, LMCMI = 61.31) represented an adaptive type of motivation, in which physical activity is perceived as part of a balanced lifestyle and a means of maintaining health. The third cluster (BIPA = 14.81, GPA = 24.76, LMCMI = 47.67) corresponded to a passive type of motivation, characterized by low engagement and the predominance of external influencing factors.

These results make it possible to differentiate

**Table 5.** Results of the comparative analysis by region (East–West)

Scale	Test	Statistic	p-value	Interpretation
BIPA	Mann–Whitney U	702.5	0.0346	significant difference ( $p < 0.05$ )
GPA	Mann–Whitney U	862.0	0.4431	no significant difference
LMCMI	Independent t-test	-1.668	0.100	no significant difference

**Table 6.** Results of the gender differences analysis across the IPAO scales

Scale	Test	Statistic	p-value	Interpretation
BIPA	Mann–Whitney U	872.5	0.3742	no significant difference
GPA	Mann–Whitney U	759.5	0.0689	no significant difference
LMCMI	Independent t-test	-1.057	0.2934	no significant difference

**Table 7.** Mean values of motivation scales in the identified student clusters

Cluster	Behavioral Indicators of Physical Activity (BIPA)	Goals of Physical Activity (GPA)	Level of Motivation and Commitment to Motor Improvement (LMCMI)
Cluster 0	19.51	33.38	61.31
Cluster 1	23.66	37.00	77.07
Cluster 2	14.81	24.76	47.67

students according to the degree of motivational expression and demonstrate that intrinsic, conscious motivation is strongly associated with stable behavioral engagement in physical activity.

As shown in Table 7, three distinct motivation profiles were identified through K-Means cluster analysis of the adapted IPAO scales. Cluster 1 had the highest mean scores across all scales, representing an intrinsically motivated (self-developing) type characterized by strong internal engagement and persistence in achieving physical activity goals. Cluster 0 reflected a balanced (adaptive) type of motivation with moderate values, where physical activity is integrated into a well-structured and health-oriented lifestyle. Cluster 2 demonstrated the lowest scores on all scales, corresponding to an externally regulated (passive) motivation type, in which participation in physical activity is irregular and primarily influenced by external factors.

These findings show that students differ in both the intensity and direction of their motivation toward physical activity, with intrinsic motivation being most strongly linked to consistent, self-determined behavioral engagement.

The analysis confirmed that the adapted Inventory of Physical Activity Objectives (IPAO) demonstrates adequate internal consistency and satisfactory construct validity in a Ukrainian student sample. The results revealed statistically significant relationships among behavioral manifestations of physical activity, physical activity goals, and the level of motivation and commitment to motor improvement. Comparison between students from Eastern and Western Ukraine showed partial differences in the intensity of certain motivational factors, while gender differences were not statistically significant. Cluster analysis identified three stable motivation profiles—self-developing, adaptive, and passive—reflecting diverse strategies and attitudes toward physical activity during wartime.

These findings form the basis for further discussion, where the identified patterns are interpreted, compared with previous research, and analyzed in relation to pedagogical implications for physical education and recreational programs among students.

## Discussion

This study examined the motivational and behavioral aspects of physical activity among students from Eastern and Western Ukraine using the adapted Inventory of Physical Activity Objectives (IPAO). The results showed satisfactory internal consistency ( $\alpha = 0.73$ ) and an acceptable factor structure ( $KMO = 0.727$ ,  $p < 0.001$ ), confirming the validity of the instrument. Positive correlations among the scales indicated relationships between behavioral patterns, goals, and motivation levels.

Regional differences were found only for the Behavioral Indicators of Physical Activity (BIPA) scale, while no gender differences were detected. Cluster analysis identified three motivation profiles (self-developing, adaptive, and passive) that reflect variations in students' motivational strategies during wartime.

The findings of this study are consistent with patterns described in research based on the Self-Determination Theory. According to Ryan and Deci [1], autonomous motivation develops when the basic psychological needs for autonomy, competence, and relatedness are fulfilled. This relationship was also evident in the present study, where intrinsic motivation was closely associated with the goal-oriented and behavioral aspects of physical activity. The conclusion agrees with the meta-analysis by Bureau et al. [19] and the systematic review by White et al. [20], both of which emphasize the importance of autonomous regulation in education and its influence on students' engagement and persistence.

Similar results have been reported in studies on university students' physical activity. Research by Durán-Vinagre et al. [21] and Manzano-Sánchez [22] showed that motivational profiles grounded in Self-Determination Theory predict the intention to remain physically active and vary by gender and age. These results correspond to the clusters identified in the present study (self-developing, adaptive, and passive) and align with the concept of novelty and personal growth proposed by Fernández-Espínola et al. [3], in which the pursuit of new experiences enhances intrinsic motivation.

In addition to theoretical aspects, several studies highlight the influence of external and sociocultural factors on motivation for physical activity. Guo et al. [13] and Kotarska et al. [14] demonstrated that cultural background, social context, and self-assessment of physical fitness contribute to variations in motivational structures, which correspond to the regional differences observed among Ukrainian students. The influence of family and educational environments was also confirmed in Kamionka et al. [15], who found that parental goals and attitudes toward activity had a lasting effect on the behavior of children and adolescents.

Further evidence supporting the motivational mechanisms identified in the present study is provided by the meta-analysis of Wang et al. [23], which showed that educational interventions grounded in Self-Determination Theory enhance intrinsic motivation and student engagement. At the same time, studies conducted in Ukraine highlight the effects of extreme external conditions on students' mental health and participation in physical activity [5, 7, 12]. These results indicate that the adapted IPAO questionnaire effectively captures both internal and external determinants of motivation under conditions of social instability

and war.

The differences identified on the Behavioral Indicators of Physical Activity (BIPA) scale between students from Eastern and Western Ukraine reflect the influence of varying socio-security conditions, levels of infrastructure accessibility, and psychological aspects of academic life. In the eastern regions, located near the front line, students face restrictions related to safety, mobility, and access to sports facilities, which limit opportunities for regular physical activity. In contrast, students from western regions show more stable behavioral patterns, likely due to greater security, preserved daily routines, and access to recreational resources [6, 7].

Similar regional disparities in activity and psychophysical condition have been reported in earlier studies. Pavlova et al. [5] noted that the combined impact of the pandemic and armed conflict increased stress levels among students, particularly those living in areas of constant threat. Polyvianai et al. [17] and Korda et al. [8] found that high anxiety and sleep disturbances negatively affected participation in physical activity, reducing self-regulation and consistency in behavior.

Additional evidence indicates that war-related restrictions have led to major changes in students' physical activity levels. A decline during remote learning and martial law was reported by Andrieieva et al. [24]. Damage to sports infrastructure and the uneven pace of recovery further intensified regional disparities in access to physical activity opportunities [25]. Vypasniak et al. [26] also confirmed territorial variation in students' physical activity, emphasizing geography and infrastructure as key differentiating factors.

Under these conditions, physical activity takes on compensatory and adaptive functions, serving as both a means of maintaining health and a resource for emotional resilience, self-regulation, and stress recovery [9, 10]. Therefore, the observed differences between students from Eastern and Western Ukraine reflect not only external constraints but also the degree to which adaptive behavioral strategies are preserved, with physical activity functioning as a psychological buffer and stabilizing mechanism.

The analysis did not reveal statistically significant differences between male and female students across the three scales of the Inventory of Physical Activity Objectives (IPAQ), indicating a similar pattern of motivational and behavioral characteristics of physical activity within the student population. Comparable tendencies have been reported in international studies showing a gradual convergence in motivation toward physical activity among students of different genders [21, 22, 27].

Espada et al. [27] found that gender differences in physical activity levels diminish as intrinsic motivation and self-regulation increase, particularly in university settings. Similar results were obtained

by Seo and Ha [28], who reported that the main determinants of physical activity are not gender-based but rather related to perceived social support and self-efficacy.

Recent meta-analytical reviews also indicate that motivational differences between men and women become less pronounced in supportive educational and social environments [19, 20]. These results suggest that motivation for physical activity is primarily influenced by contextual and psychological factors rather than biological ones.

Overall, the findings of this study point to a trend toward reduced gender disparities in student motivation and highlight the importance of internal and social mechanisms of self-regulation as key factors supporting sustained participation in physical activity.

Our cluster analysis based on the three scales of the adapted IPAQ questionnaire (BIPA, GPA, and LMCMI) identified three stable profiles: self-developing (high scores across all scales), adaptive (moderate scores), and passive (low scores). This typology corresponds to the principles of Self-Determination Theory, which distinguishes between autonomous and controlled regulation and suggests that profiles with higher autonomous motivation are associated with sustained participation in activity and the fulfillment of basic psychological needs [1, 2]. Studies of motivational profiles in educational contexts similarly identify groups differing in levels of intrinsic motivation and need satisfaction, corresponding to the self-developing cluster in this study [19, 20].

Conceptually, the identified profiles integrate behavioral indicators of activity (BIPA), goal significance (GPA), and motivational-volitional components (LMCMI). Comparable configurations have been observed in research on university populations, where more intrinsic profiles predict intentions to remain physically active and consistent participation, whereas external or passive profiles are linked with lower regularity of practice [21, 22]. The inclusion of the "need for novelty" component also helps explain why the self-developing profile shows the highest behavioral engagement, as the pursuit of new experiences supports interest and self-regulation in physical activity [3].

Cross-cultural and sociocultural factors further align with the cluster distribution. Studies show that value orientations, social support, and self-assessment of physical fitness influence motivational goals and their relative importance within profiles, a trend particularly evident in comparative and applied research [13, 14, 15]. Behaviorally, external orientation (for example, concern with appearance) is often associated with less consistent practice and less favorable attitudes, whereas internal goals are more strongly linked with healthier self-regulation [16]. Finally, recent studies of student motivation

profiles across countries confirm that clusters similar to those identified here (high, moderate, and low autonomous motivation) are consistently reproduced in different cultural contexts and are related to variations in need satisfaction and engagement [29, 30, 31].

The findings of this study have both practical and theoretical significance. From a practical perspective, the results can inform the development and adaptation of university programs aimed at maintaining students' physical activity under conditions of stress and social instability. Identifying motivational profiles allows distinguishing groups of students with different levels of intrinsic engagement and designing targeted strategies to enhance physical activity and psychological resilience. These outcomes can be incorporated into physical education systems, preventive initiatives, and recreational programs within the university setting.

From a theoretical perspective, the study extends the application of Self-Determination Theory to the context of crisis and wartime conditions, confirming that autonomous motivation remains a key factor in sustained participation in physical activity [1, 2, 19]. In addition, the research contributes to the cultural adaptation of the Inventory of Physical Activity Objectives (IPAQ), confirming its reliability and validity within the Ukrainian student population.

The scientific novelty of this study lies in expanding empirical evidence on motivational profiles of physical activity among students studying under conditions of armed conflict. The identified relationships between regional factors, types of motivation, and behavioral manifestations of physical activity complement current approaches to the study of motivation and provide a basis for future cross-cultural and comparative research.

In summary, the study confirmed a stable relationship between motivational and behavioral aspects of students' physical activity and revealed regional and gender characteristics that reflect the influence of social and psychological factors. The findings enhance understanding of internal and external motivational mechanisms under stress and instability that characterize the current Ukrainian context.

The adapted Inventory of Physical Activity Objectives (IPAQ) demonstrated reliable psychometric properties and strong analytical potential for further application in educational and research practice. The results of this study deepen understanding of the motivational mechanisms underlying students' physical activity and support

the use of the IPAQ as a diagnostic and program development tool for maintaining activity under crisis conditions.

#### *Limitations and Directions for Future Research*

Despite the significant findings, this study has several limitations that should be considered when interpreting the results. The sample included only students from Ukrainian universities in the Eastern and Western regions, which limits the generalizability of the findings to other age and social groups. The use of a self-report questionnaire may introduce subjectivity and social desirability bias, especially regarding motivation and behavior under stress. The cross-sectional design also prevents the identification of causal relationships and reflects only current trends and associations.

Future research should expand the geographic scope of the sample and compare Ukrainian data with findings from other countries affected by crisis or post-war conditions. Longitudinal studies would help trace changes in motivation over time as social stability and educational environments evolve. Further cultural validation of the Inventory of Physical Activity Objectives (IPAQ) should also be conducted to assess its sensitivity to different types of physical activity, stress levels, and individual psychological characteristics.

Overall, these limitations and future directions provide a basis for a deeper understanding of the motivational mechanisms of physical activity within educational and crisis contexts.

## **Conclusions**

The study summarized and systematized data on the motivational and behavioral characteristics of students' physical activity under conditions of war and social crisis. The findings showed that intrinsic motivation and autonomous engagement remain key factors in sustaining physical activity in challenging circumstances.

The results broaden understanding of the motivational structure related to physical activity and confirm the effectiveness of the Inventory of Physical Activity Objectives (IPAQ) within the Ukrainian educational context. The adapted instrument can be used to monitor motivational changes, develop student support programs, and improve pedagogical approaches in physical education.

Overall, this study contributes to the development of interdisciplinary approaches to studying physical activity under stressful social conditions by integrating psychometric, pedagogical, and sociocultural perspectives.

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Cite this article as:

Yermakova T, Vypasniak I, Zakharkevych T, Jagiello M. Adaptation and application of the inventory of Physical Activity Objectives (IPAQ) among Ukrainian university students under war conditions. *Pedagogy of Health*, 2026;5(2):87–98. <https://doi.org/10.15561/health.2026.0203>

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Received: 2025-12-12  
Accepted: 2026-01-24  
Published: 2026-01-26