

## Use of indices to assess women's health in wellness fitness

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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** With increasing focus on women's health and well-being, there's a pressing need for efficient tools to accurately reflect their physical condition and health status. This study aims to substantiate the use of indices as effective instruments for assessing women's health and wellness fitness.

**Material and Methods** This study involved 40 women, aged  $43.33 \pm 0.93$  years, who participated in a wellness fitness program for 8 months. Sessions were held three times a week, each lasting 1 hour. A comprehensive health improvement program was utilized, incorporating dance aerobics, strength fitness, and stretching exercises. Anthropometric measurements were taken, and the Stange test was administered to calculate 12 health-related indices. The significance of differences was evaluated using the sign criterion ( $z$ ) and Rosenbaum's  $Q$  index. Assessments were conducted both before the initiation and upon completion of the wellness program.

**Results** Significant changes were observed in several indices, including the Body Mass Index ( $z=2$ ), Erisman Index ( $z=0$ ), Vital Index ( $z=0$ ), Skibinsky Index ( $z=1$ ), Kerdo Autonomic Index ( $z=2$ ), Robinson Index ( $z=3$ ), Waist-to-Hip Ratio ( $z=11$ ), Systolic Blood Pressure Index ( $z=5$ ), Diastolic Blood Pressure Index ( $z=4$ ), and Livy Index ( $z=0$ ). Additionally, a reliable improvement in the left arm strength index was confirmed using Rosenbaum's Index ( $Q=7$ ).

**Conclusions** The results validate the use of specific indices to evaluate the efficacy of wellness fitness programs. Notable improvements were observed in the Body Mass Index, Erisman Index, and Livy Index, indicative of enhanced physical condition and normalization of body mass, particularly significant among overweight and obese participants. An increase in the strength index reflects augmented hand muscle strength, while enhancements in the vital index signal boosted respiratory system functionality. Furthermore, changes in the Skibinsky Index, Robinson Index, and Kerdo Autonomic Index highlight an elevated adaptation capacity of the cardiorespiratory system. The comprehensive set of indices employed offers insights into the cardiovascular, respiratory, and musculoskeletal systems' state. Their applicability at both individual and group levels, combined with the simplicity of calculations, clarity, and informativeness, markedly improves the monitoring effectiveness of health and fitness status.

**Keywords:** wellness fitness, women, indices, physical development, cardiorespiratory system, adaptation potential.

## Introduction

Ensuring the health of the population is a crucial aspect of the policies of many countries. The study by Cunningham and Ohles [1] highlights the critical importance of maintaining high physical fitness levels in women. It is observed that women often trail behind men in both health and physical fitness, being generally less active and more affected by sedentary lifestyles, especially in middle age [2]. Hypodynamia, or reduced physical activity, significantly increases the risk of obesity and metabolic syndrome, leading to a higher likelihood of chronic non-communicable diseases. Implementing group fitness programs emerges as a

vital health policy strategy and an effective means to positively impact women's health.

In another study [3], the relationship between physical fitness and mortality among women with metabolic syndrome was examined over a follow-up period of  $16.6 \pm 8.7$  years. Wellness fitness programs are advocated to decrease mortality rates and enhance physical fitness in women diagnosed with metabolic syndrome.

A review and meta-analysis conducted by Farrell et al. [4] investigated the impacts of various exercise types on cardiorespiratory performance and muscle strength in postmenopausal women, demonstrating the effectiveness of physical exercise in enhancing these indices. Notably, a positive effect was observed for both aerobic and weight training, whether implemented independently or in combination.

Further research [5, 6, 7] has explored the broad

effects of multimodal wellness fitness programs. These studies report improvements in cognitive functions, correction of metabolic abnormalities, and enhancement of functional indices among elderly women [5]. Incorporating strength and flexibility exercises was found to facilitate body weight normalization [6]. Additionally, another study [7] highlighted the beneficial outcomes of exercises using water motorcycles on the strength and cardiorespiratory capabilities of women.

The effectiveness of a comprehensive health improvement program for women aged 40–53 years was demonstrated in a study by Karatrantou et al. [8]. Conducted over 10 weeks, the program included aerobic dancing alongside flexibility, coordination, and strength exercises utilizing participants' body weight. The results highlighted normalization of physiological indices, enhancement of physical qualities, and improved outcomes in functional tests. These findings are in line with earlier research [9], which also explored the benefits of a holistic fitness program over an 8-month period. Participants in this program engaged in stretching, dance, and strength training exercises, leading to improved morphofunctional indices and reduced fat deposition.

Among various health fitness types, dance fitness has emerged as particularly popular among women [10, 11]. A study by Hellem et al. [11] investigated the impact of such exercises on physical fitness and homeostasis parameters, confirming a normalizing effect on body weight and blood lipid levels.

Pilates exercises have gained popularity among women, with an 8-week program demonstrating improvements in participants' somatotype and fitness levels [12]. Interestingly, these benefits persisted even during a subsequent 3-week period without exercise.

In a different vein, a study by Reppa et al. [13] investigated the impact of high-intensity Tabata interval training on affective, cognitive, and physiological measures among women. Participants were categorized according to their fitness levels, revealing a consistency in their responses to the physical activities undertaken.

The index method has become a staple in sports science due to its simplicity, clarity, and informative value [14, 15, 16]. A comparative analysis utilizing indices to examine the physical development of athletes across various martial arts disciplines elucidated characteristics crucial for success [14]. Furthermore, the efficacy of employing specialized indices for monitoring athletes' functional states has been validated, underscoring the method's utility in sports research.

The application of indices in a comparative analysis of anthropometric measurements among athletes in karate, taekwondo, judo, and kickboxing [15] underscored the utility of several indices,

including the Monourier index, acromial index, Martin index, biacromial index, and hip index, for their informativeness.

Hence, existing literature reinforces the significance of employing indices within the realms of sports and wellness physical culture. Building on this foundation, the objective of our study was to advocate for the use of indices as a methodological approach for evaluating women's health and wellness fitness.

## Materials and Methods

### *Participants*

Forty women, aged  $43.33 \pm 0.93$  years, participated in this study. All participants were injury-free at the time of the study. The research protocol was approved by the Ethics Committee of the Kharkiv State Academy of Physical Culture, ensuring adherence to ethical standards. Informed consent was secured from all individuals participating in the study.

### *Research Design*

Over an 8-month period, participants engaged in a wellness fitness regimen three times weekly, with each session lasting one hour. The comprehensive wellness program comprised dance aerobics on Mondays, strength fitness on Wednesdays, and stretching classes on Fridays.

The study's methodology included the assessment of morphofunctional indices both before and after the program, with subsequent calculation of indices derived from these measurements. Adhering to the international standardized methodology for anthropometric studies [17], the following were measured: body length and weight, chest circumference at rest, waist and hip circumferences, grip strength of both the right and left hands, lung vital capacity, blood pressure, and heart rate. Pulse pressure was calculated as the difference between systolic and diastolic blood pressure. Additionally, the breath-holding time in seconds was recorded while performing the Stange test.

### *Procedure*

The study employed a comprehensive set of indices to assess participants' health and fitness levels:

- Body Mass Index (BMI) is calculated as weight (kg) divided by the square of body length ( $m^2$ ). A BMI within the range of 19–24  $kg/m^2$  is considered normal.
- The Erisman Index is defined as the difference between the chest circumference (cm) and half of the body length (cm), with a value of at least +3.3 cm deemed normal for women.
- The Strength Index is the ratio of grip strength (kg) to body weight (kg), expressed as a percentage. Normal values range between 30%

- and 50%.
- The Waist-to-Hip Ratio is calculated as the waist circumference (cm) divided by the hip circumference (cm), with values not exceeding 0.75 considered normal.
- The Livy Index is the ratio of chest circumference at rest (cm) to body length (cm), expressed as a percentage, with a normal range of 50-55%.
- The Vital Index is the ratio of lung vital capacity (ml) to body weight (kg), with normal values within 55-60 ml/kg.
- The Skibinsky index (IS) is calculated as follows:

$$IS = (VCL \cdot t) / (HR \cdot 100) \quad (1),$$

where IS – Skibinsky index, LEF – vital capacity of lungs (ml), t – result of Stange test (s), HR – resting heart rate ( $\text{min}^{-1}$ ).

The index is interpreted using the following scale: less than 5 indicates a very poor condition, 5-9 is unsatisfactory, 10-30 is satisfactory, 31-60 is good, and more than 60 signifies an excellent condition.

- The Kerdo autonomic index is calculated as follows:

$$KAI = (1 - DP/HR) \cdot 100 \quad (2),$$

where KAI – Kerdo autonomic index, DP – diastolic arterial pressure (mm Hg), HR – resting heart rate ( $\text{min}^{-1}$ ).

The index was evaluated on the following scale: value not less than 10 – normal state of adaptation, 0-9 – adaptation stress, less than 0 – disadaptation.

- The endurance coefficient was calculated as the ratio of resting heart rate ( $\text{min}^{-1}$ ) to pulse pressure (mm Hg). The dynamics of the index were assessed. Increase in the process of exercise means weakening of functional capabilities of the cardiovascular system, decrease-increase of adaptation potential.
- Robinson's index was is calculated as follows:

$$RI = HR \cdot SP / 100 \quad (3),$$

where RI is Robinson's index, HR is resting heart rate ( $\text{min}^{-1}$ ), and SP is systolic blood pressure (mm Hg).

The index was evaluated on the following scale: less than 69 – excellent, increased reserves of cardiovascular system, 70-84 – good, the state of reserves is normal, 85-94 – average index, possible insufficiency of functional capabilities of cardiovascular system, 95-110 – low level, signs of dysregulation of cardiovascular system activity, 111 and more – very low level, expressed dysregulation of cardiovascular system activity.

- The systolic and diastolic pressure indices were calculated as the ratio of the actual pressure (mm Hg) to the proper pressure (mm Hg) in percent.
- The values of proper blood pressure were found according to the following formulas:

$$PSP = 102 + 0.6 \cdot B \quad (4),$$

$$PDP = 63 + 0.4 \cdot B \quad (5),$$

where PSP – proper systolic blood pressure, PDP – proper diastolic blood pressure, B – age (years).

The index was assessed using the following scale: 85-115% – physiological norm, less than 85% – tendency to hypotension, more than 115% – tendency to hypertension.

#### *Statistical analysis*

Statistical analysis of the collected data was conducted using licensed MS Excel software. Given the sample size and distribution characteristics, the median (Me) along with the first (25%) and third (75%) quartiles were calculated to characterize the dataset. The reliability of differences between groups was evaluated using non-parametric sign (z) and Rosenbaum (Q) criteria, with differences deemed significant at  $p < 0.05$ .

## **Results**

The results obtained are summarised in Table 1.

Table 1's data highlight substantial modifications in most assessed indices. Significant alterations were observed in the Body Mass Index (BMI) with a z-value of 2, Erisman index and vital capacity of lungs index both registering a z-value of 0, Skibinsky index at  $z=1$ , Kerdo autonomic index at  $z=2$ , Robinson index at  $z=3$ , and the waist-to-hip ratio marked significantly at  $z=11$ . Additionally, changes in the systolic pressure index ( $z=5$ ) and diastolic pressure index ( $z=4$ ) were notable, with the Livy index also recording a z-value of 0. A remarkable shift in the left arm strength index was validated by Rosenbaum's index ( $Q=7$ ). However, no significant differences were detected in the right arm strength index and the endurance coefficient.

Initially, the median Body Mass Index (BMI) of participants was above the normal range. Following the program, this index declined to the upper boundary of the normal range. Prior to initiating the program, the distribution of BMI among participants was as follows: 65% had a BMI above the normal range, 32.5% were within the normal range, and 2.5% fell below the normal range. Upon completing the program, the distribution shifted to 47.5% of participants having a BMI above the normal range, another 47.5% achieving a normal BMI, and 5% registering a BMI below the normal range.

The wellness program led to a noticeable reduction in the median Erisman index. Initially, 90% of the participants had values within the normal range, while 10% were below normal. Post-program, the distribution changed to 82.5% with normal values and 17.5% below normal.

Regarding the right arm strength index, there was a shift in values through the course of the program. Before starting, 60% of the participants had below-normal values, 35% were within the normal range,

**Table 1.** Dynamics of indices during performance of a comprehensive wellness fitness program by second-maturity women

Index	Start of the program			Finish of the program		
	25%	Me	75%	25%	Me	75%
Body mass index, kg/m <sup>2</sup>	23.24	25.47	30.46	21.28	23.98*	27.84
Erismann index, cm	7.00	15.75	22.13	5.75	11.00*	17.13
Right arm strength index (%)	23.81	26.82	33.92	22.02	27.09	34.84
Left arm strength index (%)	28.11	30.84	37.88	27.23	31.70	38.97
Waist-to-hip ratio, abs	0.73	0.79	0.84	0.74	0.80*	0.85
Livvy index, %	0.54	0.60	0.63	0.54	0.57*	0.60
Vital capacity of lungs index ml/kg	31.04	36.07	45.52	37.50	43.33*	50.77
The Skibinsky index, c.u.	8.03	9.75	15.59	12.04	15.48*	23.00
Kerdo autonomic index, c.u.	-66.67	-51.39	-38.54	-15.71	-2.94*	3.19
Endurance coefficient, c.u.	1.52	1.80	2.00	1.50	1.70	1.88
Robinson index, c.u.	81.20	87.75	110.10	74.10	80.78*	90.25
Systolic pressure index, %	89.00	92.59	98.26	84.53	89.14*	96.61
Diastolic pressure index, %	90.32	96.15	100.50	85.06	90.44*	97.92

Note. \* - differences by the signs criterion are reliable ( $p < 0.05$ ).

and 5% were above normal. After completing the program, 57.5% remained below normal but there was an increase to 42.5% in the normal range, indicating a positive impact of the program on right arm strength.

The left arm strength index demonstrated the following trends: initially, 42.5% of participants were below normal, 50% were within the normal range, and 7.5% were above normal. Post-program, there was a decrease to 37.5% below normal, an increase to 57.5% within the normal range, and a slight decrease to 5% above normal.

The median waist-to-hip ratio remained within the risk zone throughout the program, indicating no significant change. Initially, 35% of participants were at a low risk level, and this figure remained unchanged after the program.

For the Livvy index, the median value began above the average range and showed a movement towards normalization after the program. Before the program, 72.5% of participants had an above-average index, which decreased to 57.5% afterward. The percentage of participants with an average index value increased from 22.5% to 37.5%, while the proportion with a below-average index value remained constant at 5%, confirming the effectiveness of the program in influencing this index.

Before the program commenced, the medians of the vital capacity of lungs index were consistently below the normal range and remained so even after the program's conclusion. However, the median value at the end of the program indicated an effort to enhance this index, as evidenced by the index's dynamic structure. Initially, a significant majority (92.5%) of participants had a vital capacity of lungs index below the norm, which decreased to 82.5%

following the program. Concurrently, the proportion of participants with index values within the normal range increased from 7.5% to 17.5%, showcasing a positive shift towards improving the vital capacity of the lungs among the participants.

The most obvious dynamics were observed in the Skibinsky index. The median value of this index before the start of the program was unsatisfactory. The median at the end of the program belonged to the satisfactory assessment interval. The pattern of this index before the program was as follows: 7.5% of participants – very bad, 47.5% – unsatisfactory, and 45% – satisfactory. After the program, there were no participants with a very bad index, 12.5% had index at the unsatisfactory level, 85% had a satisfactory index, and 2.5% had a good index.

The endurance coefficient showed no significant differences in the dynamics of the wellness program. Improvement of functional capabilities according to this index was found in 52.5% of participants, 7.5% had no changes.

The median value of Robinson's index before the program is typical of the average index, and it can be assumed that the functional capabilities of the cardiovascular system are insufficient. After the program, the median decreased to a level that assessed the state of reserves as normal.

The structure of participants according to this index before the program: 7.5% – elevated cardiovascular reserves, 22.5% – state of reserves as normal, 35% – median, 10% – low reserves, 25% – very low reserves. After completion of the program: 17.5% – increased cardiovascular reserves, 42.5% – reserve status normal, 25% – average, 5% – low reserves, 10% – very low reserves.

The median of Kerdo autonomic index before

the program characterises the presence of disadaptation and the predominance of the tone of the parasympathetic nervous system. After the finish of the program, this index reflects a decrease in disadaptation, a transition to adaptation tension as a less dangerous state.

The median systolic pressure index before and after the program was within the normal range. At the end of the program, a decrease in this index was observed. The structure of the participants according to this index before the program was as follows: the tendency to hypotension was found in 12.5%, normal in 82.5%, and hypertension in 5%. After the program: tendency to hypotension in 27.5%, norm in 72.5%, no participants with tendency to hypertension. Similarly, the median diastolic pressure index can be evaluated. The dynamics of the pattern of this index were similar to those of the previous one. Before the program: tendency to hypotension in 17.5%, normal – 75.0%, tendency to hypertension in 7.5%. After the program: 25.0% tended to hypotension, the norm was 75.0%, and no participants had a tendency to hypertension.

## Discussion

The application of indices for assessing the physical condition of both professional athletes and fitness enthusiasts is widespread in the realm of sports and wellness. Notably, the efficacy of using a comprehensive set of physical development indices for predicting the performance of athletes across various martial arts disciplines has been examined [14].

A crucial aspect in utilizing these indices effectively lies in their selection based on high informativeness and relevance to the specific sport or fitness activity in question. This approach was employed in evaluating the physical development of kickboxing athletes, demonstrating the utility of such indices in assessing athletes' condition at the early stages of training [18]. The findings underscore the necessity of employing sport-specific indices for a more accurate and informative assessment.

The group of female participants exhibited notable variations in physiological indices and levels of physical fitness, a differentiation commonly acknowledged in scientific research [6, 11, 13]. This distinction underscores the varied emphasis placed on sports and fitness within research domains.

Unlike the competitive and performance-oriented goals inherent in sports, the primary objectives of health and fitness programs are geared towards optimizing physical health, with a significant focus often placed on the normalization of body weight. The success of this health-centric approach is well-documented across numerous studies [9, 11, 19, 20].

The program's multifaceted nature was evident in its impact on key bodily systems, including the

cardiovascular, respiratory, and musculoskeletal systems. This necessitated the utilization of indices capable of reflecting the status of these systems comprehensively. Consequently, the selected battery of indices comprised five indicators of physical development and six markers of cardiorespiratory system condition, providing a holistic assessment framework.

An integrated approach is crucial for accurately assessing the impact of health-enhancing activities. Similar to the methodology [12], where somatometric and physiometric indices, outcomes of functional tests, and somatotype data were utilized to validate the benefits of Pilates classes, our study adopted a comparable strategy. The indices applied in our research offer insights into the nuances of physical development and the health of cardiovascular, respiratory, and musculoskeletal systems.

Incorporating classes with varied orientations within the program significantly boosts its overall efficacy. Each class type targets different bodily systems, aligning with findings from existing literature [4, 5, 6, 7, 8], and underscores the comprehensive impact of such diverse interventions on health improvement.

The essence of health fitness programs lies in their focus on regular and sustained exercise. Opting for an 8-month program duration in this study has demonstrated efficacy in significantly influencing the morphofunctional indices of participants. This observation is in harmony with the results reported by Hong et al. [5], where a holistic 12-week program yielded significant improvements in various health aspects, including psycho-emotional status, bone mineral density, blood lipid levels, limb flexibility, dynamic balance, and endurance.

Moreover, the review by Khalafi et al. [4] underscored the augmented benefits derived from incorporating both strength and cardiovascular exercises into a fitness routine. Such a multifaceted approach was found to considerably enhance muscle strength across different groups and elevate the functional performance of the cardiovascular and respiratory systems.

In their study, Lee et al. [6] explored the impact of cycling and water exercises on women's health, confirming enhancements in cardiorespiratory system functioning and strength indices. Similarly, another investigation [7] evaluated the ABS+FLEX fitness program's efficacy in weight management among women, employing a combination of strength training focused on abdominal and lower back muscles, alongside flexibility exercises. The study reported favorable outcomes from this innovative approach.

Dance fitness, a preferred choice among many women [10, 11], was the subject of research by Wang et al. [11], where the influence of dance-based exercises on body composition, cardiorespiratory

system efficiency, and blood lipid profiles in obese women was analyzed. The participant demographic in Wang et al.'s study [11] closely matched that of our study, making their findings particularly relevant. They reported significant improvements in anthropometric measurements and aerobic capacity, outcomes that resonate with the results of our research. The congruence of findings across these studies reinforces the validity of incorporating dance elements into fitness programs, highlighting their efficacy in promoting women's health.

The body mass index (BMI) is a pivotal metric serving as a benchmark for evaluating nutritional status and physical fitness. Gacek et al. [19] established a direct correlation between BMI and the physical fitness levels of women, noting that individuals of normal weight outperformed their obese counterparts in tests of agility and endurance.

Prior to initiating the wellness program, a significant portion of participants were classified as overweight or obese. The observed BMI dynamics throughout the program underscore its efficacy, showcasing the beneficial impact of regular exercise on body composition. A noteworthy shift was observed as the number of participants categorized as obese or overweight decreased, while those with a BMI within the normal range saw an increase.

Echoing these findings, Horbacz et al. [20] utilized BMI as a metric to evaluate the effectiveness of wellness interventions for women over 60. This comprehensive program, which focused on enhancing aerobic endurance, strength, and dynamic balance, resulted in a notable reduction in BMI values.

These studies collectively affirm the instrumental role of BMI in gauging the success of physical fitness and wellness initiatives, particularly highlighting the positive transformation achievable through consistent exercise regimens.

The observed changes in the Erisman index align with the patterns noted in BMI analysis, with decreases particularly marked among overweight participants. Similarly, adjustments in Livy's index support BMI analysis, indicating a normalization of body weight as reflected by the shift in average values. These trends underscore the wellness program's impact.

This study utilized three indices, including body weight, to gauge the program's effectiveness. Their collective dynamics affirm the positive outcomes of the wellness initiative.

Notably, the strength index (SI) increase serves as evidence of enhanced hand muscle strength, attributable to the strength fitness component of the program. A noteworthy trend is the right-hand SI improvement, demonstrating a shift from lower to normal SI values among participants.

This observation suggests the strength index (SI) might not be as informative for monitoring the

condition of female participants in health fitness programs as it is for athletes in strength sports and street workouts, where its high informativeness has been confirmed [21]. The distinct nature of health fitness necessitates the development of new indices that more accurately reflect strength capabilities, potentially incorporating grip strength measured in pulse mode. Such indices have shown promise in studies assessing the condition of street wrestling athletes [21].

It's noteworthy that the baseline vital index for most female participants was below normal, a trend that persisted even after the program's conclusion. This finding underscores the need for continued exercises specifically aimed at improving the functional state of the respiratory system.

Similar outcomes were seen in the research by Ljubojevic et al. [2], where Zumba Fitness® training's impact on respiratory function and body composition among healthy sedentary women was examined. Vital lung capacity, body mass index, and somatotype components served as markers of the training's effectiveness.

An enhancement in vital capacity indicates improved functionality of the respiratory system. Incorporating dance fitness into a broader wellness program plays a crucial role in boosting the capabilities of the cardiorespiratory system and overall endurance. Consequently, a notable rise in the vital index is a rational expectation.

These hypotheses are supported by the changes observed in the Skibinsky index, which serves as an indicator of the cardiorespiratory system's adaptability. The health improvement program facilitated a noteworthy advancement in this index, evidencing positive shifts in the participants' results. The fitness regimen resulted in the elimination of participants categorized under the very poor index values, and a nearly fourfold decrease in those with unsatisfactory indices. Concurrently, the count of individuals with satisfactory index values saw a twofold increase.

For the evaluation of the cardiovascular system's functional capacity, indices such as the endurance coefficient, Robinson index, Kerdo autonomic index, and the indices for systolic and diastolic blood pressure were employed.

The evolution of the endurance coefficient primarily indicates a trend towards the enhancement of the functional capabilities of the participants throughout the course of the program. However, this index is deemed to be of limited informativeness.

The Robinson index emerged as a definitive measure of the program's success. Notable improvements in this index were observed across the entire participant group. Initially rated at an average level, by the program's conclusion, the Robinson index reached a level indicative of good cardiovascular health. The program effectuated

more than a two-fold increase in the number of participants with high cardiovascular reserves. Simultaneously, the cohort of individuals with normal reserves expanded, while those categorized under low and very low reserve levels saw nearly a 50% reduction post-program.

The dynamics observed underscore an enhancement in myocardial power as a consequence of participating in health fitness activities. The outcomes support the use of the Robinson index as a viable criterion for monitoring the recreational fitness of amateurs.

Prior to the initiation of the program, all participants exhibited negative Kerdo Autonomic Index (KAI) values, indicating a predominance of the parasympathetic nervous system's tone and a state of disadaptation among them. Following the conclusion of the program, there was a noticeable shift in this distribution: the proportion of participants with such negative indices decreased to 52.5%, 30% transitioned into a state of adaptation stress, and 17.5% achieved a normal state of adaptation. This progression in the Kerdo autonomic index is indicative of an increase in the participants' adaptive capabilities.

The comparison of actual blood pressure values with optimal ones aids in forecasting the potential onset of conditions like hypertension and hypotension. Initially, the participants predominantly displayed normal levels, with a small subset showing tendencies towards hypotension (12.5%) and hypertension (5%). Upon concluding the program, a noticeable shift towards hypotension was observed, while tendencies towards hypertension were completely absent. This transition underscores the beneficial impact of regular exercise on the cardiovascular system. Engaging in recreational fitness activities enhances overall bodily health, steering it towards more efficient operation. The observed shift towards hypotension is indicative of this improvement.

The waist-to-hip ratio is advocated as a predictive measure for assessing the risk of metabolic syndrome development, which itself is a precursor to various chronic non-communicable

diseases. This function of the index was validated in our research, revealing a considerably elevated risk level among participants. These findings align with those reported in the study by Farrell et al. [3], where a higher degree of physical fitness was shown to notably diminish mortality risk in women diagnosed with metabolic syndrome. Consequently, monitoring physical fitness and adhering to physical activity recommendations are strongly advised.

The program incorporated stretching exercises targeted at enhancing flexibility. The efficacy of these exercises is typically assessed through the goniometric method or specific exercises. Previous studies, such as [9], have validated the effectiveness of goniometric measures in health and fitness contexts.

The objective of this research was to test and validate indices. However, the absence of specialized indices for assessing flexibility somewhat limits the study's validity. This gap underscores the need for the development and evaluation of indices specifically designed for flexibility assessment.

## Conclusions

The findings validate the use of indices for evaluating the impact of health and fitness programs. Improvements in physical condition are indicated by changes in the body mass index, Erisman index, and Livy index, with these indices' dynamics reflecting weight normalization, particularly notable among overweight and obese participants. An increase in the strength index denotes enhanced hand muscle strength, while a rise in the vital index signals augmented respiratory system functionality. Furthermore, changes in the Skibinsky index, Robinson index, and Kerdo autonomic index demonstrate an elevated adaptation capacity of the cardiorespiratory system. The comprehensive set of indices employed permits assessment of cardiovascular, respiratory, and musculoskeletal system states. These indices, applicable both individually and collectively, simplify the monitoring process, enhancing the oversight of health and fitness participants through easy calculations, clear results, and informative insights.

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Cite this article as:

Podrihalo O, Podrigalo L, Podavalenko O, Perevoznik V, Paievskiy V, Sokol K. Use of indices to assess women's health in wellness fitness. *Pedagogy of Physical Culture and Sports*, 2024;28(2):132–140. <https://doi.org/10.15561/26649837.2024.0207>

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Received: 02.03.2024

Accepted: 14.04.2024; Published: 30.04.2024