



Features of training runners for ultramarathon distances

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Abstract. The study aimed to analyse the peculiarities of training athletes in preparation for an ultramarathon race. The study addressed the three phases of preparation for sports competitions – transition and recovery, the central training phase and the main competitive phase – and included a sample of 174 participants from Europe and other countries. The study revealed physiological and psycho-emotional characteristics of ultramarathon participants that distinguish them from participants in races at different distances and determine the peculiarities of the training process. These features include a lower body mass index of ultramarathon runners and an active desire to reduce it to achieve better results, a higher average age of ultramarathon participants, previous experience in other sports, and the integration of certain sports, mainly summer sports, into the process of training for a long-distance race. Based on the profiles of 65 participants who were preparing for an ultra-marathon race, the following training strategies were analysed: preliminary analysis of an athlete's profile to individualise training efforts; planning a sports season with three phases of training (recovery, preparation and competition) or a double training cycle; a combination of continuous low-intensity running and interval training; use of tracks with different surfaces to adapt to mechanical stress; parallel training in other sports to improve athletes' stability and endurance skills; ensuring long and quality sleep to prevent cognitive and psycho-emotional exhaustion of the competitors. The recommendations can be applied to the further development of the marathon movement in the country and abroad

Keywords: sports season; athlete's profile; endurance; oxygen saving; anthropometric indicators; motivation

Introduction

Running, including ultra-marathon distances, is not just a form of physical activity, but also a life philosophy that has received support and has been popularised internationally. The popularity of running is driven by the public demand for a healthy lifestyle and personal growth. To avoid contradictions, it should be noted that any distance exceeding 42 km 195 m is considered an ultramarathon. There are two types of ultramarathon competitions: time and distance. In the first type of competition, the winner is the participant who covers a certain distance in the shortest possible time, and in the second, the winner is the one who covers the longest distance. Although there are no clear limits for ultra-marathon competitions, the most popular distances are 50 km and 100 km. Among the world's leading ultra-marathon runners are Ukrainian athletes, including M. Ostrovska, whose 100 km record of 7:56:33 has been held for over 26 years. Another record holder is Ukrainian athlete S. Yanenko, who in 1997 ran the 100 km course at 6:25:25 and won the World Championship (IAU records, n.d.). Thus, the Ukrainian sports segment has sufficient potential

for setting new records, the disclosure of which largely depends on effective training for ultra-marathon distances.

B. Knechtle *et al.* (2024) highlighted the growing popularity of ultra-marathon competitions, which have replaced short-distance competitions. Confirmation of this opinion was also discovered in studies conducted around the world since 2020. The first researchers emphasised the emergence of different types of ultra-marathon runners, including amateur and recreational runners. After analysing a sample of 1,149 Brazilian athletes, M. Thuany *et al.* (2020; 2022) concluded that belonging to one of these types determines the volume and frequency of training per week, training motivation and body mass index (BMI). According to D. Tanous *et al.* (2022), the motivation, and, accordingly, the peculiarities of preparation for competitions, are determined by the athlete's gender. Analysis of a sample of 210,455 runners aged 18 to 86 concluded that in contrast to male athletes who are more focused on the result, such as covering the distance in the shortest possible time. Female athletes pay more attention to such aspects of preparation

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for competitions as belonging to a sports movement and running as a meaning of life (Motevalli *et al.*, 2022).

A detailed profile of an ultramarathon competitor was also proposed by B. Knechtle & P.T. Nikolaidis (2018), who compared the typical profile of marathon and ultra-marathon runners. According to the experts, a typical ultra-marathon runner is an educated male and aged 45 years or older. A typical representative of the ultra-marathon movement also has anthropomorphic features such as a low BMI and low body fat. In addition to these characteristics, the researchers also examined the training characteristics of ultra-marathon runners in comparison with other categories of runners. According to B. Knechtle & P.T. Nikolaidis (2018), training for ultra-marathon runners is characterised by a higher volume and higher speed. Confirmation of this opinion was found in the study by D. Boulloussa *et al.* (2020), who analysed the existing training practices of ultra-marathon runners and concluded that they are characterised by a weekly run of more than 70 km. Thus, creation of a detailed profile of an ultra-marathon runner can determine the specifics of their training and plan training in such a way as to achieve high results with minimal risk to the health and well-being of athletes.

T. Haugen *et al.* (2022) emphasised that the main goal of training athletes for a long-distance race is to improve three main indicators: maximal oxygen uptake (the rate at which the body can absorb and use oxygen during strenuous exercise), partial utilisation (i.e. the body's ability to maintain a high percentage of oxygen during running) and oxygen saving at a given submaximal running speed. According to K. Papadimitriou (2024), the effectiveness of efforts to improve these indicators depends on several factors, including whether athletes are professional or amateur. According to M. Besomi *et al.* (2019), the training of ultra-marathon runners depends on previous achievements, availability of training time, possible injuries, etc. Since the training of ultra-marathon runners involves many variables, there is no single training protocol that can guarantee consistently high results. Given the lack of a universal training protocol for athletes, the study aimed to analyse the characteristics of runners in preparation for ultramarathon distances. Based on the analysed features, effective strategies for training runners for ultra-marathon distances were identified and ways of their implementation were proposed depending on the type of athlete.

Materials and Methods

The periodisation of athletes' preparation for marathon and ultra-marathon competitions, which involves a three-phase preparation for participation in an ultra-marathon: transition & recovery, central preparation phase and main competitive phase, was used as the material for the analysis. At each of these stages, the following parameters were recorded: the number of training sessions per week; the number of km covered per week; the number of hours allocated for training. The data obtained through an online survey of athletes who provided informed consent to participate in the study, which was conducted in March 2024, were also used as materials. The survey was conducted using Google Forms tools to quickly collect and statistically process the data. The link to the online survey was sent to the email address provided during registration for the study and was

active for 4 weeks from the date of sending. The survey participants were asked to answer 30 questions, which were divided into four semantic sections.

The first section contained seven questions aimed at collecting demographic and anthropometric information about the participants, including their age, gender, motivation for training, BMI and height. The second section of the questionnaire contained ten questions aimed at identifying macro-habits that determine the training regime of the participants. The questions asked in this section concerned the duration of preparation for the main competition, the specifics of training management and parallel participation in other sports activities. The third section contained six questions to identify the peculiarities of training runners at different stages of preparation for competitions. The questions in this section concerned the number and duration of weekly sessions at different stages of training. In the last section of the questionnaire, the participants were offered seven questions about the peculiarities of nutrition as an element of preparation for sports competitions. Questions were asked about dietary habits, dietary compliance during preparation for competitions, assistance in diet preparation, and the risks of overeating. The surveys were conducted in compliance with the requirements of The Declaration of Helsinki (2013). Participants were guaranteed anonymity, which involved coding confidential data and refusing to use it in the final version of the study.

Participants who met all the inclusion criteria and whose information was cleared by data cleaning were eligible for the cross-sectional study. The following inclusion criteria were applied to potential study participants: providing informed consent to participate in the study; age 18 years or older; completing an online survey; successful participation in a running event, including a half marathon or ultramarathon, no later than two years before the study. Participants were also asked to select an ultramarathon event in which they were willing to participate within 6 months of participating in the study.

At the initial stage of selection, 250 candidates applied to participate in the study, 76 of whom did not meet the selection criteria and were excluded from the final sample. Candidates were excluded from the sample for the following reasons: did not provide information about their age (6); did not provide information about a possible conflict of interest (48); did not provide information about a personal dietary regimen (22); BMI ≥ 30 -3. Thus, the final sample consisted of 174 participants ($N=174$) who, according to the results of the survey, were identified as participants of half marathon competitions ($n=32$), participants of ultramarathon competitions ($n=76$) and participants of 10 km races ($n=66$). Participants belonging to the ultramarathon group were further divided into subcategories depending on the distance they ran. In the analysed sample, the shortest ultramarathon distance was 50 km, and the longest was 160 km.

The study participants were offered a 5-point scale for assessing heart rate. The proposed scale is based on an understanding of the mechanism of heart rate, in particular, the idea that a slow heartbeat in response to an increase in the intensity of physical activity is a sign of exhaustion. Thus, the participants were asked to assess the level of exhaustion after a week of training on a 5-point scale, where "1" meant the lowest level of exhaustion and "5" meant the

highest. The athletes' self-assessment data were collected weekly for one month and used to calculate the median value for each group of participants. The statistical analysis of the collected data was carried out using the χ^2 test:

$$\chi^2 = \frac{\sum(O_i - E_i)^2}{E_i}, \tag{1}$$

where O_i – observed (actual) value; E_i – expected value. Participants completed three self-assessment forms that were used to analyse the following parameters: mood, motivation and sleep quality, perceived effort and heart rate. At the end of each training week, participants were asked to rate these parameters using a 5-point Likert scale, with “1” indicating the lowest level of satisfaction with the aspects under study and “5” indicating the highest level of satisfaction. Participants were also asked to rate their efforts on a 10-point Likert scale. Participants were advised to choose “10” if they deemed that their running pace or power was fully consistent with the level of effort they expended, or “1” if it was completely inconsistent. Scores from 2 to 9, inclusive, were used to more accurately indicate the level of correspondence or inconsistency between the pace and power of running and the effort expended.

Results

Of the 174 participants whose questionnaires passed the data cleaning stage and were eligible for further study, 79 were women and 95 were men. The median age of the participants was 38.5 years, and the median body weight was 65 kg. The median BMI of the study participants was 21.7 kg/m². Most study participants were from Austria ($n = 69$) and Germany ($n = 52$). Another 11 participants were from Belgium, the Netherlands, Brazil, Canada, Italy, Luxembourg, Poland, Spain, and the United Kingdom. A significant difference ($p = 0.008$) in the median age of the study participants identified as half marathoners, ultra-marathoners and 10 km participants was documented. The oldest in the sample were marathon and ultra-marathon runners, with a median age of 44 years.

There were also significant anthropomorphic differences among runners at different distances. There was a significant difference ($p = 0.007$) in body weight: the highest median weight was 62 kg and was recorded for runners

on 10 km distances. A statistically significant ($p = 0.007$) difference was also observed among different groups of athletes: the tallest were marathon and ultra-marathon runners, whose median height was 1.8 m. When analysing the results of the survey, a statistically significant difference was also observed between the motive for training and belonging to a particular group of runners ($p < 0.001$). Among 10 km runners, the predominant motive was health, which was chosen by 54% of respondents. For 64% of the half marathon runners who took part in the survey, recreation was the key motive for running and participating in competitions. Marathon and ultra-marathon runners mostly (58%) trained and participated in competitions to achieve high results. Thus, there was a significant difference in the motivation of the study participants, which was reflected in the choice of a particular distance for the race.

There was, however, no statistically significant relationship between the following variables: participants' education and choice of the race distance ($p = 0.177$), social status and choice of the race distance ($p = 0.744$). The analysis of demographic variables revealed that one-third (34%) of the study participants had vocational or vocational-technical education, and another third (32%) had a university degree. That is, it can be argued that the level of education is one of the factors that influence the motivation to engage in sports running but does not determine the choice of a specific type of physical activity. Analysis of the social status of participants revealed that most participants (69%) were married or living with a permanent partner, 6% were divorced, 2% were widowed, and another 23% chose not to disclose their social status. Given the analysis of the social status of the study participants, it is possible to assume that being married or living with a permanent partner can be a factor in participation in training and sports competitions but does not have a statistically significant impact on the choice of a specific type of sports activity. Table 1 documents the macro habits associated with participants' training, including the duration of training for sports competitions, training management and concurrent participation in other competitive sports.

The study examined the peculiarities of training runners for different distances by the phases of preparation. The results of the comparative analysis are presented in Table 2.

Table 1. Macro habits that determine the training regime of the study participants

Parameters	General	10 km	Half marathon	Marathon/ultramarathon	Statistics
	100% ($n = 174$)	37.9% ($n = 66$)	18.4% ($n = 32$)	43.7% ($n = 76$)	
Duration of preparation for the main competition					
1-2 months	17% (30)	17% (11)	22% (7)	12% (9)	$\chi^2_{(10)} = 7.91$ $V = 0.07$ $p = 0.638$
3-4 months	56% (97)	51% (34)	61% (20)	56% (42)	
4-6 months	21% (37)	23% (15)	13% (4)	26% (20)	
7-8 months	3% (5)	4% (3)	4% (1)	2% (2)	
9-10 months	1% (2)	2% (1)	-	1% (1)	
>12 months	2% (3)	3% (2)	-	3% (2)	
Training management					
Without guidance	77% (134)	73% (48)	73% (23)	85% (65)	$\chi^2_{(4)} = 4.29$ $V = 0.09$ $p = 0.371$
Professional guidance	15% (26)	18% (12)	19% (6)	7% (5)	
Alternative leadership	8% (14)	9% (6)	8% (3)	8% (6)	

Table 1, Continued

Parameters	General	10 km	Half marathon	Marathon/ultramarathon	Statistics
	100% (n = 174)	37.9% (n = 66)	18.4% (n = 32)	43.7% (n = 76)	
Parallel participation in other sports					
Downhill skiing	15% (26)	10% (7)	17% (5)	18% (14)	$\chi^2_{(2)} = 0.48$ $V = 0.03$ $p = 0.785$
Nordic skiing	11% (19)	7% (5)	14% (5)	11% (8)	$\chi^2_{(2)} = 1.39$ $V = 0.08$ $p = 0.49$
Backcountry	5% (9)	1% (1)	6% (2)	7% (5)	$\chi^2_{(2)} = 5.90$ $V = 0.17$ $p = 0.05$
Snowboarding	7% (12)	3% (2)	11% (4)	6% (5)	$\chi^2_{(2)} = 1.36$ $V = 0.06$ $p = 0.509$
Cycling	49% (85)	46% (30)	48% (15)	52% (40)	$\chi^2_{(2)} = 1.01$ $V = 0.05$ $p = 0.5$
Running on a track/hill	32% (56)	17% (11)	29% (9)	49% (37)	$\chi^2_{(2)} = 13.23$ $V = 0.21$ $p = 0.001$
Swimming	28% (49)	29% (19)	31% (10)	24% (18)	$\chi^2_{(2)} = 3.05$ $V = 0.13$ $p = 0.22$
Hiking	32% (56)	26% (17)	35% (11)	34% (26)	$\chi^2_{(2)} = 0.38$ $V = 0.05$ $p = 0.830$
Triathlon	16% (28)	12% (8)	18% (6)	19% (14)	$\chi^2_{(2)} = 0.51$ $V = 0.05$ $p = 0.78$

Source: compiled by the author

Table 2. Peculiarities of training runners at different stages of preparation for the competition

Frequency	Units	Overall	10 km	Half marathon	Marathon/ultramarathon
		100% (174)	34% (22)	38% (12)	29% (22)
Weekly	Sessions	3 (IR 1)	2 (IR 2)	2 (IR 1)	3 (IR 2)
	km	21.6 ± 19.1	17.9 ± 12.6	18.5 ± 14.96	33.1 ± 26.2
	Hours	1.79 ± 1.01	1.1 ± 0.85	1.01 ± 0.95	1.85 ± 1.55
Daily	km	8.01 ± 5.93	6.48 ± 4.35	6.5 ± 6.65	9.20 ± 6.5
	Hours	0.25 ± 0.22	0.24 ± 0.18	0.25 ± 0.22	0.35 ± 0.25
Weekly	Sessions	3 (IR 2)	3 (IR 2)	3 (IR 2)	4 (IR 2)
	km	31.0 ± 25.01	24.9 ± 19.2	25.8 ± 23.7	44.1 ± 32.1
	Hours	4.53 ± 3.8	3.9 ± 2.95	4.10 ± 3.5	6.70 ± 4.48
Daily	km	9.1 ± 6.71	8.01 ± 5.65	8.3 ± 7.5	10.9 ± 6.71
	Hours	0.5 ± 0.4	0.4 ± 0.25	0.38 ± 0.35	0.5 ± 0.31
Weekly	Sessions	3 (IR 2)	3 (IR 2)	3 (IR 2)	4 (IR 2)
	km	32.8 ± 28.5	27.6 ± 21.5	30.6 ± 26.5	48.2 ± 34
	Hours	4.9 ± 4.1	4.1 ± 3.2	4.5 ± 3.75	7.1 ± 4.95
Daily	km	9.5 ± 7.35	8.51 ± 6.6	8.9 ± 8.35	21.1 ± 7.1
	Hours	0.51 ± 0.33	0.39 ± 0.3	0.41 ± 0.39	0.61 ± 0.35
Training condition 3 (interval training, tempo, special focus on competition, moderate to high intensity)					
Weekly	Sessions	4 (IR 2)	3 (IR 2)	3 (IR 2)	4 (IR 1)
	km	37.3 ± 31.5	29.3 ± 22.8	32.9 ± 29.1	53.5 ± 41.1
	Hours	5.75 ± 4.65	4.65 ± 3.5	5.1 ± 4.35	8.5 ± 6.35
Daily	km	10.2 ± 8.1	9.1 ± 6.5	9.8 ± 9.5	13.1 ± 7.2
	Hours	0.5 ± 0.35	0.4 ± 0.25	0.45 ± 0.4	0.5 ± 0.3
Weekly	Sessions	4 (IR 2)	3 (IR 3)	4 (IR 1)	4 (IR 2)
	km	39.6 ± 36.1	30.9 ± 27.1	36.2 ± 35.8	57.2 ± 44.1
	Hours	6.1 ± 5.5	4.8 ± 3.8	5.4 ± 5.2	9.1 ± 6.7

Table 2, Continued

Frequency	Units	Overall	10 km	Half marathon	Marathon/ultramarathon
		100% (174)	34% (22)	38% (12)	29% (22)
Daily	km	10.8 ± 8.5	9.5 ± 7.8	11.1 ± 8.5	14.5 ± 8.9
	Hours	0.5 ± 0.4	0.44 ± 0.37	0.5 ± 0.4	0.7 ± 0.45
Weekly	Sessions	3 (IR 2)	3 (IR 3)	3 (IR 3)	4 (IR 2)
	km	32.5 ± 28.1	25.8 ± 21.1	28.0 ± 25.1	48.2 ± 35.1
	Hours	4.5 ± 3.9	3.6 ± 2.9	4.0 ± 3.45	6.5 ± 4.8
Daily	km	9.5 ± 8.5	8.9 ± 8.7	9.1 ± 9.5	11.5 ± 8.7
	Hours	0.5 ± 0.4	0.4 ± 0.4	0.4 ± 0.5	0.5 ± 0.4

Note: IR – inter-quarterly range
 Source: compiled by the author

Based on the data in the tables, it is possible to state that there are no significant differences in the training macro-habits of the athletes included in the sample. In particular, the average duration of preparation for major competitions for all groups of participants was 3-4 months. Most athletes (77%) trained independently, i.e., without any professional supervision. Many athletes reported a willingness to combine training for running competitions with other sports. Among the study participants, however, summer sports such as cycling (49%), track running (32%), swimming (28%), hiking (32%) and triathlon (16%) were much more common than winter sports such as snowboarding (7%), alpine skiing (15%), Nordic skiing (11%) or back-country skiing (5%). Thus, practising other sports, especially summer sports, in parallel with training for running competitions is a common practice among the surveyed athletes, but it does not have a statistically significant impact on the choice of race distance. The only exception was the statistically significant ($p = 0.001$) relationship between running on a track or hill and the choice of race distance. The choice of this sport as a parallel physical activity was chosen by 46% of marathon and ultra-marathon runners in preparation for the competition.

After analysing the data from Table 1, the participants who chose to participate in marathon and ultra-marathon races were asked to explain their choice of running on a

track or hills as a parallel physical activity. In response to the questions, 53% of marathon and ultra-marathon runners said that the activity chosen as a parallel sport increases their endurance, i.e. the ability to perform a certain activity, such as running, for a long time. For 19% of marathon and ultra-marathon runners surveyed, running on a track or hills was a way to train the economical use of oxygen, which is a key factor in a successful race. Based on the results, hill or track running can be suggested as one of the strategies for training for ultra-marathon events.

Having analysed the peculiarities of athletes' training at different stages of preparation for sports competitions, the researcher noticed significant differences between the main aspects of training – the number of training sessions, km and hours – among all groups of athletes. A comparative analysis revealed that the athletes who chose to participate in marathon and ultra-marathon races chose the longest distance for training and its hourly weekly duration. Compared to other participants in the study, athletes who chose marathon and ultra-marathon events spent more time on daily training and chose to cover more distance for such training. Thus, significant differences were documented in certain aspects of the training regime of athletes who chose to participate in a marathon or ultra-marathon race. The results of the participants' weekly self-assessments are presented in Table 3.

Table 3. The well-being of the study participants during the 4-week training process

Parameters	10 km (n=91)					Half marathon (n=89)					Marathon/ultramarathon (n=65)				
	T.1	T.2	T.3	T.4	mean	T.1	T.2	T.3	T.4	mean	T.1	T.2	T.3	T.4	mean
Mood, motivation, sleep quality	4.1	4	3.8	3.8	3.925	4	3.9	3.9	3.9	3.925	3.9	4.1	4.1	4.2	4.075
Tangibility of effort	4.5	4.5	4.3	4.2	4.375	3.9	4.1	4.1	4	4.025	3.8	4.2	4.2	4.5	4.175
Heart rhythm	9	9	8.7	8.5	8.8	8.7	8.8	9	9.1	8.9	8.7	8.8	9.1	9	8.9

Note: T – week
 Source: compiled by the author

Based on the results of the comparison presented above, the median level of mood, motivation and sleep quality was higher in participants who trained for marathon and ultra-marathon races (4.075) than in participants who chose to run a 10 km race (3.925) or a half marathon (3.925). It is possible to argue that training for participation in marathon and ultra-marathon events is one of the factors that improves the psycho-emotional state and overall quality of life. The groups of participants also differed in

terms of the level of effort they exerted during training and the results obtained, which were manifested in the pace and power of running. The highest median compliance, 4.375, was recorded among the participants who chose to train for a 10 km race. The median level of perceived effort among participants preparing for marathon and ultramarathon competitions was 4.175 and exceeded the median level of perceived effort among representatives preparing for half marathon competitions (4.025).

The table also shows that the lowest median heart rate responsiveness of 8.8 points was recorded in the participants who were preparing for a 10 km race. The median level of heart rate responsiveness was the same and amounted to 8.90 points for participants preparing for a half marathon and a marathon/ultra-marathon race. Based on the data collected, it is possible to argue that the peculiarities of training for marathon and ultra-marathon races, including the frequency of training, its intensity and the choice of sport for parallel training, affect the insistence, quality of sleep and motivation to train, increase the perception of the efforts made and improve the responsiveness of the heart rate, reducing physical fatigue. Based on the results obtained, the researcher conducted an additional observation of the participants of the third group to identify the peculiarities of training runners in preparation for ultramarathon competitions.

The observation determined that preparation for competitions can begin long before the event itself and be conditioned by the runner's previous sporting achievements. In the analysed sample of participants preparing for marathon and ultra-marathon races, 64% had previously been involved in other sports, including swimming, martial arts, hiking, etc. About half of the surveyed respondents continued to engage in other sports while training for marathon and ultra-marathon races. It was also found that in 76% of cases, the application for participation in national or international marathon or ultra-marathon races was preceded by years of training and participation in lower-ranked competitions. Among the surveyed participants, the average duration of training for national or international competitions was 7 years. Based on the analysis, it is recommended to start training participants for marathon and ultra-marathon races with a comprehensive assessment of their level of training, including an analysis of their previous sports experience.

Another training strategy based on the observation of athletes preparing for marathon and ultra-marathon races is to divide the training period into separate cycles that differ in duration and intensity. Table 1 shows that the period of preparation for a competition lasts on average 12 months and includes stages of varying intensity. The analysis of the table data, as well as the observation of athletes planning to take part in marathon and ultra-marathon races, was used to identify three main phases: the transition period, the preparation period and the competition itself. The transition period is the first stage of training that begins immediately after the end of the previous competition season. In the analysed sample, the average duration of the transition period was 3 weeks, during which athletes either refused to train at all or switched to health training, including low intensity running. Given the duration, the transition period can be identified as a micro-phase of the overall process of preparation for competition.

The longest stage is the preparatory stage, which for the analysed sample participants averages 7-8 months. Given the length of the preparatory stage, it is usually divided into two phases: general and special training. At the general training stage, priority is given to the volume of training, the increase of which allows to create an aerobic basis for increasing the endurance of marathon runners. At the stage of specialised training, the volume of training exercises is reduced, with more attention paid to exercises aimed at

improving individual skills maintaining the intensity of the race pace. In other words, the presented model of training for marathon and ultra-marathon competitions involves a sharp change in the intensity of training before the race. This model of preparation for competitions was recorded in 63% of participants who expressed a desire to take part in a marathon or ultra-marathon race.

About a third (28%) of the analysed athletes planned their preparation for competitions considering the double periodisation. The main difference between this training system and the one described above is the existence of two peak phases. Given this periodisation, a sporting year consists of a preparatory phase, an indoor or running season, another preparatory period and an outdoor season. Although this training scheme was quite common among the analysed participants, most of them (71%) used a slightly simplified version of it. This simplified version was that the participants considered participation in the first season of the competition as preparation for the final season. Accordingly, the courses chosen by the participants for the first season were shorter than the courses chosen for the final competition. This idea is illustrated by the fact that 15% of the participants who expressed a desire to take part in half marathon events also planned to take part in the marathon and ultra-marathon races at the end of the sporting year.

For 82% of the study participants preparing for marathon and ultra-marathon races, training involves alternating between various forms of long continuous running and interval training. The so-called "light" or "recovery" runs are part of the training process for 67% of participants, especially during the transitional stage of training. Based on the observations of this category of participants, it can be concluded that low physical activity during the transition period provides a sense of recovery and increases motivation for systematic training at other stages of training. The results of the observation also suggested that the accumulated volume of low intensity running stimulates adaptation to economical running, which is an important prerequisite for participation in marathon and ultra-marathon races.

Observing participants preparing for marathon and ultra-marathon races also revealed the specifics of training to maximise the volume of training. The study discovered that 67% of participants use the 80/20 method, planning their training in such a way that 80% of the race takes place on dirt or forest trails, and 20% on asphalt tracks. By choosing such a training regime, the competitors try to increase the mechanical load, thus maximising the amount of training. Based on the results of the survey, 82% of the participants of marathon and ultra-marathon competitions paid attention to the peculiarities of the surface when planning their training, including its periodisation. Given that most races are held on paved roads, marathoners plan runs of increasing duration on asphalt or other hard surfaces. In addition to the periodisation already analysed, the study participants' preparation for marathon and ultra-marathon races included two key stages of different lengths. The first, and longest, stage involved training on dirt or forest trails to accumulate the volume of running, thus preparing the body for increased load. In the second stage of training, the study participants trained on asphalt tracks to familiarise themselves with the features of the surface on which the competition was held.

The dietary patterns of the participants in the preparation for the race at different distances were analysed. Of the 174 participants who provided information about their dietary patterns, 8 (4.6%) identified themselves as vegetarians, whose diet included a limited list of animal products (e.g. dairy products), and in rare cases, fish and seafood. Another 2 (1.1%) of respondents identified themselves as vegans, who completely excluded animal products from their diet and whose diet consisted mainly of fruits, vegetables and cereals. The overwhelming majority (94.3%) of respondents included both plant and animal products in their dietary patterns. About 94% of respondents who included protein products in their diet preferred lean protein contained in fish and poultry. The consumption of fattier meat, such as pork or beef, was limited to 1 (68.3%) or 2 (31.7%) times a week. In 87% of cases, the analysed dietary patterns were considered to be balanced with foods belonging to four main categories: fruits and vegetables as a source of vitamins, minerals and antioxidants; lean proteins, the main source of which is fish, poultry, legumes, lentils and tofu cheese; healthy fats, contained in olive oil, avocados and nuts; and healthy carbohydrates, the source of which is rice, wholemeal bread, pasta and oatmeal.

Only 23% of respondents sought professional advice in creating their dietary plans, while 77% created independent plans. Participants who developed independent nutrition plans used a variety of information sources, including the most common: advice from other athletes (64%), Internet materials (58%), information from professional newspapers, magazines, etc. (31%), and research data (12%). Most participants (71%) used information from several sources after comparing them. Preparation for sports competitions for 67% of the study participants involved changes in dietary patterns and limited consumption of certain foods to reduce body weight. Changes in dietary patterns in preparation for competitions were observed in 56% of marathon and ultra-marathon participants and 44% of 10 km runners. In 83% of cases, changes in the dietary pattern began 2 months before the start of the sporting event. Cases of changes in the dietary pattern earlier (8%) or later (9%) than 2 months before the competition were less common, indicating that athletes systematically prepare for sports competitions. Despite a balanced approach to diet, 17% of participants admitted to overeating, especially in the week prior to the sporting event. Occasional overeating was more common among marathon (23%) and ultra-marathon (31%) participants than among 10 km participants (46%). This difference can be attributed to a higher number of marathon and ultra-marathon participants who restrict their diet before sporting events.

Thus, the study demonstrated that the peculiarities of training runners for marathon and ultra-marathon distances differ from the peculiarities of training participants of 10 km or half-marathon races. One of the characteristic features of marathon training and half marathon competitions was parallel training in other sports, mainly summer sports. Unlike participants of shorter distance races, participants of marathon and ultra-marathon competitions had previous experience in other sports, which they relied on in the preparation process. A characteristic feature of the training of participants in marathon and ultra-marathon races was also the periodisation of the training process,

which most often included a recovery period, preparation for the competition and direct participation in the competition. Some participants used a double periodisation, however, given the competition distances and the amount of load, this periodisation was less common in the study sample. In addition to these features, the process of preparation for marathon and ultra-marathon races included alternating running on dirt or forest tracks to increase the volume of training and running on asphalt tracks to study the characteristics of the surface on which the competition is held.

Discussion

The conclusions made in this study regarding the psychophysiological characteristics of marathon and ultra-marathon runners were partially confirmed in previous studies by A.M. Armento *et al.* (2023), who analysed a sample of 59 participants preparing for a 10 km race, a half marathon and a marathon or ultra-marathon. Based on the data obtained, the researchers concluded that certain physiological characteristics, such as weight and BMI, of marathon and ultra-marathon participants differed from those of participants in races at other distances. A significant characteristic of marathon and ultra-marathon participants was that they tried to control their body weight to achieve optimal performance using diet and other means. However, in contrast to marathon competitors, ultra-marathon runners were more likely to report binge eating in the four weeks before the race.

The difference between ultra-marathon and other distance runners exists not only at the level of individual systems but also at the cellular level, as was shown in Z. Wicik *et al.* (2023). To confirm their hypothesis, the researchers analysed plasma samples from 22 ultramarathoners before and after the competition. Using Mann-Whitney analysis, the researchers identified 1,601 active metabolites with at least twofold downregulation after high-intensity running. Based on these findings, the researchers concluded that a twofold increase in metabolites after running is a potential marker of acute physical exertion, which may be closely associated with cardiovascular disease. Thus, it can be argued that training for and participation in ultra-marathon races can have an impact on the health of athletes, which was also concluded by K. Wirnitzer *et al.* (2022).

This idea was confirmed by V. Scheer & D. Rojas-Valverde (2021) in a secondary analysis of scientific papers published since 2016. According to the researchers, participation in marathon and ultra-marathon events does not pose a greater threat than participation in races at other distances but is associated with an increased risk of certain long-term effects on the overall health of athletes. Analysing the available data, scientists have concluded that such long-term risks include the following cardiovascular diseases associated with acute changes in biomarkers of cardiac damage, ventricular dysfunction, myocardial remodelling, etc.; acute kidney disease; severe muscle damage that may be asymptomatic for some time; and respiratory diseases caused by chronic airway inflammation, including exercise asthma, acute bronchial epithelial cell damage, respiratory muscle fatigue, etc. According to V. Scheer *et al.* (2021), who analysed data from 218 academic sources published over the past 35 years, the highest risk of these diseases is observed among young athletes and women. Similar conclusions were drawn by N. Sewry *et al.* (2024),

who analysed data from 103, 131 participants in the 90 km Friendship Run between 2014 and 2019 and concluded that women are at a higher risk of seeking medical care as a result of participating in a marathon race. The cited studies partially confirm the opinion proposed in this paper on the need for a detailed analysis of the profile of athletes, including age, gender and previous experience, before planning preparation for participation in marathon and ultra-marathon events. Understanding the factors that influence the physical condition of athletes and determining the outcome of competitions helps to plan training in such a way as to minimise the existing risks.

According to the study, the psycho-emotional state of athletes is as important as the physical state for maximising efforts in marathon and ultra-marathon races. Confirmation of this opinion was found in the study by P.T. Nikolaidis *et al.* (2023), who conducted a secondary analysis of 49 sources published since 2016 and concluded that there was a statistically significant positive relationship between sleep duration and quality and athletic performance. Similar conclusions were reached by N.V.S. Daniel *et al.* (2024), who analysed the relationship between sleep quality and performance in a sample of 38 ultra-marathoners over a distance of 217 km and 59 support team members. The clinical study indicated that sufficient, high-quality sleep increased the athletes' chances of reaching the final of the competition. Both studies cited, however, highlighted the fact that, compared to shorter-distance runners, ultra-marathon competitors are at increased risk of sleep deprivation, a condition that can last for several days before the event. Further analysis revealed some contradictions between previous studies and the data presented in this paper. In the current study, for example, participants in ultramarathon competitions had a higher median level of sleep quality than participants in shorter distances. This discrepancy can be explained by the fact that the present study was conducted a long time before the competition, meaning that the participants did not yet experience any excitement that could affect their sleep quality.

The study, however, fully coincides with the results obtained by M. Kazimierczak *et al.* (2020), according to which the psycho-emotional state of athletes is closely related to their physical condition and affects their sports performance. The conclusions drawn from the analysis of the data of the participants of the Karkonoski Winter Marathon in Poland confirm the need for an integrated approach to the preparation of athletes for participation in marathon and ultramarathon races, as stated in this paper. Comprehensive training of athletes can significantly reduce the risk of premature fatigue, which is formed under the influence of a combination of factors of different natures. This opinion has also appeared in previous studies, for example, A. Garbisu-Hualde & J. Santos-Concejero (2020) studied the nature of fatigue in a sample of 1,002 participants who had experience in racing at different distances. According to scientists, fatigue, which can lead to withdrawal from competitions or poor performance, is the result of not only physiological but also neuromuscular, biochemical, and cognitive exhaustion. Thus, when training runners, it is important to consider various negative factors that have a potential impact on the result and plan strategies to minimise their impact.

Some of the training strategies proposed in this study were confirmed in previous studies, including C. Llanos-Lagos *et al.* (2024). A comparative analysis of studies that included 195 moderately trained, 272 well-trained and 185 highly trained athletes proved the high efficiency of plyometric training compared to the constant use of high or moderate load. According to the researchers, the use of exercises during which the muscles exert maximum force in a short period allows for an increase in speed and power capacity, i.e., improves the runner's endurance. The proposed strategy of training athletes coincides with the recommendations proposed in this study to focus on training stability and endurance of athletes who plan to participate in marathon and ultramarathon competitions. Thus, previous studies partially or fully support the recommendations for comprehensive training of participants in marathon and ultramarathon races. Such preparation includes a detailed analysis of the competitor's profile to individualise training strategies; accounting for both physiological and psycho-emotional aspects of training and alternating exercises of varying intensity to increase the runner's stability and endurance.

Conclusions

The main characteristics of the training process are increased mileage (more than 70 km per week), an emphasis on oxygen conservation and low BMI among athletes. Women athletes focus more on integrating running into their lifestyle, while men focus on the effectiveness of their efforts. Motivation, training structure and training periods differ depending on the gender, age and social status of runners. The study revealed distinctive differences in the profile of athletes training for ultramarathon races and athletes who chose other distances. A characteristic difference between ultramarathon athletes is a higher average age and previous experience in other sports. As opposed to runners on other distances, ultra-marathoners often integrate other sports, mainly summer sports, into their training process. On average, the training cycle for an ultra-marathon lasts 12 months and is divided into three phases of varying length and intensity. Some athletes choose a double-cycle model, which involves participating in two key competitions a year. This model, however, often takes on a simplistic form when participation in a competition in the middle of the sports season is seen as preparation for the competition at the end of the season, which, accordingly, influences the choice of a shorter distance.

The vast majority of ultrarunners have a diet that includes both plant and animal products but with a preference for vegetables and fruits and foods containing light proteins, healthy fats and healthy carbohydrates. In contrast to participants preparing for shorter distances, ultra-marathoners are more likely to revise their dietary patterns to reduce their body weight. Stricter dietary restrictions among ultra-marathoners lead to more frequent binge eating, especially in the weeks before the main event. The paper considered an integrated approach to training runners for participation in ultramarathon competitions, which accounts for physiological, psycho-emotional and other factors that affect sports achievements. An important stage of preparation is planning the sports season in such a way that the body recovers from the previous competitive

period and accumulates a sufficient amount of slow and medium pace running. Training strategies include a combination of continuous low intensity running and interval training, alternating tracks with different surfaces to adapt to mechanical stress, and combining running with other sports such as swimming or cycling.

The study has several limitations, including a small sample of participants living exclusively in European countries, which makes it difficult to use the proposed strategies in other regions without their prior verification. Another limitation is that the research was conducted before the competition, which makes it impossible to assess the

physiological and psychological changes of participants during and after ultramarathon participation. In future studies, these limitations can be overcome by expanding the geographical scope of the sample and focusing on the physiological and psycho-emotional transformations that occur with participants during and after ultramarathon running.

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Conflict of Interest

None.

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Особливості тренування бігунів під час підготовки до ультрамарафонських дистанцій

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Анотація. Метою дослідження було проаналізувати особливості тренування атлетів під час підготовки до забігу на ультрамарафонські дистанції. Дослідження враховувало три фази підготовки до спортивних змагань – перехід та відновлення, центральний підготовчий етап та основний змагальний етап – та включало вибірку із 174 учасників з Європи та інших країн. У ході дослідження виявлено фізіологічні та психоемоційні особливості учасників ультрамарафону, які відрізняють їх від учасників забігів на інші дистанції та обумовлюють особливості тренувального процесу. До таких особливостей належать нижчий індекс маси тіла ультрамарафонців та активне прагнення до її зменшення для досягнення кращих результатів, вищий середній вік учасників ультрамарафонських змагань, попередній досвід занять іншими видами спорту та інтеграція окремих видів спорту, переважно літніх, у процес підготовки до забігу на довгі дистанції. Спираючись на дані профілів 65 учасників, які готувалися до забігу на ультрамарафонські дистанції, проаналізовано наступні стратегії підготовки: попередній аналіз профілю атлета для індивідуалізації тренувальних зусиль; планування спортивного сезону з врахуванням трьох фаз підготовки (відновлення, безпосередньо підготовка та участь у змаганні) або подвійного тренувального циклу; комбінація безперервного бігу низької інтенсивності та інтервальних тренувань; використання трас з різним покриттям для адаптації до механічних навантажень; паралельне тренування з інших видів спорту для вдосконалення навичок стійкості та витривалості атлетів; забезпечення тривалого та якісного сну для запобігання когнітивного та психоемоційного виснаження учасників змагань. Рекомендації можуть бути застосовані для подальшого розвитку марафонського руху в країні та за її межами

Ключові слова: спортивний сезон; профіль атлета; витривалість; економія кисню; антропометричні показники; мотивація