EVALUATING TREND ANALYSIS IN THE PERFORMANCE OF ALMATY MARATHON RUNNERS FROM 2016 TO 2021

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"DECLARATION"

"I hereby, declare that this manuscript, entitled *"trend analysis in the performance of almaty marathon runners from 2016 to 2021",* is the result of my own work except for quotations and citations which have been duly acknowledged."
"I also declare that, to the best of my knowledge and belief, it has not been previously or concurrently submitted, in whole or in part, for any other degree or diploma at Nazarbayev University or any other national or international institution."

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ABSTRACT

The aim of the present study was to investigate trends in performance and participation of Almaty Marathon since 2016 to 2021. We analyzed 48 885 runners from different region, including Kazakhstan as individual region, because 46 723 racers were local participants, Asia, Europe and “Other” region in which: North and South America, Australia and African countries were included. For all countries, total involvement grew throughout 5 years since 2016 to 2021. Men performed better results than women across all 5 years. Since 2016 to the year prior to the pandemic in 2019, the quantity of racers increased annually. However, after the outbreak in 2021, there was a noticeable decline for 7392 competitors. 61.89% of all finishers over a five-year period ran the 10 km distance, which attracted the most runners. The Kazakhstan region had the worst performance for the three key distances of 10 km, 21 km, and 42 km. Athletes from Europe and "Other" regions performed best at the "Almaty Marathon," with the greatest results primarily coming from African nations. We found that between 2016 and 2021, there was an average finish time gap between male and female runners of about 20 minutes for all distances except 3 km. Regarding participation patterns, the number of runners climbed from 2016 to 2017, when there were 8323 participants, to 10333 in 2017, a difference of 2010 runners. The "Almaty Marathon" attracted 11347 runners the next year, an increase of 1014 runners, or participants. And the number of competitors increased by 1790 finishers between 2018 and 2019.

Key Words: *Marathon, participants, Anova test, finish time*

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1. BACKGROUND

The global records for distance running are close to being broken, and top men are outpacing top women in terms of speed. Nevertheless, scientists know relatively little about the way age-group competitors' performances have changed over the past few years. Huge city events like the "New York City Marathon" and many other runs of the "World Marathon Majors" have been evaluated to better understand involvement and performance patterns in distance running. Multiple researches showed that when contrasted to younger ages, female and male athletes increased participation and better performance in distance running. [1] In distance races like marathons, athletes out from local population frequently represent a large percentage of competitors. With a rising increase in competitors and winners, marathons and some other longstanding race types like the half-marathon are emerged to be among the most famous sporting events worldwide. Yet, it is common knowledge that competitors from a particular area or nation dominating a particular sport area. We are aware that East African runners are currently the quickest in marathons.[2] The amount of open running competitions, including races, and the participation rate have both dramatically increased recently. There has been more research done on running marathons, primarily focusing on competitions and events that take place in the US. [3] Individual success is influenced by endogenous variables, including physical, hereditary, and physiological traits as well as environmental variables that are relevant to all competitors. Because there are more people overall, there is now more genetic variation in distance running. [4] It has additionally been questioned whether there is a connection between birthplace and success in distance runners. Additionally, every single one of the top twenty achievements in marathon running and half-marathons in 2011, particularly for men, were accomplished by East African marathoners from Kenya, Ethiopia, and Eritrea, according to the International Association of Athletics Federations (IAAF) shortlist for half-

marathon and racing runners. It is well recognized that these East African competitors dominate the long-distance running world. A improved racing environment and favorable genetic inheritance have both been proposed as specific beneficial variables for East African athletes' performance.[5]

Nevertheless, the value of physical exercise has been demonstrated, especially in relation to the advantages for psychological wellbeing, functional status, general well-being, and a decline in fully functioning deficits brought on by aging. The primary endeavors to boost physical activity have been frequently concentrated on aerobic workouts like racing and aerobic activities. The public races serve as a substitute for changing one's behaviors. Some of the many factors that influence individuals to run a short distance include worries about their bodies and wellbeing, the fellowship of peers, portability and ease of exercise, low prices, the pursuit of beauty ideals, as well as the pursuit of unreachable performance objectives. Thereby, across the 1980s, endurance running spread like wildfire throughout the globe. [6] The increase in the number of competitors in marathon has not been evaluated and there is no research which analyzing trends performances of marathons in Kazakhstan. Therefore, the aim of this study is to analyze the participation trends by sex, nationality, distance, calendar year, finishing time in “Almaty Marathon” between 2016 and 2021.

2. PROBLEM STATEMENT

2.1. RESEARCH QUESTION

What was the trends in the performance of Almaty Marathon runners from 2016 to 2021?

2.2. HYPOTHESIS

There are positive trends in the performance of Almaty Marathon runners from 2016 to 2021.

2.3. OBJECTIVE

To investigate the participation and performance trends of both men and women of Almaty Marathon runners from 2016 to 2021.

2.4. SPECIFIC AIMS

1) Approval from the NU Institutional Ethics Committee
    a) Approach to Marathon organization
    b) Enter an agreement with them to participate in the study
2) Request data from marathon organization on number, age, sex, distance, nationality and finish time of marathon runners:
    a) Distribute marathon runners for: 3, 10, 21 and 42 km
    b) Divide male and female runners for each year
    c) Compare runners from different regions
    d) Compare runners finish time using different statistical tests.
3) Perform data analysis using statistical software “Stata”, analyze data and draw conclusions.

3. MATERIALS AND METHODS

Ethical approval

The Institutional Review Board of Nazarbvaev University School of Medicine approved this study. Since the study involved analysis of publicly available data, the requirement for informed consent was waived.

Methodology

Data (i,e., sex, nationality, calendar year and running speed) on finishers in the Almaty Marathon from 2016 to 2021 were examined. Initially, 54 544 runners were considered. These reports acquired from the race's official webpage.[7] Race time in h:min:s was converted to minutes. Runners who finished Ekiden running and Nordic walking were excluded, to produce a finished sample of 48 885. Since runners from Kazakhstan were the highest competitors, considering their region, runners were classified to Asia, Europe, Kazakhstan and "Other region", which include South and North America, Australia and African countries.

Statistical and Data Analysis

For continuous variables, all data are given as mean values with standard deviations, and categorical variables were summarized using frequencies and proportions. Statistical software "STATA" were used to analyze the data. The main trends of sex, calendar year, nationality and finish time were tested by a one-way analysis of variance (ANOVA). Using the Chi-square test the relationships between the calendar year, sex and the finish time categories were examined. Histogram, QQ-plot, and Shapiro-Wilk test was used. We performed a t-test to test whether difference exists in mean finish time between the genders.

Descriptive statistics, bivariate analysis is used in the dataset analysis to determine whether there is a substantial relationship between the variables.

4. RESULTS

Participation trends

Between 2016 and 2021, 48 885 runners crossed the finish line with 27 808 were male and 21 077 were female. (Table 1) The 2021s displayed the fewest participants (5745), the 2019s the highest (13137). Since 2016 to 2019, across 4 years there has been an upward trend in the number of participants. Compared to 2016, numbers of finishers increased by 4814 participants in 2019. Both male and female runners were increasing each year since 2016 to 2019. Nevertheless, the number of women who finished has never surpassed that of males. The finish time was constant throughout 2016 and 2017 overall for women, men. Starting from 2018 until 2021 overall runners finishing time found slower than 2016 and 2017 years. Kazakhstan (46723) topped the list of participants across all 5 years when there was breakdown for different region, followed Asia (993) and Europe (980), while only 189 finishers from "Other region" which were: North and South America, Australia, and Africa.

When analyzing participation in different distance, we noted that mostly runners participated in 10 km distance (30256), following 21 km distance (12340) and 42 km distance (4026) and only 2263 runners participated for 3 km distance.

Performance trends

The average finish time of all participants from 2016 to 2021 was 103.79 (minutes). Men finished marathon quicker than women, indicating a minor primary impact that gender had on race time. The average finish time for 10 and 21 km distance were increasing since 2016 to 2018 by 7 minutes for 10 km distance and there was found 12 minutes difference for 21 km correspondingly. (Table 2)

Variable	N/mean	%/SD
Gender		
Female	21,077	43.12
Male	27,808	56.88
Distance		
3	2,263	4.63
10	30,256	61.89
21	12,340	25.24
42	4,026	8.24
Year		
2016	8,323	17.03
2017	10,333	21.14
2018	11,347	23.21
2019	13,137	26.87
2021	5,745	11.75
Region/Country		
Kazakhstan	46,723	95.58
Asia	993	2.03
Europe	980	2.00
Other regions ()	189	0.39
Finish time	103.79(minutes)	62.53(minutes)

Table 1. Descriptive statistics

Variable								
	Finish time in minutes, mean (SD)							
	Distance=3	p-value	10	p-value	21	p-value	42	p-value
Gender		<0.001		<0.001		<0.001		<0.001
Male	18.3 (7.3)		67.08(14.9)		130.8(23.7)		269.03(49.7)	
Female	20.5 (5.5)		82.2(17)		151.7(26.1)		288.5(50.4)	
Year								
2016	19.3(5.2)		72.4(18.8)		130.07(24.9)		274.05(49.5)	
2017	20.5(11.1)		73.15(18.9)		135.20(26.3)		265.6(47.8)	
2018	18.08(4.05)		79.06(17.1)		142.73(26.4)		284.1(47.3)	
2019	18.6(4.02)		77.38(16.8)		138.28(25.7)		265.07(54.2)	
2021			71.73(14.8)		133.28(25.3)		265.08(44.3)	
		<0.001*						
Region								
Asia	22.6(3.7)		71.5(15.4)		136.1(25.4)		261.6(52.5)	
Kaz	19.05(6.4)		75.4(17.7)		137.2(26.2)		272.8(49.8)	
Europe	22.6(28.7)		64.08(15.03)		124.3(22.5)		255.4(50.7)	
Others	16.5(3.7)		63.4(17.1)		133.1(31.08)		262.9(37.9)	

Table 2. Bivariate analysis

*Kruskal-Wallis test

For 10 km distance – fastest average speed was found in 2017, while for 21 km distance fastest average speed of runners appeared in 2016 and for long distance run for 42 km distance quickest average finish time was detected in 2019. For 3 km distance "Other" region showed best results which was 16.5 minutes, as well as for 10 km distance "Other" region finishers performed better than Kazakhstan and Asian runners, but there was only 1 minute difference for European finishers between "Other" region in 10 km distance. However, European countries revealed best finish time in 21 km distance, which was 124.3 minutes, and in this distance, there was significant change between "Other" region – 8.8 minutes. Kazakhstan showed average slowest results for 3 different distances: 10 km, 21 km and 42 km. (Table 2)

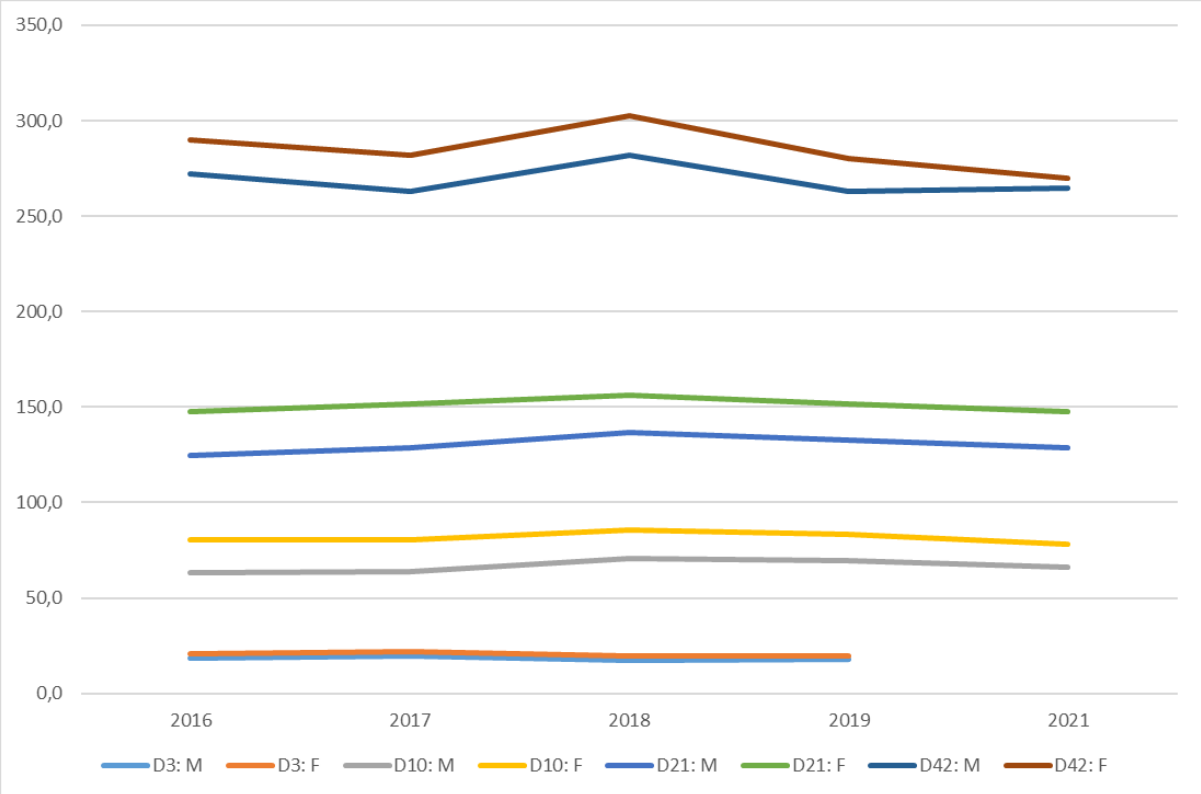

Figure 1. Finish time according to different distance and years.

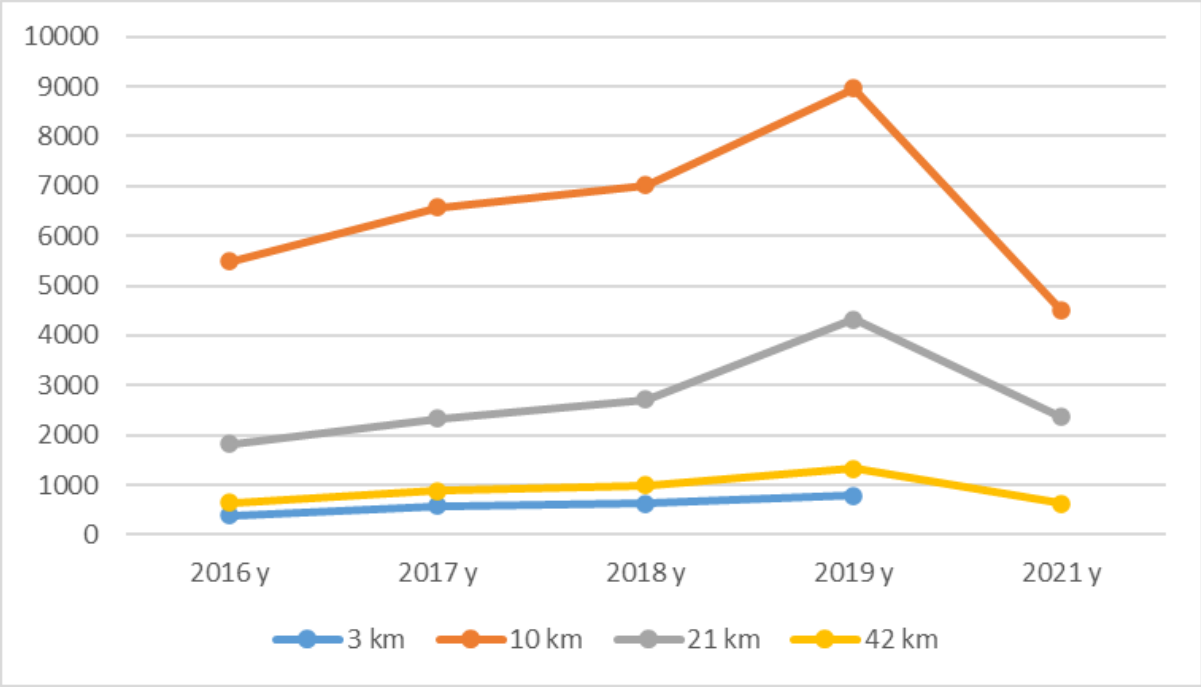

Figure 2. Total number of runners through different years and different distance

When the average finish time was considered for all distances, trend for 3 km, 10 km and 21 km was not changing that much. Nevertheless, for 42 km distance difference was found and average time was fluctuating every year. (Figure 1)

Concerning the trends according to total number of finishers through different years, we found positive trends for 10, 21 and 42 km distance before 2019, but after pandemic number of participants for each distance group decreased sharply. (Figure 2,)

For 3 km distance Asian male and female runners performed worst result, showing average finish time 22.9 minutes for male and 22 minutes for female correspondingly. Both female and male runners from "Other" region displayed best results. (Figure 3)

The fastest female performance for 10 km distance unveiled from European countries, average finish time was – 69.6 minutes, while male runners from "Other" region demonstrated impressive results – 56.2 minutes average finish time. Slowest female runners for 10 km distance appealed from Kazakhstan with 82.4 minutes average finish time. (Figure 4)

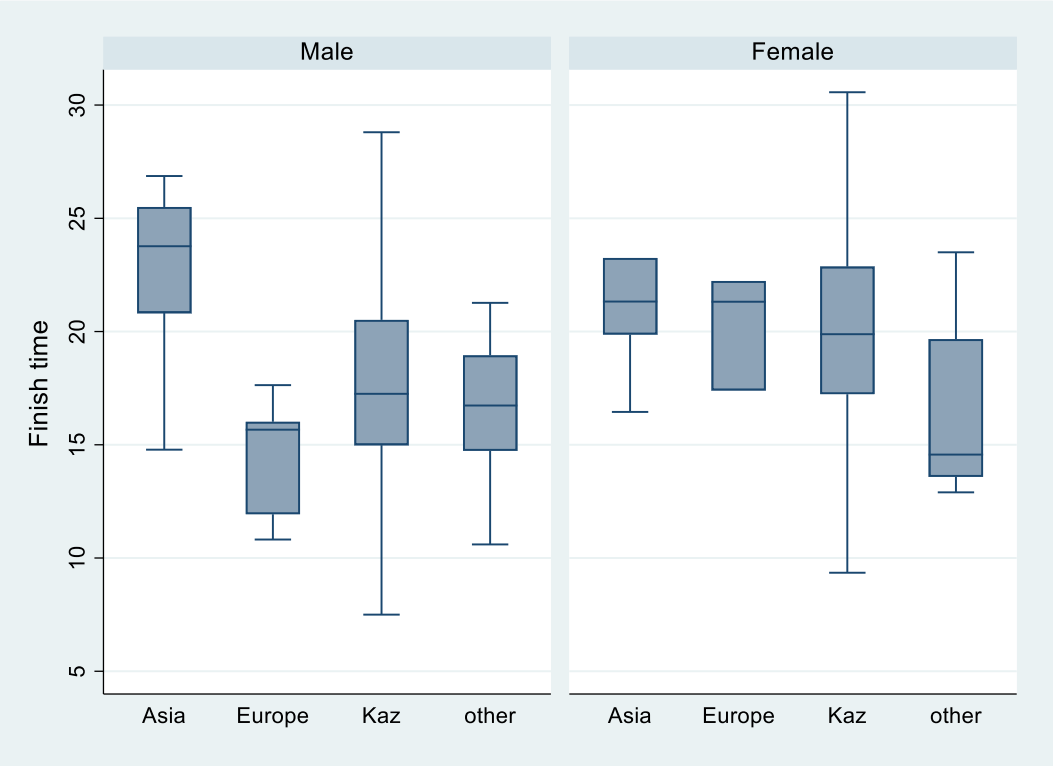

Figure 3. Finish time in minutes according to different regions for both male and female.

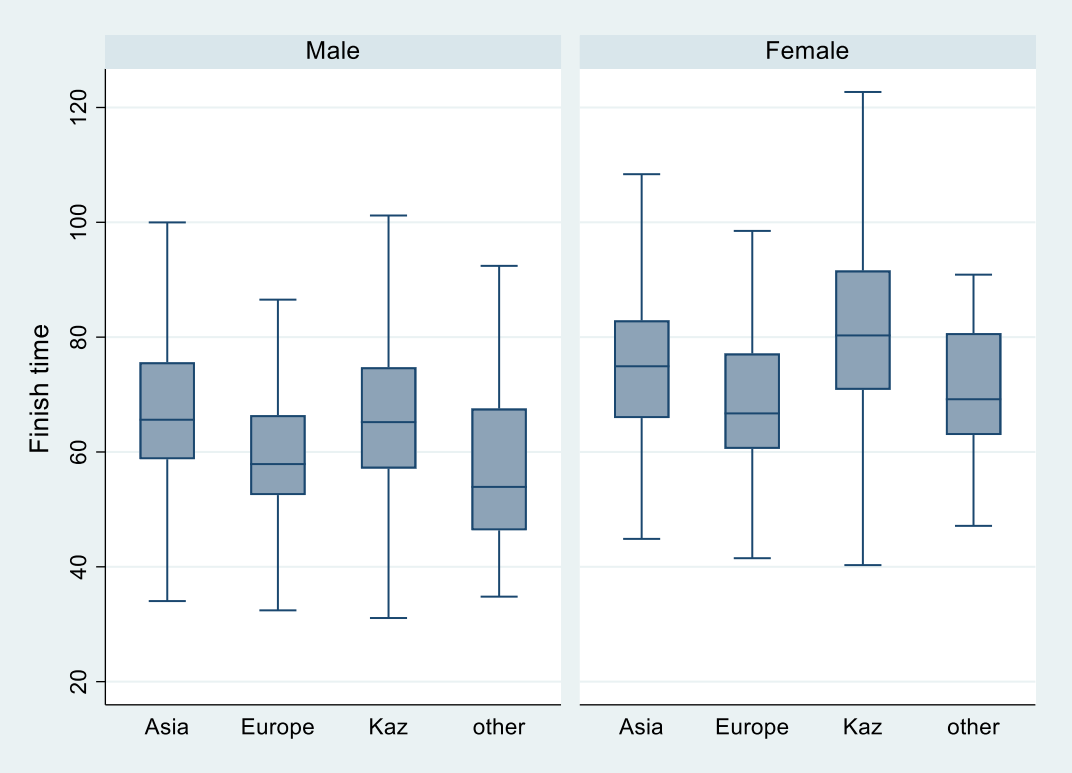

Figure 4. Finish time in minutes according to different regions for both male and female.

For 21 km distance both male and female runners from Europe manifested quickest results 119 minutes for male runners and 134.3 minutes average finish time for female runners accordingly. Kazakhstan male and female runners in this category exhibited worst results among all regions, 152.7 minutes for female runners and 131.3 minutes for male runners appropriately. (Figure 5) Moreover, Kazakhstan illustrated worst results as well for 42 km distance, 290 minutes for female runners and 270.85 minutes for male runners accordingly. European region female and male runners appeared fastest with 273.3 minutes for female with only 1.4 minutes difference between "Other" region, and 253 minutes for male finishers consequently. (Figure 6)

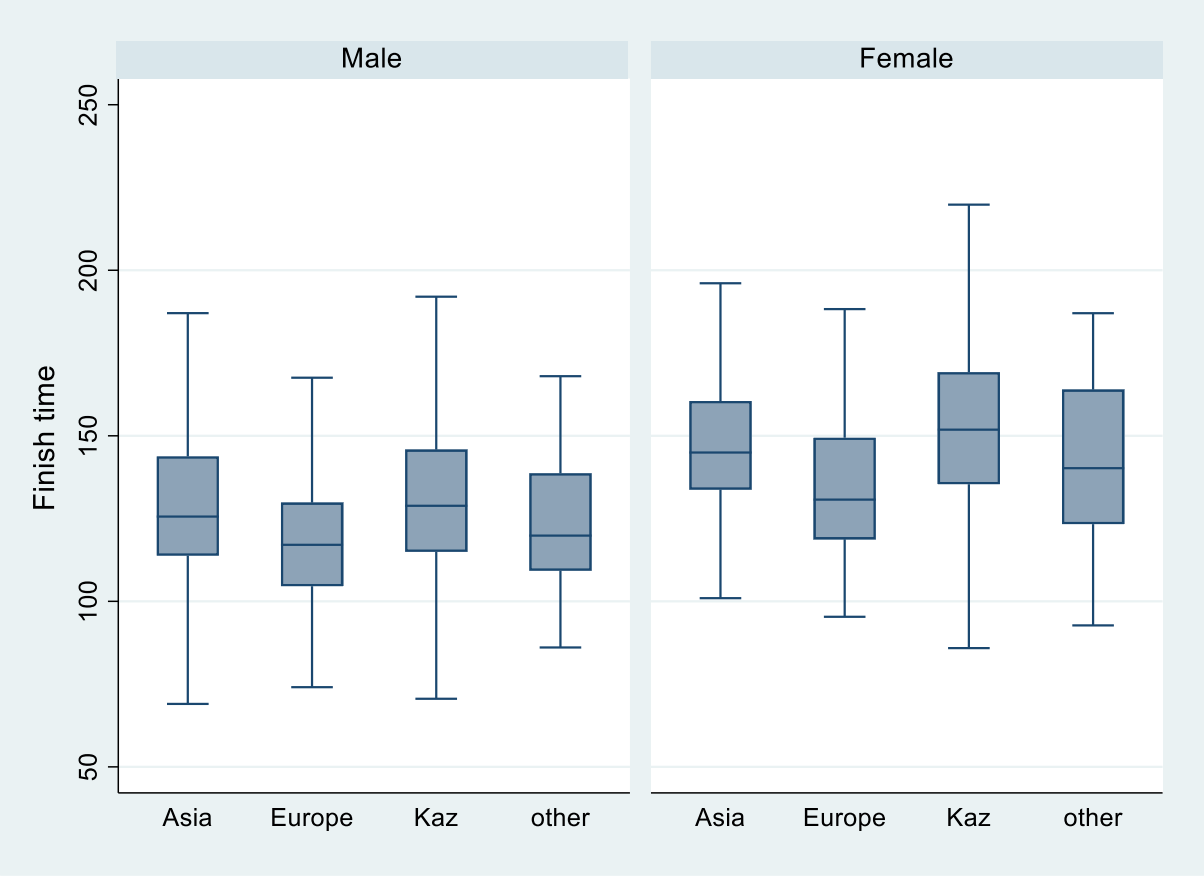

Figure 5. Finish time in minutes according to different regions for both male and female.

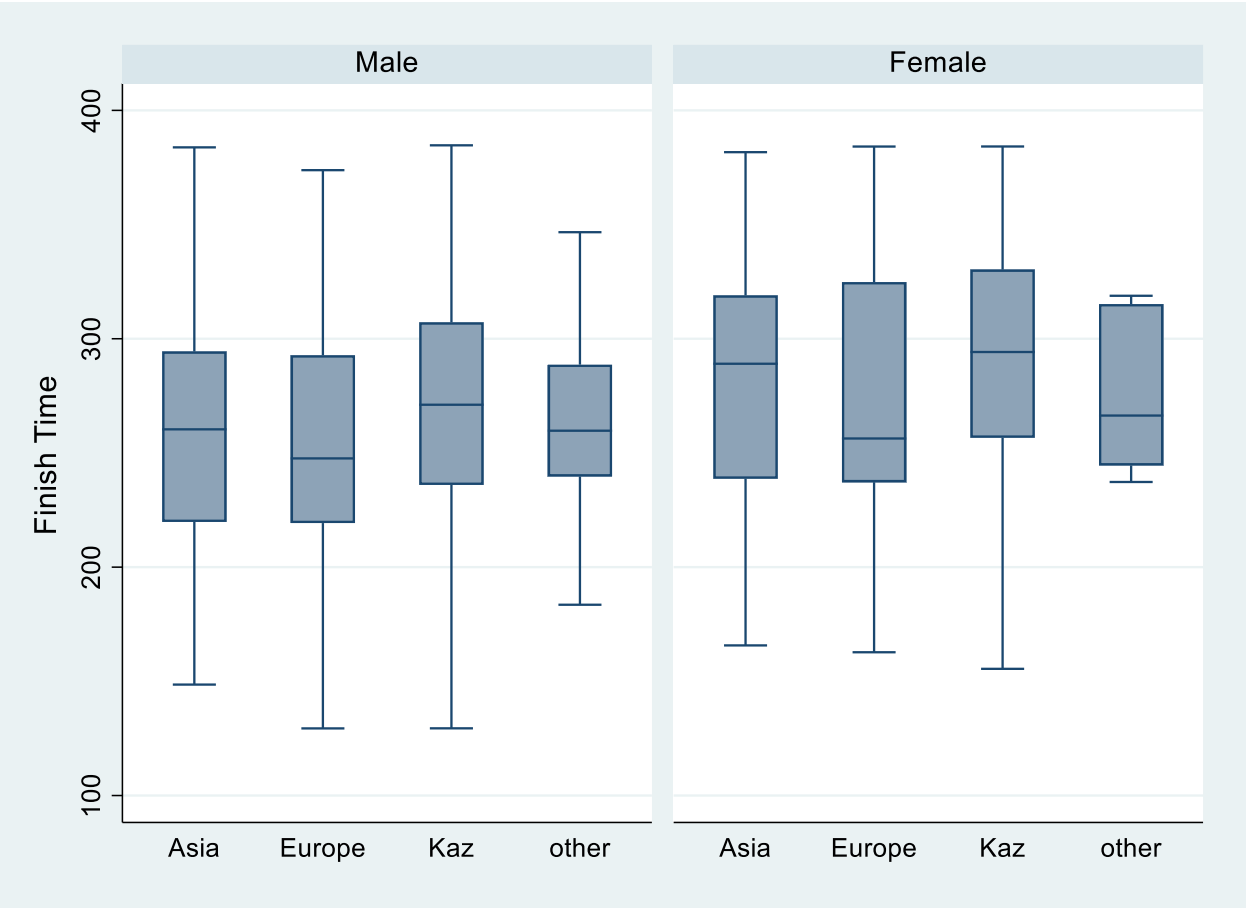

Figure 6. Finish time in minutes according to different regions for both male and female.

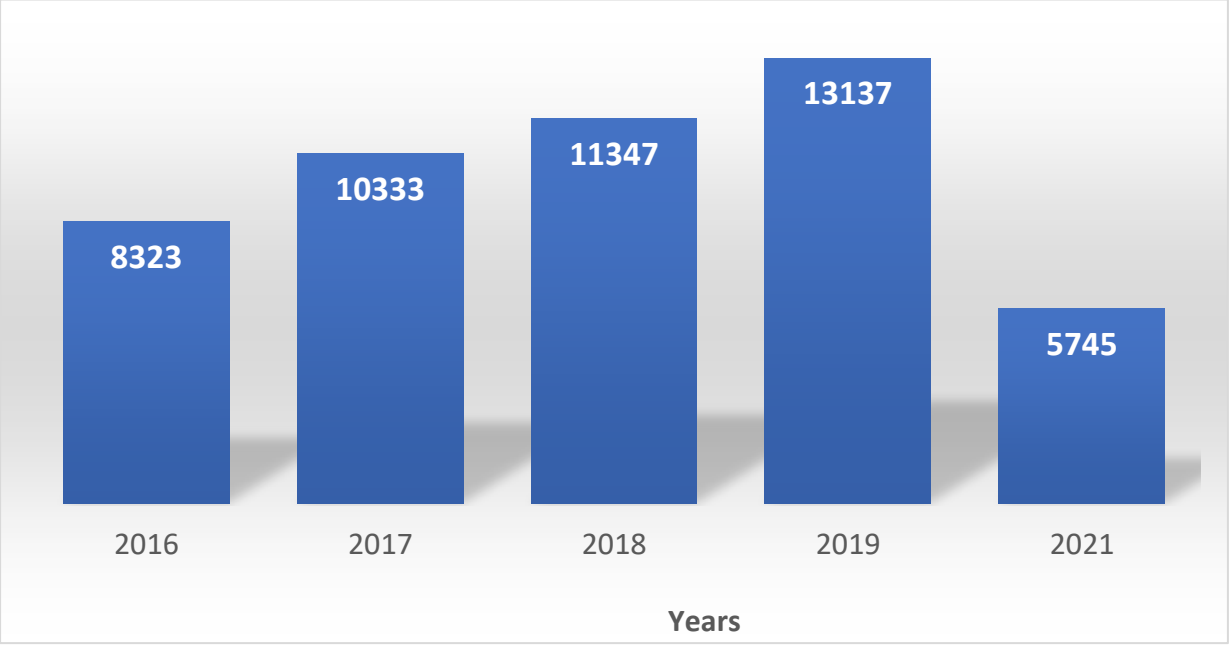

Figure 7. Total number of participants across 5 years.

5. DISCUSSION

The goal of this research was to look at participation and performance trends over a 5-year timeframe in relation to gender, finish time, region, distance and calendar year of "Almaty Marathon". We analyzed 48 885 participants from 4 different regions: Kazakhstan, Asia, European region and "Other" in which North and South America, Australia and Africa were all included. The key findings of our study were that: (i) men showed faster results than women in all distances. (ii) the number of runners expanded every year since 2016 until 2019 just before pandemic, and there was markedly reduction for 7392 participants after pandemic in 2021. (iii) runners mostly participated for 10 km distance, 61.89% of total finishers within 5 years. (iv) European regions displayed best results for 3 main category distances: 10 km, 21km and 42 km. (v) Kazakhstan region performed worst results for 3 main distances: 10 km, 21km and 42km.

According to our research, marathon times have gotten faster for runners of both gender and in every percentile. Essential factor affecting how women and men runners perform differently when racing is the involvement of women inside the sport.[8] Typically, more males than women enter running competitions like marathons [9] and males outpace women in running. [10]

The research has demonstrated that an increasing number of elite runners have begun to participate in marathons.[11] The mainly two causes of why there was increase in female participation were physical health goals and mental resilience.[12] In summary, research has demonstrated that people engage in racing competitions for sociocultural benefits in alongside their physical activity.[13]

The best performance in "Almaty Marathon" was by athletes from European and "Other" region, and mostly in "Other" region best results showed African countries. The prosperity of Africans has been the subject of numerous investigations. Their natural traits might be

one of the causes of the supremacy. Africans typically run at a greater proportion of their peaks throughout racing than Asians, regardless of comparable highest oxygen consumption. [5] Some research demonstrated that there is a significant genetic element to human factor variety as well as athletic capability. [14] Additionally, studies have shown that having a tiny body can help you sprint farther, especially in hot weather.[15] Variations in racing efficiency inside the hot weather between people of various sizes may be explained by a higher percentage of mass that is lean. Bigger and heavier individuals may run more slowly even as temperature rises from twenty-five to thirty-five degrees Celsius due to a higher buildup of warmth, which raises temperature and quickens the beginning of exhaustion.[16] According to studies, African endurance athletes perform better since their gracile extremities have smaller inertia times and therefore demand fewer internal mechanical effort to function properly throughout each racing movement. Furthermore, the shorter ball contact duration in such athletes might enhance running efficiency. [17] In fact, because their legs are lighter in comparison to their Nordic competitors, they generated less sweat and made for a more rapid and simple movement.

When comparing all female and males' runners between 2016 and 2021, we discovered a difference in performance of around 20 minutes average finish time for every distance except 3 km. The percentages of attendance may be a factor in the difference between the statistical methods. Once all racers are considered, it is believed that because fewer number of female than male enter races, female finishers may be more preferential than male racers, which may help to close the gender disparity.

Regarding participation trends, number of runners increased since 2016 to 2017, in 2016 number of participants were 8323, while in 2017 it was 10333, difference between 1 year participation is 2010 runners. Next year in 2018, 11347 runners participated in "Almaty Marathon", which means there was grow in participants for 1014 runners. And between

2018 and 2019 number of racers expanded by 1790 finishers (Figure 7). Therefore, we can see that there was positive trend in participation of “Almaty Marathon” before pandemic. Although, after pandemic number of participants in “Almaty Marathon” in 2021 clearly collapsed, final finishers were only 5745, which means 7392 less runners than before pandemic in 2019. The latest COVID-19 outbreak has altered how sports are typically played, requiring a type of at-home activity to allow participants to continue working out and practicing. This also has implications for how sporting events are "served," with customers at home possessing influence so over periods, places, and modes of transmission used for sport.[18] The Covid-19 has had a profound impact on daily living in many ways, including sport activities. [19] The globe will be affected by COVID-19, outbreak spread by droplets that could be lethal. To stop the spread of the disease, the WHO advised social isolation and prohibited direct human interaction. A quarantine has been imposed in many nations, and sporting activities, such as the 2020 Olympics, have indeed been impacted. Activity and sports practice, which are usually seen as fitness activities, also came up for discussion. The possibility of getting sick for the on athletes is not as well understood, even though big crowds of spectators are very well understood to be contagious dangers. In addition to observing athletes work out, numerous people chose to go on holiday hikes in the region to escape the holiday masses. [20] It might be one of the reasons why number of runners declined dramatically in 2021.

Recently it was noted that competing male marathoners had much more regular workout hours, athletic expertise, and running distance than female competitors.[21] The fact that fewer female than male complete the race might also account for the growing gender disparity in movement with age.[22]

Strength, weakness, limitations and implications for future research

The large number of runners from different regions who participated in Almaty Marathon over the course of 5 years are one of the strengths of the present research. This research has limitations because exercise, anthropometrics, physiology, diet, and motivation—all of which affect performance—were left out. Also, one limitation of this study is the fact that we considered regions, distance, finish time and sex, but unfortunately not age, because of missing values in excel sheet that we got from organizers for age groups. This study still requires further work considering age groups if further data will be accurate. Age may have a significant impact on both success and involvement. Another drawback is which only area was taken into account; as a result, competitors could become citizens of other countries involved. This research has limitations because we did not consider environmental effects. Furthermore, the variation in the route and the number of levels could affect how quickly participants run. It would be also interesting to compare trends in the participation and performance between "Almaty Marathon" and "Astana Marathon", since they also have big number of participants. This research demonstrates insightful information into the growth of performance and participation in Almaty Marathon since 2016-2021. The area of study still needs to be expanded and improved upon for this study. One of the directions for future work might be why there was big difference in number of participants after pandemic in 2021.

6. CONCLUSION

The next findings arise from an analysis of performance patterns and the growth of “Almaty Marathon” between 2016 and 2021. The number of participants of “Almaty Marathon” is growing dramatically taking into account with the exception of 2021, because of consequences after pandemic. Mostly average fastest runners originated from European region and “Other” which was included North and South America, Africa, and Australian region. Male runners showed significantly better results and outpaced female runners in terms of speed and finishing time. Primarily local runners were dominating in terms of participation in “Almaty Marathon” with 95.58% of total finishers across 5 years. Future studies should analyze performance and participation trends in Marathon of top 10 finishers for every distance, thus it would be better to analyze from which country runners finishing their marathon, but not from which region. 61.89% of all runners from 2016-2021 participated in 10 km distance, following 25.24% racers for 21 km distance, 8.24% for long distance run 42 km and only 4.63% of runners participate in 3 km distance.