

## Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)

Hamza Abdennouz<sup>1</sup>, Djamel Nasri<sup>2</sup>, Abdelkader Belaid Akil<sup>3</sup>,  
Kheireddine CHAICHI<sup>4</sup>.

<sup>1</sup> ISTAPS University of Djilali Bounaama -Khemis Miliana -  
h.abdennouz@univ-dbkm.dz

<sup>2</sup> ISTAPS University of Djilali Bounaama -Khemis Miliana-  
d.nasri@univ-dbkm.dz

<sup>3</sup> ISTAPS University of Djilali Bounaama -Khemis Miliana-/APSSSES  
laboratory, University of-Chlef- iep sakil@gmail.com

<sup>4</sup> ISTAPS University of Constantine2 chaichikh@yahoo.com

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**Abstract:** This research will be concentrated on the dynamics of performance development of 800 and 1500 meters races on all the Veterans categories having participated in the World Veteran Championships. We also collected the world record of each category. Our labour is a cross-sectional study approach according to age. The aim of study is to determine in an objective way, which are the periods of progressive reduction, or increased, or very marked reduction in the capacity to achieve sports performance according to age. The main conclusions of our study illustrate a decrease in sports performance. The declines not only increase with age, but there are greater at 60 than at 40 and at 80 than at 60.

**KEY WORDS:** PERFORMANCE; 800m & 1500m RACES; SENIORS; VETERANS.

**المخلص:** يرتكز بحثنا على ديناميكية تطور الأداء في اختصاصي 800 و 1500 متر لدى فئات كبار السن الذين شاركوا في بطولة العالم للكهول. وقد قمنا بإحصاء الرقم القياسي العالمي لكل فئة. فالبحث هو عبارة عن دراسة مقطعية حسب العمر، حيث قمنا بمراجعة الأرقام والنتائج التي ترتبط بشكل أساسي بمتغيرين مستقلين (الجنس والعمر). وتهدف الدراسة إلى تحديد فترات الانخفاض في القدرة على تحقيق الأداء وفقاً لمتغير السن. وقد أظهرت الاستنتاجات أن تطور النتائج يتميز بانخفاض في الأداء مع التقدم في العمر. كما أن تراجع أداء العينة ليس خطياً، بل يكون أكبر في سن 60 عن سن 40، وفي سن 80 عن سن 60.

**الكلمات المفتاحية:** الأداء الرياضي؛ سباقات 800م و 1500م؛ صنف الأكابر؛ صنف الكهول.

## **1-Introduction:**

The high-level sport presents specific conditions: particular environment, nature of specific problems, exceptional conditions... the primary objective is to get athletes to the podiums during sport major events (Olympic Games, World Championships, Continental Championships, etc.). These objectives are essentially qualitative and not quantitative, the benchmarks of an international and not a national nature. The performance progress is continuous, but above all, it becomes **denser**. The coach has competition, performance or more or less sophisticated tests to assess the worth of an athlete. As such, the classic performance of athlete is the best indicator of his abilities. As part of a search for performance optimization, we are witnessing an increase in the interest in analyzing performance in a competitive situation... In addition, sports performance is at the crossroads of a set of factors that are extremely complex to isolate.

The analysis of the evolution of the various world records in middle distance during the period from 1912 to 2021 went from 1'51"9 to 1'40"91, a gain of 11 seconds, or else 9.83 %, while the 1500m record improved from 3'55"8 to 3'26"00, a gain of about 29 seconds with a percentage of 12.64 %. For longer events such as the 5000m and 10000m which have progressed by 13.89% and 16.54 % respectively, it can be deduced that it is the long events that are progressing the most, in particular during the last decades.

The analysis of performance evolution of high-level sports population that we are going to begin will focus on the dynamics of the performance development of the 800m and 1500m, on all the "Veterans" categories having participated in the World Master Championships. We also collected the world record of each category of both genders. Our work is a cross-sectional study approach according to age. In this study, we examined observations affected mainly by two independent variables (or two sources of variation): the sex variable (Men / Women) and the age variable (by 5-year category).

Adulthood spans a period three to four times longer than childhood and youth, so we have divided into periods by 5 years. In athletics, you are veteran from the age of 35. The choice of this study is justified by the fact that **"physical retirement" does not exist in sport**. Advances in medicine, and the lengthening of life have enabled a growing number of women and men to maintain remarkable physical activity. Despite the alterations associated with aging, many

## **Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)**

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runners continue to compete successfully into old age. In addition, the extension of the lifespan has naturally led to an increase in the active period of individuals who are sporty or not, but we lack information on the decline in physical capacities because of aging. Until now, the opportunity has rarely arisen to study the effects of age on athletic performance in middle distance running. We have virtually no (or very little) sports results regarding the decline in physical ability with age. We can therefore only base ourselves on the evolution of the performance in competitions, which will allow us to have some indications on the evolution of the capacities involved in middle distance races.

The aim of this study is to determine in an objective and quantifiable way, **which are the periods of progressive reduction, or increased, or very marked reduction in the capacity to achieve sports performance according to age.** A study of distance runners reported by David L. COSTILL (COSTILL, 1984) on data collected from three runners over a large number of years of competition showed a rapid decline in performance after age of 30 to 32 years old. Another Study reported by Paolo Gava and collaborators (GAVA, KERN, & CARRARO, 2015) on 'Age-associated power decline from running, jumping and throwing male masters world records' concluded that Human power in Masters athletes and their Skeletal muscle power starts declining after the age of 30. Moreover, a study reported by (Wright & Perricelli, 2007) on 'Age related of decline in performance among elite senior athletes, showed that Senior athletes' performance declined (male and female) approximately 3.4% per year over 35 years -slowly from age 50 to 70 years and dramatically after age 75 years-. Therefore, we want to test the hypothesis that the trainability of qualities and then the achievement of performance peaks at the age of adult competitions, that is, between 20 and 30 years old. Afterward 30 years, there follows a period of gradual reduction in performance capacity.

### **2- General objective of the study:**

The choice of study subject is justified by the fact that "**physical retirement**" **does not exist in sport.** Advances in medicine, and the lengthening of life have enabled a growing number of women and men to maintain remarkable physical activity. Despite the alterations associated with aging, many runners continue to compete successfully into old age. In addition, H. BENZIDANE and his collaborators (2019, (بن زيدان، مقрани، و أحسن، affirmed -from their study published in

## **Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)**

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The Excellence Journal in Sciences Techniques of Physical Activities and Sports -, that there are largely positive trends towards leisure time among the elderly (in Algeria). Then, sport is at the same time a real moment for leisure and self-affirmation, where people can spend an excellent time. So, this research aims to describe the dynamics of performance evolution according to age in 800m and 1500m races, therefore, veterans will have more motivation to continue the practice sport (Athletics), keep healthy bodies and flow-state, and have more medals and considerations by knowing the characteristics of sport performance in their several age categories (of veterans)...

### **3- Procedural definition of the concepts mentioned in the research:**

**3-1 Sport performance:** Issam Abdel-Khaliq (1983 ، الطالب ن.) defined sports performance as the delivery of something to the addressee. It is a reflection of the capabilities and motives of each individual for the best possible behavior because of mutual influences of internal forces; and it is often performed individually. In addition, it is an activity or behavior that leads to a result, as well as it is the measure by which learning outcomes are measured, and it is the means by which the learning process is behaviorally expressed.

Sports performance has levels including:

- **Maximum athletic performance:** It means that the individual performs the best possible sporting performance as possible.
- **Distinguished athletic performance:** It refers what the individual actually performs, the manner of his athletic performance, and not the maximum he can perform.

**3-2 The 800m and 1500m races:** Middle-distance running events are track races longer than sprints, up to 3000 meters. The standard middle distances are the 800 meters, 1500 meters and Mile run, although the 3000 meters may also be classified as a middle-distance event (Britannica, 2020)". In addition, middle distance races are so named because they are contested over intermediate distances between the sprint and the long-distance (from 800m to 3000m). The middle distance races are as follows: 800m, 1 000m, 1 500m, Mile (1,609m), 2 000m and 3,000m. Only the 800m and the 1 500m are on the program for the Olympic Games and World Athletics Championships, the 3 000m having disappeared from the women's events at the time of the 1996 Atlanta Games and it was replaced by the 5 000m race. It should be noted that it is possible to distinguish between the **Short**

## Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)

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**Middle distance races** (Demi-fond court), which includes the distances between 800 and 1500 meters, and the **Long Middle distance races** (Demi-fond long), which includes other races of up to 3 000 meters or up to 5 000 meters, as some think." (BILLOUIN, 1980).

**800 meters:** The 800m consists of two laps around a standard 400m track, and has always been an Olympic event. It was included in the first women's track program in 1928, but suspended until 1960 because of shock and the exhaustion it caused the competitors. Without the benefits of modern training, men of the era were, in contrast expected to run themselves to complete exhaustion during competitions (Wikipedia, 2020). The athletes in the 800m run the first curve in separate lanes and break after around 100m to avoid crowding. It is an advantage for an athlete to be drawn in one of the outer lanes as they can choose which position they want to take in the track. The 800m is one of the most tactical races, where speed and ability to handle lactic acid are the most important strengths. **David Rudisha** (from Kenya) is the current record holder: 1'40"91 /London, 9 August 2012. **Jarmila Kratochvílová** (Czechoslovakia) set the current women's record: 1'53"28 /Munich, 26 July 1983 (World Athletics, 2021). In addition, Kratochvílová's record represents the oldest world record in Athletics.

**1500 meters:** Also known as the metric mile or the queen of races, this is a premier middle-distance race, covering three laps and three-quarter laps around a standard Olympic-sized track. In recent years, races over this distance have become more of a prolonged sprint, with each lap averaging 55 seconds for the world record performance by **Hicham El Guerrouj** of Morocco: 3'26"00 on 14 July 1998 at Rome (two 1'50" 800m performances back to back). Thus, speed is necessary, and it seems that the more aerobic conditioning, the better. **Genzebe Dibaba** from Ethiopia holds the women's world record 3'50"07 set in Monaco on 17 July 2015 (World Athletics, 2021). In the 1500m, tenacity and a well-developed sense of strategy are important assets besides speed and endurance. This is a difficult distance at which to compete mentally, in addition to being one of the tactical middle-distance track events. The distance is often witness to some of the most tactical physical races in the sport, as many championship races are won in the final few meters (Wikipedia, 2020).

**3-3 Seniors:** A senior is a person belonging to the seniors' category. Depending on the angle adopted, several definitions of the concept

## **Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)**

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may however coexist and correspond to different ages. In Athletics, the athlete becomes senior, when his age is above the juniors' category (which corresponds to the under 20 years' category) and below the veterans' category (which corresponds to the over 35 years' category). However, one can find high-performance athletes who continue to participate with the seniors even if their ages exceed 35 years, one can also distinguish athletes younger than their age does not reach the age of the seniors' category (very gifted / upgraded) participate with the category of seniors, but this does not happen often.

**3-4 Veterans:** In Athletics, the athlete becomes veteran, when his age above the seniors' category, that means over 35 years old.

Veterans have several categories which are classified by 5 year categories, the first category of Veterans (or Masters) from 35 to 39 years (C35), the second one is (C40) from 40 to 44 years, and so on, until reaching the (C85 and over), and this is for both genders.

## **4- The methodological procedures used in the study:**

### **4-1 Method and tools:**

**-Method:** We have used the **descriptive approach** in this study as it suited the research theme; therefore, we collected the data and applied the statistics that are suitable (mainly descriptive statistics).

**-Population:** The population of our study is composed from veteran athletes (male and female) specialists in middle distance races (800m and 1500m).

**-Sample:** The sample of our research consists of the dataset that represents the performances reached by international level middle distance runners who have competed in Veteran World Championships.

The analysis of performance evolution of a high-level sports athletes that we are going to begin, will focus on the dynamics of the performance evolution of the 800m and 1500m, on all the "Veterans" categories having participated in the World Masters Championships. We also collected the world record of each category of both genders. Hence, our work is a cross-sectional study approach according to age.

**-Data processing:** The first step in processing the statistics collected will be the classification of the information that will allow us to obtain a structured body of data. The statistical analysis of the data begins with determining the values that best describe the results obtained. To describe these data, we will have to resort to the usual **descriptive**

## Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)

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**statistics** for each variable; where it will be a question of highlighting the essential statistical elements that characterize a group. The 2 most important characteristics of the distribution of a statistical variable are its central tendency (**mean**) and its dispersion (**standard deviation**). To compare performance carried out in this study we will have to resort to "**statistical tests**" which will establish the probability of obtaining by chance a difference between the results. It will be a question of whether these groups are facing the results achieved, at the same level or at a different level. It will then be necessary to compare the groups two by two. In addition, it is then possible to use the **Student "t" test**. When comparing one group of observations to another, if it is found that the difference between the average results is too great to be explained only by fortuitous variations, we will be led to seek an explanation.

The variance is a measure of the variability of the distribution and tells us if the subjects are grouped around the mean, or on the contrary very dispersed. So when the calculation of the variances showed that they are equal, that is to say that their differences are not significant, we applied for the comparison of the groups the "t" test of equality of 2 observations of equal variances. When the variances are unequal (the difference is significant), we applied the "t" test of equality of 2 observations of unequal variances.

### -Tools:

Personal Computer (acer).

Statistical processing software.

## 4-2 Presentation and Analysis of Results:

In this part of study, we will proceed to present the results obtained in well-defined tables, we will begin with the representations of the world records of each age category on the two disciplines (800m & 1500m) for the two genders (Men & Women). Then, we move to show the dynamics of performance evolution from senior to veteran categories, and we finish by discussion and interpretation of the research results.

## Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)

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### 4-2-1 Presentation:

Table n°01: Evolution of world records according to the various veteran categories /800m Men.

| <b>800m</b> | Records<br>(by<br>seconds) | Difference<br>from the<br>previous<br>category | Loss in %<br>compared to the<br>previous<br>category | Loss in %<br>compared to<br>category M 35 |
|-------------|----------------------------|------------------------------------------------|------------------------------------------------------|-------------------------------------------|
| M 35        | 103.36                     |                                                |                                                      |                                           |
| M 40        | 108.05                     | 4.69                                           | 4.54                                                 | 4.54                                      |
| M 45        | 109.86                     | 1.81                                           | 1.68                                                 | 6.29                                      |
| M 50        | 118.65                     | 8.79                                           | 8.00                                                 | 14.79                                     |
| M 55        | 122.92                     | 4.27                                           | 3.60                                                 | 18.92                                     |
| M 60        | 128.56                     | 5.64                                           | 5.59                                                 | 26.38                                     |
| M 65        | 134.33                     | 5.77                                           | 4.49                                                 | 29.96                                     |
| M 70        | 140.52                     | 6.19                                           | 4.61                                                 | 35.95                                     |
| M 75        | 150.59                     | 10.07                                          | 7.17                                                 | 45.69                                     |
| M 80        | 168.95                     | 18.36                                          | 12.19                                                | 63.46                                     |
| M 85        | 186.69                     | 17,74                                          | 10.50                                                | 80.62                                     |

Table n°02: Evolution of world records according to the various veteran categories / 800m Women

| <b>800m</b> | Records<br>(by<br>seconds) | Difference<br>from the<br>previous<br>category | Loss in %<br>compared to the<br>previous<br>category | Loss in %<br>compared to<br>category W 35 |
|-------------|----------------------------|------------------------------------------------|------------------------------------------------------|-------------------------------------------|
| W 35        | 116.53                     |                                                |                                                      |                                           |
| W 40        | 119.25                     | 2.72                                           | 2.33                                                 | 2.33                                      |
| W 45        | 122.82                     | 3.57                                           | 2.99                                                 | 3.40                                      |
| W 50        | 132.50                     | 9.68                                           | 10.77                                                | 13.70                                     |
| W 55        | 139.63                     | 7.13                                           | 4.72                                                 | 19.82                                     |
| W 60        | 153.09                     | 13.46                                          | 10.16                                                | 31.37                                     |
| W 65        | 159.61                     | 6.55                                           | 3.10                                                 | 36.97                                     |
| W 70        | 170.66                     | 11.05                                          | 10.96                                                | 46.45                                     |
| W 75        | 187.35                     | 16.69                                          | 17.72                                                | 60.77                                     |
| W 80        | 210.41                     | 23.06                                          | 6.45                                                 | 80.56                                     |
| W 85        | 255.99                     | 45.58                                          | 33.59                                                | 119.68                                    |

## Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)

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Table n°03: Evolution of world records according to the various  
veteran categories / 1500m Men

| <b>1500m</b> | Records<br>(by<br>seconds) | Difference<br>from the<br>previous<br>category | Loss in %<br>compared to the<br>previous<br>category | Loss in %<br>compared to<br>category M 35 |
|--------------|----------------------------|------------------------------------------------|------------------------------------------------------|-------------------------------------------|
| M 35         | 212.51                     |                                                |                                                      |                                           |
| M 40         | 221.87                     | 9.36                                           | 4.40                                                 | 4.40                                      |
| M 45         | 228.72                     | 6.85                                           | 3.09                                                 | 7.63                                      |
| M 50         | 238.26                     | 9.54                                           | 4.17                                                 | 12.12                                     |
| M 55         | 252.35                     | 14.09                                          | 5.91                                                 | 18.75                                     |
| M 60         | 264.00                     | 11.65                                          | 4.62                                                 | 24.23                                     |
| M 65         | 279.87                     | 15.87                                          | 6.01                                                 | 31.70                                     |
| M 70         | 292.95                     | 13.08                                          | 4.67                                                 | 37.85                                     |
| M 75         | 311.27                     | 18.32                                          | 6.25                                                 | 46.47                                     |
| M 80         | 347.35                     | 36.08                                          | 11.59                                                | 63.45                                     |
| M 85         | 387.3                      | 39.95                                          | 11.50                                                | 82.25                                     |

Table n°04: Evolution of world records according to the various  
veteran categories / 1500m Women.

| <b>1500m</b> | Records<br>(by<br>seconds) | Difference<br>from the<br>previous<br>category | Loss in %<br>compared to the<br>previous<br>category | Loss in %<br>compared to<br>category W 35 |
|--------------|----------------------------|------------------------------------------------|------------------------------------------------------|-------------------------------------------|
| W 35         | 237.73                     |                                                |                                                      |                                           |
| W 40         | 239.78                     | 2.05                                           | 0.86                                                 | 0.86                                      |
| W 45         | 245.44                     | 5.66                                           | 2.36                                                 | 3.24                                      |
| W 50         | 275.40                     | 29.96                                          | 12.21                                                | 15.85                                     |
| W 55         | 281.46                     | 6.06                                           | 2.20                                                 | 18.39                                     |
| W 60         | 306.65                     | 25.19                                          | 8.95                                                 | 28.99                                     |
| W 65         | 325.65                     | 19.00                                          | 9.20                                                 | 36.98                                     |
| W 70         | 346.9                      | 21.25                                          | 6.53                                                 | 45.92                                     |
| W 75         | 394.22                     | 52.68                                          | 15.19                                                | 65.83                                     |
| W 80         | 412.77                     | 18.55                                          | 4.70                                                 | 73.63                                     |
| W 85         | 530.42                     | 117.65                                         | 28.50                                                | 123.12                                    |

**Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)**

Figure n° 01: Evolution of 800m Veterans World Records (Men & Women).

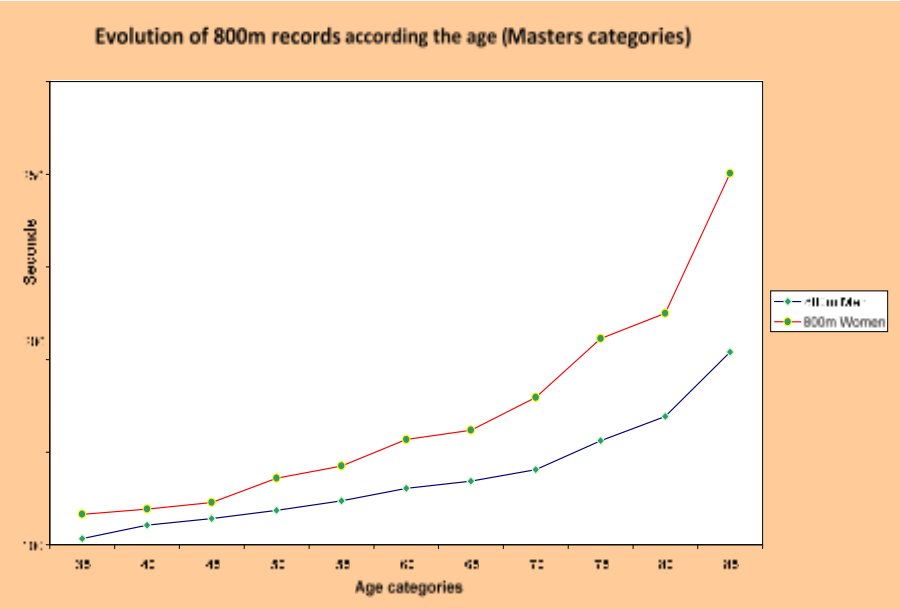
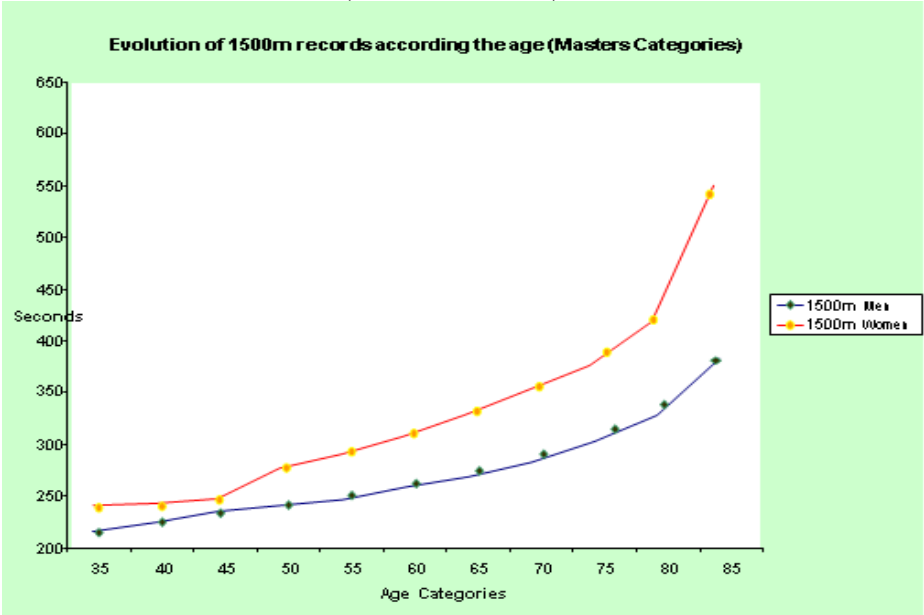


Figure n° 02: Evolution of 1500m Veterans World Records (Men & Women).



## Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)

Table n° 05: Decrease in performance compared to the previous age category and to the senior and [35 – 40[ years old categories (800m Men).

| 800m<br>Men |     |        |       | Decreased performance compared to the previous age category |       |       |         |                 | and compared to the senior and [35–40[ years old categories |
|-------------|-----|--------|-------|-------------------------------------------------------------|-------|-------|---------|-----------------|-------------------------------------------------------------|
|             | n   | X      | SD    | Absolute difference                                         | in %  | T     | in %    | in %            |                                                             |
| Seniors     | 724 | 107.88 | 3.41  |                                                             |       |       | Seniors | [35 – 40[ years |                                                             |
| 35          | 102 | 122.63 | 4.98  | 14.75                                                       | 13.67 | S**** | 13.67   |                 |                                                             |
| 40          | 272 | 123.47 | 8.39  | 0.84                                                        | 0.68  | NS    | 14.45   | 0.68            |                                                             |
| 45          | 269 | 128.82 | 8.44  | 5.35                                                        | 4.33  | S**** | 19.40   | 5.04            |                                                             |
| 50          | 279 | 131.46 | 7.81  | 2.65                                                        | 2.05  | S**** | 21.86   | 7.20            |                                                             |
| 55          | 242 | 138.22 | 10.36 | 6.76                                                        | 5.14  | S**** | 28.12   | 12.71           |                                                             |
| 60          | 256 | 145.56 | 9.90  | 7.34                                                        | 5.31  | S**** | 34.93   | 18.70           |                                                             |
| 65          | 183 | 156.99 | 17.22 | 11.43                                                       | 7.85  | S**** | 45.52   | 28.02           |                                                             |
| 70          | 182 | 168.32 | 21.89 | 11.32                                                       | 7.21  | S**** | 56.02   | 37.25           |                                                             |
| 75          | 137 | 184.24 | 23.55 | 15.92                                                       | 9.46  | S**** | 70.78   | 50.24           |                                                             |
| 80          | 70  | 203.48 | 21.21 | 19.24                                                       | 10.44 | S**** | 88.62   | 65.93           |                                                             |
| 85          | 75  | 242.82 | 35.90 | 39.34                                                       | 19.33 | S**** | 125.08  | 98.01           |                                                             |

**Nb:** n: Number of observations. / X: Arithmetic average or Mean. / %: percentage.  
SD: Standard Deviation. / T: Significance of T-Test: S\*: p=0.05 / S\*\*: p=0.01 / S\*\*\*\*: p=0.001: Significant  
NS: Not Significant

**Evolution of performance in 800m and 1500m according to age  
from senior to veteran categories (35-90 years old)**

Table n° 06: Decrease in performance compared to the previous age category and to the senior and [35 – 40[ years old categories (800m Women).

| 800m<br>Women |     |        |       | Decreased performance<br>compared to the previous<br>age category |       |       | and compared to<br>the senior and<br>[35–40[ years old<br>categories |                  |
|---------------|-----|--------|-------|-------------------------------------------------------------------|-------|-------|----------------------------------------------------------------------|------------------|
|               | n   | X      | SD    | Absolute<br>difference                                            | in %  | T     | in %                                                                 | in %             |
| Seniors       | 605 | 123.77 | 9.51  |                                                                   |       |       | Seniors                                                              | [35–40[<br>years |
|               |     |        |       |                                                                   |       |       |                                                                      |                  |
| 35            | 108 | 140.88 | 10.13 | 17.11                                                             | 13.82 | S**** | 13.82                                                                |                  |
| 40            | 191 | 140.96 | 14.13 | 0.08                                                              | 0.06  | NS    | 13.89                                                                | 0.06             |
| 45            | 158 | 148.48 | 11.05 | 7.52                                                              | 5.34  | S**** | 19.97                                                                | 5.40             |
| 50            | 167 | 155.36 | 14.36 | 6.88                                                              | 4.63  | S**** | 25.52                                                                | 10.28            |
| 55            | 148 | 163.95 | 14.60 | 8.59                                                              | 5.53  | S**** | 32.46                                                                | 16.38            |
| 60            | 155 | 173.84 | 13.42 | 9.90                                                              | 6.04  | S**** | 40.45                                                                | 23.40            |
| 65            | 129 | 189.21 | 20.57 | 15.37                                                             | 8.84  | S**** | 52.87                                                                | 34.31            |
| 70            | 113 | 205.09 | 26.41 | 15.88                                                             | 8.39  | S**** | 65.70                                                                | 45.58            |
| 75            | 58  | 249.44 | 49.38 | 44.34                                                             | 21.62 | S**** | 101.53                                                               | 77.06            |
| 80            | 31  | 269.38 | 27.59 | 19.94                                                             | 7.99  | S**** | 117.64                                                               | 91.21            |
| 85            | 18  | 328.93 | 38.39 | 59.55                                                             | 22.11 | S**** | 165.75                                                               | 133.48           |

**Nb:** n: Number of observations. / X: Arithmetic average or Mean. / %: percentage.  
**SD:** Standard Deviation. / **T:** Significance of T-Test: **S\***: p=0.05 / **S\*\***: p=0.01 /  
**S\*\*\***: p=0.001: Significant  
**NS:** Not Significant

## Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)

Table n° 07: Decrease in performance compared to the previous age category and to the senior and [35 – 40[ years old categories (1500m Men).

| 1500m<br>Men |     |        |       | Decreased performance compared to the previous age category |       |       |         |               | and compared to the senior and [35–40[ years old categories |
|--------------|-----|--------|-------|-------------------------------------------------------------|-------|-------|---------|---------------|-------------------------------------------------------------|
|              | n   | X      | SD    | Absolute difference                                         | in %  | T     | in %    | in %          |                                                             |
| Seniors      | 753 | 221.62 | 6.35  |                                                             |       |       | Seniors | [35–40[ years |                                                             |
| 35           | 45  | 262.19 | 12.94 | 40.58                                                       | 18.31 | s**** | 18.31   |               |                                                             |
| 40           | 163 | 259.70 | 23.46 | -2.49                                                       | -0.95 | NS    | 17.19   |               | -0.95                                                       |
| 45           | 173 | 267.39 | 21.12 | 7.69                                                        | 2.96  | s**   | 20.66   |               | 1.98                                                        |
| 50           | 184 | 278.21 | 26.15 | 10.81                                                       | 4.04  | s**** | 25.54   |               | 6.11                                                        |
| 55           | 166 | 293.22 | 32.38 | 15.01                                                       | 5.39  | s**** | 32.31   |               | 11.83                                                       |
| 60           | 158 | 302.60 | 24.13 | 9.39                                                        | 3.20  | s**   | 36.55   |               | 15.41                                                       |
| 65           | 148 | 329.02 | 34.86 | 26.42                                                       | 8.73  | s**** | 48,47   |               | 25.49                                                       |
| 70           | 90  | 360.63 | 57.94 | 31.61                                                       | 9.61  | s**** | 62.73   |               | 37.54                                                       |
| 75           | 43  | 382.60 | 69.98 | 21.97                                                       | 6.09  | NS    | 72.64   |               | 45.92                                                       |
| 80           | 39  | 411.21 | 42.68 | 28.61                                                       | 7.48  | s*    | 85.55   |               | 56.83                                                       |
| 85           | 24  | 496.20 | 85.36 | 84.99                                                       | 20.67 | s**** | 123.90  |               | 89.25                                                       |

**Nb:** n: Number of observations. / X: Arithmetic average or Mean. / %: percentage.  
**SD:** Standard Deviation. / **T:** Significance of T-Test: **S\***: p=0.05 / **S\*\*:** p=0.01 / **S\*\*\*\*:** p=0.001: Significant  
**NS:** Not Significant

## Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)

Table n° 08: Decrease in performance compared to the previous age category and to the senior and [35 – 40[ years old categories (1500m Women).

| 1500m<br>Women |     |        |       | Decreased performance compared to the previous age category and compared to the senior and [35–40[ years old categories |       |       |         |               |
|----------------|-----|--------|-------|-------------------------------------------------------------------------------------------------------------------------|-------|-------|---------|---------------|
|                | n   | X      | SD    | Absolute difference                                                                                                     | in %  | T     | in %    | in %          |
| Seniors        | 531 | 252.19 | 11.38 |                                                                                                                         |       |       | Seniors | [35–40[ years |
| 35             | 87  | 293.03 | 17.97 | 40.84                                                                                                                   | 16.19 | S**** | 16.19   |               |
| 40             | 92  | 295.21 | 24.83 | 2.18                                                                                                                    | 0.75  | NS    | 17.06   | 0.75          |
| 45             | 100 | 313.87 | 33.07 | 18.66                                                                                                                   | 6.32  | S**** | 24.45   | 7.12          |
| 50             | 105 | 326.40 | 32.79 | 12.54                                                                                                                   | 3.99  | S**   | 29.42   | 11.39         |
| 55             | 86  | 349.26 | 42,64 | 22.86                                                                                                                   | 7.00  | S**** | 38.49   | 19.20         |
| 60             | 86  | 366.26 | 30.16 | 16.99                                                                                                                   | 4.87  | S**   | 45.23   | 25.00         |
| 65             | 68  | 375.05 | 35.65 | 8.79                                                                                                                    | 2.40  | NS    | 48.71   | 27.99         |
| 70             | 61  | 423.87 | 38.87 | 48.82                                                                                                                   | 13.02 | S**** | 68.07   | 44.66         |
| 75             | 34  | 461.71 | 72.67 | 37.85                                                                                                                   | 8.93  | S**   | 83.08   | 57.57         |
| 80             | 15  | 532.16 | 83.09 | 70.45                                                                                                                   | 15.26 | S**   | 111.01  | 81.61         |
| 85             | 7   | 636.82 | 36.98 | 131.66                                                                                                                  | 24.74 | S**** | 163.22  | 126.54        |

**Nb:** n: Number of observations. / X: Arithmetic average or Mean. / %: percentage.  
SD: Standard Deviation. / T: Significance of T-Test: S\*: p=0.05 / S\*\*: p=0.01 / S\*\*\*: p=0.001: Significant  
NS: Not Significant

**Nb:** All veterans' world records and performances were retrieved from World Masters Athletics (World Masters Athletics, 2021).

## **Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)**

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### **4-2-2 Dynamics of performance evolution from senior to veteran categories:**

The evolution of the mean, standard deviation and mean gain according to age categories allows us to understand the dynamics of performance development in the 800m and 1500m races.

#### **4-2-2-1 The 800m races:**

The average performances observed in this test increase (in time) in both men and women from category C45 years to category C85 years as shown by the average gains which are very significant ( $p = 0.001$ ). There is an important inter-individual difference expressed by the standard deviations (greater in women) and which increases even more from the age of 65 in both sexes. This inter-individual dispersion means that the possibilities of the subjects in the 800m race are very different as the age increases. Moreover, this observation is undoubtedly valid for all the disciplines practiced by veterans. In the C85 category, the time achieved in 800m for men increased by 125.08% compared to the results recorded for seniors, while for women it increased by 165.75%. When an athlete moves up to the veterans' category and reaches the C85 category, his 800m result is on average 98.01% (for men) and 133.48% (for women) higher in terms of seconds than his performance in the C35 category.

#### **4-2-2-2 The 1500m races:**

Like the 800m, the average values of the 1500m performances increase from 35 to 85 years with a significant dispersion in each age group and which increases significantly, as one passes from an age category to another. From C45 to C70 years for men and from C35 to C60 years for women, there is a phase of increase in average results in which the average earnings are very significant, followed by a phase (C75 years men and C65 years women) not significant, then a resumption of a very significant performance increase, with even greater average gains. The increase in average score over performance observed at C35 to C85 of 89.25% (for men) and 126.54% (for women). In the C85 years old category, performances increase on average in seconds by 123.90% (for men) and by 163.22% (for women) compared to the results achieved in seniors.

### **4-3 Discussion and interpretation of the results:**

The performance review shows the reduction in the level of performance which occurs almost linearly from age 35 to 60, with a more marked drop from age 65. We can observe for the 800m as for the 1500m, regardless of gender, that the passage from one age

## **Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)**

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category to the next leads to only one type of variations, which are predictable variations so that each category tends to be observed a better performance result than in the next age category. Obviously many biological causes can explain the deterioration in performance with age. One explanation for this decline in performance (especially after the age of 30-32) is the gradual decrease in the ability to consume oxygen during intense exercise (COSTILL, 1984). With age, the capacities of our tendons and our muscles decrease (strength, stiffness...). These losses are almost as marked in runners as in sedentary people; similarly Paolo Gava and his collaborators (GAVA, KERN, & CARRARO, 2015) affirm that skeletal muscle power starts declining over age 30. Therefore, we can notice that the average age of world record holders of 800m and 1500m is around 24 years old. Consequently, we find that David RUDISHA (800m / Men) was 23 years and 233 days old, Hicham EL-GUERROUJ (1500m / Men) was 23 years and 303 days old and Genzebe DIBABA was 24 years and 158 days old (1500m / Women) when they got their world records. Only, the athlete Jarmila KRATOCHVÍLOVÁ (from Czechoslovakia) who was 32 years and 162 days old when she broke the Women's 800m world record.

Our research results confirm the conclusions of Vonda J WRIGHT and Brett C PERRICELLI (Wright & Perricelli, 2007), who find that senior athletes' performance declined (for male and female) approximately 3.4% per year after the age of 35 -slowly from age 50 to 65 - 70 years and dramatically after age of 70 years. Our findings are also similar to outcomes of A B BAKER and his collaborators (Baker, Tang, & Turner, 2003) who find that in general, men's performance declined to 75% of peak performance in sprint events by the early 70 years old age, in the longer track distances by late 60 years age. Women's performance declined to a similar extent by their mid-60s years old in track events.

With age, runners tend to change their stride; they promote a more economical stride with less suspension time. Researchers from the Institute of Biomechanics in Cologne (Germany) recently showed that these changes in running technique accompanied a reduction in the capacities of muscles and tendons. One of the main factors of regression is probably the decrease in production of hormones (testosterone) which decreases significantly with age. Therefore, the change in age categories caused a predictable variation in observed performance (in other words, this variation is said to be significant) and it is attributed to a systematic source of variation, which is the **age**

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## **Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)**

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**variable.** However, not all athletes in the same age group have the same results; these variations appear to be unpredictable here. These variations can be attributed to factors that we cannot identify in our labour, which will therefore be considered here as fortuitous. Age within the same category, sport-training methods, but also differences in nationality are among these sources of fortuitous variation, because we could not separate the respective effects of these different sources. In addition, we can underline the importance of a good hydration in the achievement of sports performances and in the recovery and the maintenance of a good state of physical form and health in the veteran athletes, especially that we tend not to thirsty with age (specially for older people). On this subject, Dr Ali HAKOUMI has shown in the conclusion of his study published on The Excellence Journal in Sciences Techniques of Physical Activities and Sports 'that GEBERT - cited by WEINECK – specifies that depending on the proportion of fats, 50 to 70% of the body's weight is made up of water. Maintaining this level of water ratio is very important insofar as, among other things, water fulfils the following vital functions: - it is an important constituent of blood serum - it is a constituent of macromolecules - it is involved in many of enzymatic reactions - it plays an important role in the capacity of maximum absorption of oxygen' (HAKOUMI, 2017).

In deduction, when moving from one age category to another, performances vary significantly in a predictable way under the effect of a systematic factor, '**age**'. They also vary in an unpredictable way under the effect of a set of factors which, unrelated to age, can differentiate certain athletes of an age category (40 years for example) from certain athletes of a different age category (45 years). These latter factors stand alone when moving from one athlete to another in the same category.

### **Conclusion:**

Here we are at the end of our research or we will have to conclude; what lessons can be drawn from this methodological approach on the evolution of sports performance according age?

In order to know the dynamics of the development of the performances achieved in the 800m and the 1500m during the veterans' world championships (35 to 90 years old), the results of all the competitors were collected. By insisting on the statistical characteristics of data processing, we wanted to show by this that a research is not just a simple collection of data, followed by a reading

## Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)

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of the results leading to "obvious" conclusions, then to take recorded results at face value without performing a critical reading, without scrupulously observing the validity requirements of these data.

The evolution of performance in the 800m and 1500m for men and women (from the senior category to the veterans' categories) is characterised by a decrease in sports performance.

The decline in performance among veterans is not linear; it follows a progression squared. The declines not only increase with age, they are greater at 60 than at 40, and at 80 than at 60. In a general way, from 65 to 75 years old, the drop in performance is twice as large as from 35 to 45, which shows the importance of the **effect of age**. However, it should be pointed out that this is probably the result of the decrease in the **frequency of training with age** (older persons need more time for recovery to be able to restart the following training...) and **that both factors are involved in this accentuation of the decline in performance**.

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## Evolution of performance in 800m and 1500m according to age from senior to veteran categories (35-90 years old)

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