The excellence Journal in Sciences Techniques Of Physical Activity And Sports
Volume: -08 N°02 -2023 P: 26 - 45
ISSN: 2507-7201 EISSN: 2602-6899 NDL: 787-2016
ASJP: https://www.asjp.cerist.dz/en/PresentationRevue/208

# Effects of fitness training on the immunological profile of sedentary women aged 25-40 years

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***Received***: 30/06 */2023* ***Accepted***: 29/09 */2023* ***Published***: 31/12 */2023*

**Abstract:** our study aims to evaluate the effect of fitness training on the immunological profile of women aged 25-40.to do this, we used the experimental methodology through the implementation of a pre-test and a post-test of blood collected in edta tubes, immediately centrifuged (3000 revolutions / min) to measure the cell blood count (cbc); in 14 sedentary women whose characteristics are as follows: age: 29.928±4.028 years, height:1.634±0.039cm,weight:72.125±10.420kg,bmi: 26.533± 4.093 kg/m². this group was subjected to fitness training, scheduled 2-3 times / week, at a rate of 60'-90' per session, which is spread over a period of 12 weeks. it should be noted that consent was signed by the participants in this experiment.analysis of the results obtained showed: no statistically significant difference for all leukocyte types.

**KEYWORDS:** Fitness Training; Immunological Profile; Sedentary Women.

**الملخص:** تهدف هذه الدراسة إلى تحديد تأثير التدريب الهوائي على الجانب المناعي للنساء أعمارهن من 25−40سنة. من أجل ذلك استخدم الباحثان المنهج التجريبي على عينة مكونة من 14 إمرأة قليلة النشاط البدني: متوسط عمرهن 29,928±4,028م، متوسط وزنهن 72,125±10,420كلغ، متوسط طولهن 1.634±0,039م و متوسط مؤشر كتلتهن الجسمية 26,533±4,093كلغ/م$^2$ تدربن لمدة 12 أسبوعا بواقع 2−3حصة/أسبوع لمدة 60−90 دقيقة للحصة. تم قياس عدد الخلايا المناعية: الكريات الدموية البيضاء، اللمفاوية، الأحادية، المعتدلة، الحامضية و القاعدية قبل و بعد نهاية البرنامج و كانت النتائج جد دالة إحصائيا لجميع المتغيرات.

**الكلمات المفتاحية:** التدريب الهوائي؛ الجانب المناعي؛ النساء قيلات النشاط البدني.

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## 1-Introduction:

The chronic lack of physical activity (PA) leads to a progressive deterioration of physical condition (Bounab & Chadi, 2022, 971). The practice of physical activity is recognized for its health benefits. Its action on the cardiorespiratory system would be explained through its effect on muscle strength, body composition and fat mass distribution (Jakes et al, 2002). Indeed, weight gain is significantly associated with lung dysfunction (Chen, Horne & Dosman, 1993).

The objective is to organize a program of personalized physical activities is to fight against a sedentary lifestyle and inactivity, and to increase the level of daily physical activity, Maintain and improve physical condition (cardio-respiratory endurance, muscular strength, flexibility, balance), develop pleasure and give a taste for physical and sporting practice, create social relationships, improve the spatio-temporal sensation.

The chronic lack of physical activity leads to a progressive deterioration of physical condition. (Watts et al, 2005, 381). In intervention studies, the promotion of physical activity, apart from any action aimed at diet or a sedentary lifestyle, improves body weight and reduces the risk of overweight and obesity (Dwyer & al. 1983; Catenacci & Wyatt, 2007). The level of physical activity required could be moderate to intense activity for about 60 minutes per day (Fogelholm & Kukkonen-Harjula, 2000; Oppert, 2003; Jakicic & Otto, 2005).

The increase in sedentary activities in recent decades has a deleterious effect on energy balance, by reducing expenditure related to physical activity and increasing food caloric intake through an increase in snacking and the size of the portions consumed. .

Physical activity and sports seem to be a determining factor for the acquisition of an active lifestyle. In addition, physical activity measurement tools are complex. However, the beneficial effects of physical activity in healthy women have been demonstrated for the prevention of osteoporosis, atherosclerosis, dyslipoproteinemia and for the improvement of cardiovascular and respiratory capacity during exercise. (Thibault, 2008)

Physical activity has benefits; In the short term, the practice of physical activity improves health, reduces stress, strengthens the heart and lungs, increases energy levels, helps to achieve and maintain a healthy weight, promotes a positive philosophy of life and provides a general feeling of well-being. In the long term, better physical condition reduces the risk of having health problems. And while physical activity carries some risks, such as injury and overtraining, sedentary living carries many more. (Fahey & al, 2013, 28-29)

The practice of a physical activity is known as a non-drug therapy in order to boost the immune defenses and this is specified by the law known as: Sport-Health on prescription. The Covid-19 pandemic highlights this unequal role of our immune defense because for various reasons 80% of organisms protect themselves against the virus by allowing either not to make the disease or to develop a minor non-fatal form. of it. (Bacquaert, 2020)

On the other hand, the fitness market, and more generally indoor sports, is showing above-average growth. Under the term fitness are grouped a plurality of activities whether individual, such as cardio exercises, weight training, stretching, or collective, such as zumba, step, abs-glutes, body combat or other variations aimed at improving physical condition. Fitness activities allow you to lose weight, work your whole body, your endurance and your cardio, build muscle, relax and maintain yourself. It is ultimately about promoting the well-being of the participants and their overall fitness. (Madame.lefigaro, 2015)

The term fitness is Anglo-Saxon and means to be in shape or in good health. Needless to say, it is a sport that is good for you. Often associated with bodybuilding, fitness has nothing to do with it. No question of lifting heavy weights here. The objective is essentially to keep you in good physical shape by combining sports activities, healthy lifestyle and appropriate nutrition. It is a global lifestyle based on well-being. In the gym, practice is made very easy with attentive coaches who offer a program and group sessions adapted to the level. (Jean-Louis, SD)

The effects of inactivity promote health-damaging genes. Inactivity for any reason reduces heart health and increases the long-term risk of coronary heart disease and sudden cardiac death. The

positive impact of PA on preventing coronary heart disease and reducing sudden cardiac death (Godeau, 2021, 408; Morris & Crawford, 1958, 1490)

The choice of our study fell on sedentary women who wanted to pasticate a physical and sporting activity of the fitness type in order to fight against sedentary lifestyle, given that nowadays, it is a problem that presents itself more and more. within our society.

**Hypotheses :**

- ✓ There is a statistically significant difference in white blood cell count between pre- and post-test in sedentary women aged 25-40 after 12 weeks of fitness training.
- ✓ There is a statistically significant difference in the number of lymphocytes between pre and post-test in sedentary women aged 25-40 years after 12 weeks of fitness training.
- ✓ There is a statistically significant difference in the number of monocytes between pre and post-test in sedentary women aged 25-40 years after 12 weeks of fitness training.
- ✓ There is a statistically significant difference in the number of neutrophils between pre and post-test in sedentary women aged 25-40 years after 12 weeks of fitness training.
- ✓ There is a statistically significant difference in the number of eosinophils between pre and post-test in sedentary women aged 25-40 after 12 weeks of fitness training.
- ✓ There is a statistically significant difference in the number of basophils between the pre and post-test in sedentary women aged 25-40 years after 12 weeks of fitness training.

## 2- General objective of the study:

The objective of this research is to compare some immunological parameters of Constantine women practicing fitness aged between 25-40 years.

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

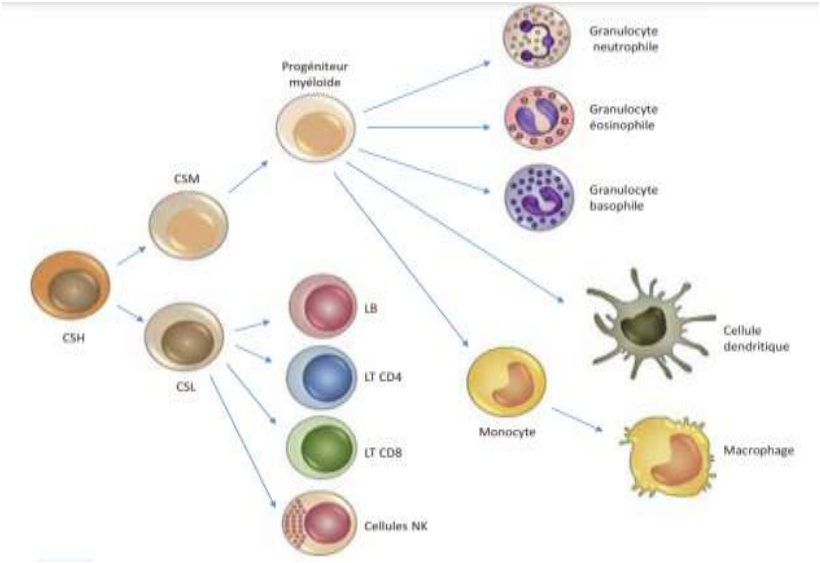
**- Fitness :**

Fitness (abbreviation of the English expression physical fitness, "physical form"), also called form gymnastics (French Language Enrichment Commission) or physical training (Great Terminology Dictionary), designates a set of physical activities allowing the practitioner to improve his physical condition and his lifestyle, with a view to well-being.

**- Immunity:**

Encompasses the defense mechanisms which contribute to the maintenance of the energy of the organism, are classically divided into two: non-specific constituted by the anatomical barriers and humoral and cellular defense systems which are quickly activated. (Guénard, 2001, 497). And specific which integrates two cell types; T and B lymphocytes.

**Fig. 1.** The different immune cells




**Source :** (Carcelain et al, 2018, 9)

**- Sedentary**

A sedentary lifestyle is one of the evils of the century: it corresponds to little or no physical activity with an energy expenditure

close to zero; measuring the time spent in front of a screen, whether it is an organizer or a television, is a very good indicator of sedentary lifestyle. (Le Figaro, SD).

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

This study took place between March 09 and May 31, 2022, the women trained fitness twice a week, 60-90 'per session, at the El-Hana Sidi Mabrouk gym in the wilaya of Constantine-Algeria.

### 4-1- Population:

14 women participated in this study, the criteria of which are:

### 4-1-1- Inclusion criteria:

Participants with the following characteristics:

- ✓ The age between 25-40 years old.
- ✓ Did not practice any physical activity before.
- ✓ Sedentary.

### 4-1-2- Exclusion criteria:

- ✓ Smokers.
- ✓ Subjects with pathologies anyone.
- ✓ Subject who did not train regularly.
- ✓ Subject responding 7/7 on the physical activity readiness questionnaire (PARQ).

### 4-1-3- General characteristics:

They are presented in the following table:

**Table N°1:** Characteristics of the sedentary group

| Parameters: | Age (an) | Height (m) | Weight (Kg) | BMI (Kg/m²) |
|---|---|---|---|---|
| M±SD | 29,928±4,028 | 1,634±0,039 | 72,125±10,420 | 26,533±4,093 |

**Source:** Values established by the authors

### 4-1-4- Ethical considerations:

The subjects were reassured that the data will be collected with respect for confidentiality and anonymity. This is a study that did not

lead to any particular risk. All subjects (14 women) signed informed consent about the purpose and protocol of the study.

## 4-2- Data collection method:

Data collection was carried out through biological examinations.

## 4-3- Material and experimental protocol:

As part of screening for a lipid abnormality, assays of white blood cells (WBC), lymphocytes (LY), monocytes (MO), neutrophils (NE), eosinophils (EO) and basophils (BA).

**Fig. 2.** MIN-BC-3000Plus hematology automat

**Source :** https://www.socimed.com

The blood sample collected in EDTA tubes, immediately centrifuged (3000 revolutions/min) to measure the: Complete Blood Count (CBC). Of which the reference intervals:

**Table N°2:** Reference values of immune cells in men aged 40-60

| Parameter | Reference interval |
|---|---|
| White Blood Cells (WBC) | 4-10x$10^3$/µL |
| Lymphocytes (LY) | 20-40 |

| | |
|---|---|
| Monocytes (MO) | 0-10% |
| Neutrophils (NE) | 40-70% |
| Eosinophils (EO) | 0-4% |
| Basophils (BA) | 0-2% |

**Source:** El Aziza; medical biology laboratory-Constantine, Algeria

## 5- Statistical analysis:

Data were analyzed using the statistical program SPSS (version 20.0). Quantitative parameters are presented as mean ± standard deviation, and analyzed by T-test or Wilcoxon test for difference between means.

## 6- Presentation and Analysis of Results:

We will first present the results, analyze them and finally discuss them.

## 6-1- Results:

We first confirm the normal distribution of our group in the four parameters studied so that we can choose the appropriate statistical test for the comparison of the means.

## 6-1-1- The distribution of parameters:

**Table N°3:** Normality tests of immunological parameters

| Test | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| WBC Pre_test | 0,187 | 14 | 0,199 | 0,897 | 14 | 0,103 | S |
| WBC Post_test | 0,283 | 14 | 0,003 | 0,824 | 14 | 0,010 | NS |
| LY Pre_test | 0,201 | 14 | 0,131 | 0,921 | 14 | 0,229 | S |
| LY Post_test | 0,137 | 14 | 0,200* | 0,924 | 14 | 0,251 | S |
| MO Pre_test | 0,148 | 14 | 0,200* | 0,935 | 14 | 0,354 | S |
| MO Post_test | 0,238 | 14 | 0,030 | 0,871 | 14 | 0,043 | NS |
| NE Pre_test | 0,129 | 14 | 0,200* | 0,951 | 14 | 0,570 | S |
| NE Post_test | 0,147 | 14 | 0,200* | 0,929 | 14 | 0,293 | S |
| EO Pre_test | 0,410 | 14 | 0,000 | 0,618 | 14 | 0,000 | NS |
| EO Post_test | 0,387 | 14 | 0,000 | 0,535 | 14 | 0,000 | NS |
| BA Pre_test | 0,286 | 14 | 0,003 | 0,810 | 14 | 0,007 | NS |
| BA Post_test | 0,290 | 14 | 0,002 | 0,705 | 14 | 0,000 | NS |

*. This is a lower bound of the true significance.

S : Résultat Significatif. NS : Résultat Non Significatif.

**Source:** Values established by the authors

Table 3 shows that the value of the test (Shapiro-Wilk) is significant (greater than 0.05) for the parameters: LY and NE, so the parametric test T test is used, and not significant for the parameters: GR, MO, EO and BA, so uses the Wilcoxon non-parametric test.

## 6-1-2- White Blood Cells (WBC) :

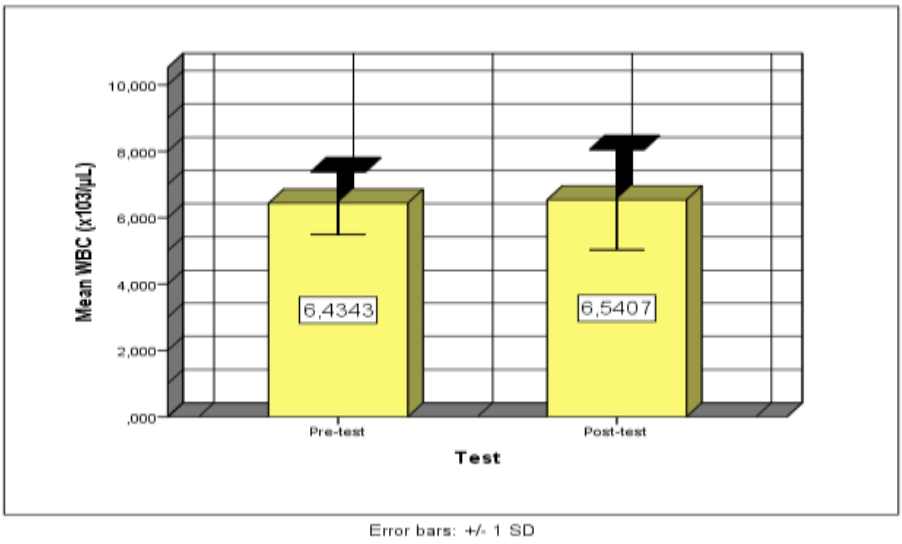
**Table N°4:** Difference in Means Between Pre and Post WBC Test

| Test | Pre | | Post | | Wilcoxon Test | df | Sig. |
|---|---|---|---|---|---|---|---|
| WBC ($x10^3/\mu L$) | 6,434 | 0,947 | 6,541 | 1,509 | -0,374 | 13 | 0,753 |

**Source:** Values established by the authors

The white blood cell count of our experimental group was 6.434±0.947.103/µL which became 6.541±1.509.103/µL after the fitness training period, the Wilcoxon test which was -1.045 shows no statistically significant difference as shown in figure 3.

**Fig. 3.** Comparison of white blood cells mean from Pre and Post Test




**Source:** Histogram established by the authors.

## 6-1-3- Lymphocytes (LY) :

**Table N°5:** Difference in means between pre and post lymphocyte test

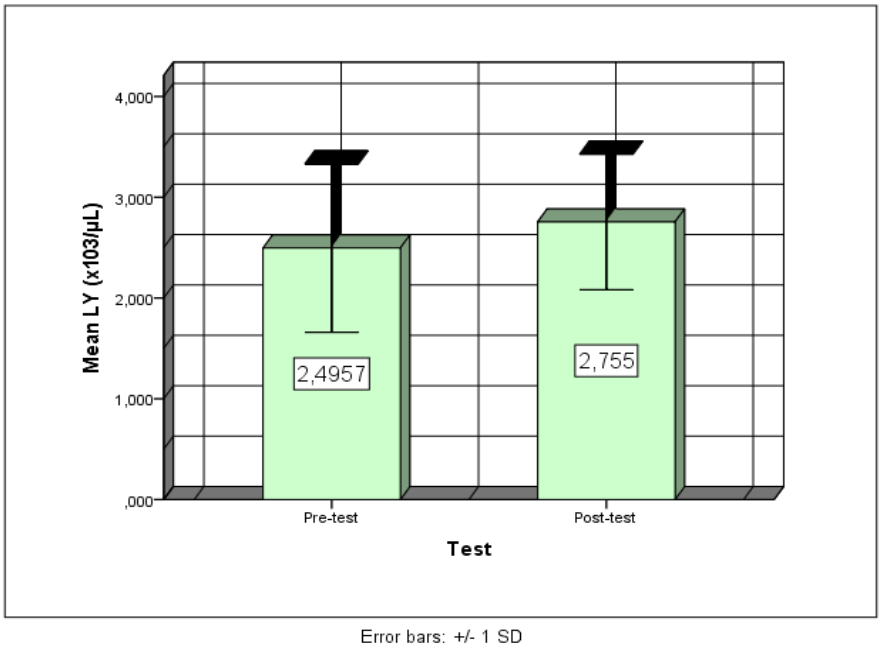
| Test | Pre | | Post | | T test | df | Sig. |
|---|---|---|---|---|---|---|---|
| Lymphocytes (x103/µL) | 2,496 | 0,836 | 2,755 | 0,673 | -1,496 | 13 | 0,158 |

Not significant result

**Source:** Values established by the authors

The number of lymphocytes in our experimental group was 2.496±0.836.103/µL which became 2.755±0.673.103/µL after the fitness training period, the T test which was -1.496, shows no statistically significant difference as shown in figure 4.

**Fig. 4.** Comparison of pre- and post-test lymphocyte mean




**Source:** Histogram established by the authors.

## 6-1-4- Monocytes (MO) :

**Table N°6:** Difference in means between pre and post monocyte test

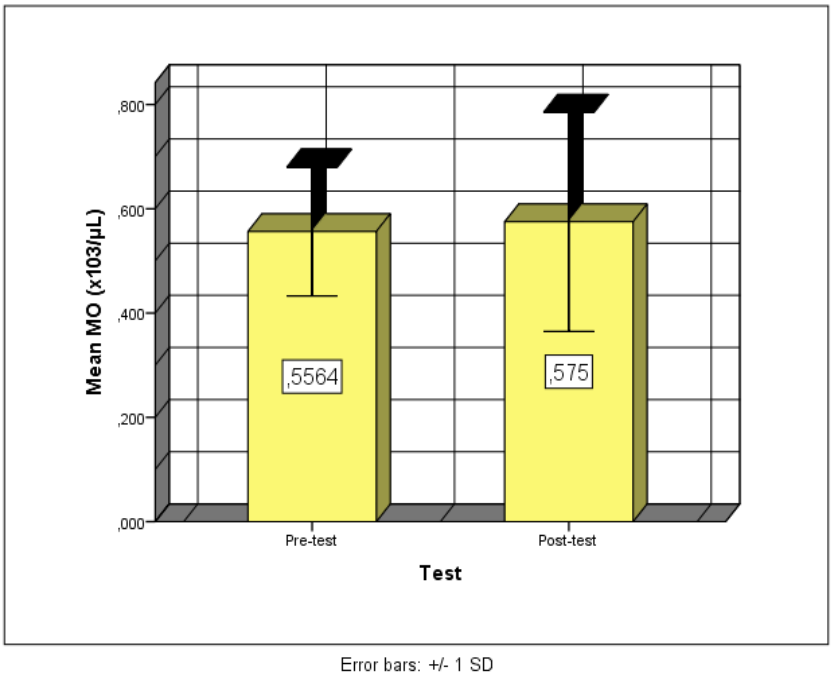
| Test | Pre | | Post | | Wilcoxon Test | df | Sig. |
|---|---|---|---|---|---|---|---|
| Monocytes (x103/µL) | 0,556 | 0,124 | 0,575 | 0,210 | -0,321 | 13 | 0,916 |

Not significant result

**Source:** Values established by the authors

The number of monocytes in our experimental group was 0.556±0.124.103/µL which became 0.575±0.210.103/µL after the fitness training period, the Wilcoxon test which was -0.321, shows no statistically significant difference as shown in figure 5.

**Fig. 5.** Comparison of pre- and post-test monocyte mean




**Source:** Histogram established by the authors.

## 6-1-5- Neutrophils (NE) :

**Table N°7:** Difference in means between pre and post neutrophils test

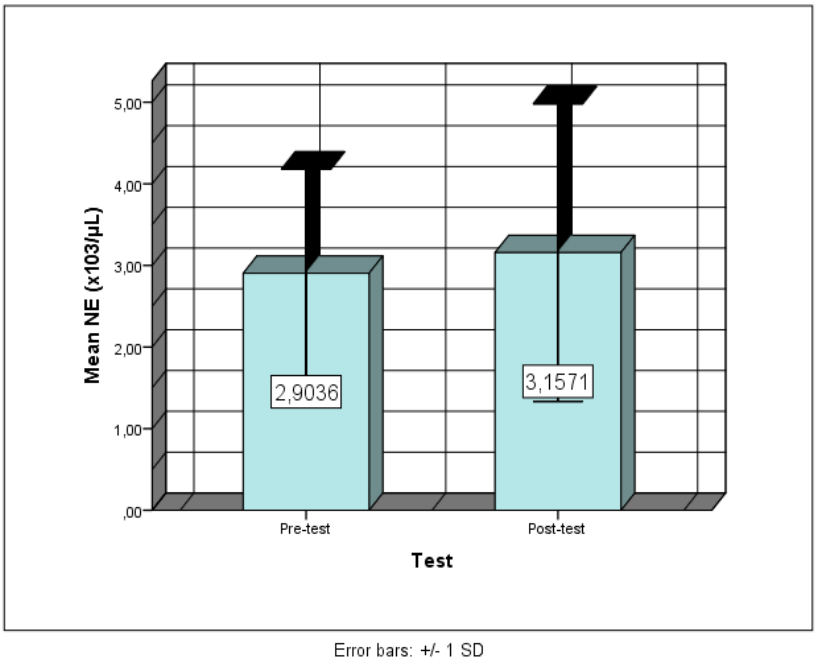
| Test | Pré | | Post | | T test | df | Sig. |
|---|---|---|---|---|---|---|---|
| Neutrophiles (x103/µL) | 2,904 | 1,277 | 3,157 | 1,823 | -0,427 | 13 | 0,677 |

Not significant result

**Source:** Values established by the authors

The number of neutrophils in our experimental group was 2.904±1.277.103/µL which became 3.157±1.823.103/µL after the fitness training period, the T test, which was -0.427, shows no statistically significant difference as shown in Figure 6.

**Fig. 6.** Comparison of pre- and post-test neutrophil mean




**Source:** Histogram established by the authors.

## 6-1-5- Eosinophils (EO) :

**Table N°8:** Difference in means between pre and post eosinophils test

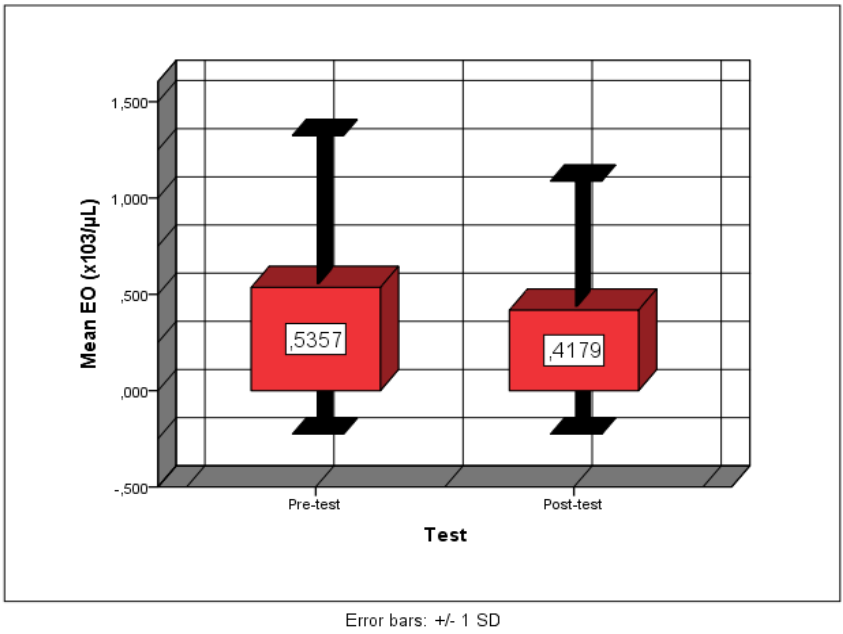
| Test | Pre | | Post | | Wilcoxon Test | df | Sig. |
|---|---|---|---|---|---|---|---|
| Eosinophiles (x103/µL) | 0,536 | 0,775 | 0,418 | 0,657 | 0,391 | 13 | 0,950 |

Not significant result

**Source:** Histogram established by the authors.

The number of eosinophils in our experimental group was 0.697±0.875.103/µL which became 0.181±0.108.103/µL after the fitness training period, the T test which was -1.777, shows no statistically significant difference as shown in figure 7.

**Fig. 7.** Comparison of pre- and post-test eosinophil mean




**Source:** Histogram established by the authors.

## 6-1-5- Basophils (BA) :

**Table N°9:** Difference in means between pre and post basophiles test

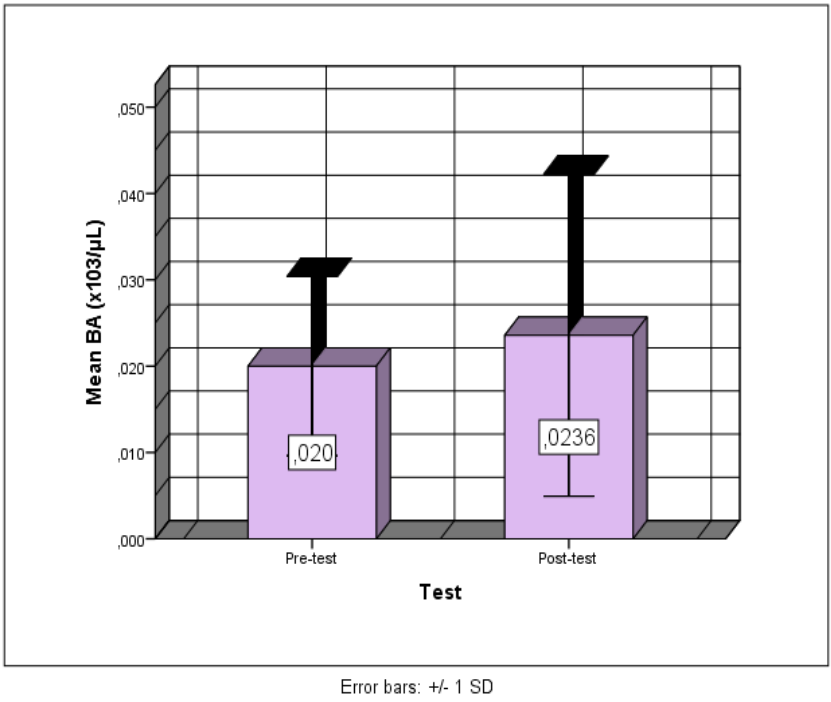
| Test | Pre | | Post | | Wilcoxon Test | df | Sig. |
|---|---|---|---|---|---|---|---|
| Neutrophiles (x103/µL) | 0,020 | 0,010 | 0,024 | 0,019 | -0,579 | 13 | 0,809 |

Not significant result

**Source:** Values established by the authors

The number of neutrophils in our experimental group was 0.019±0.010.103/µL which became 0.028±0.020.103/µL after the fitness training period, the T test which was -1.132, shows no statistically significant difference as shown in figure 8.

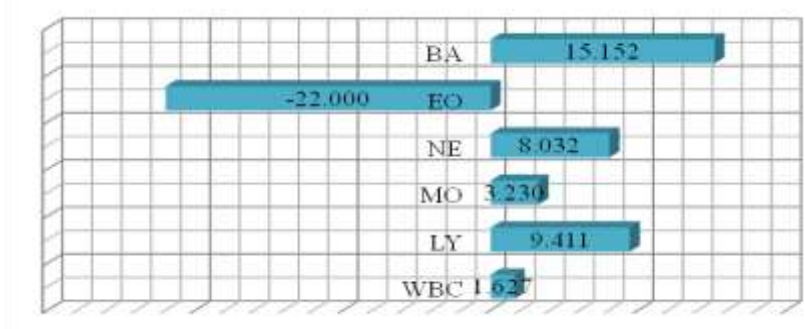
**Fig. 8.** Comparison of pre- and post-test basophil mean




**Source:** Histogram established by the authors.

Despite the non-significance of the evolution of all the studied immunological cells of our research group: they experienced a change of: 1.627%, 9.411%, 3.230%, 8.03%, -22.000%, 15.152% successively for white blood cells (GB), lymphocytes (LY), monocytes (MO), neutrophils (NE), eosinophils (EO) and basophils (BA), as shown in Figure 9.

**Fig. 9.** Evolution of immunological cells after the training period



**Source:** Histogram established by the authors.

## 6-2- Discussion and interpretation of the results:

From a methodological point of view, the choice of a reduced number of the sample does not contribute with precision to the evolution of the various parameters observed and their independence. In our study, this choice is justifiable because even with this reduced number, we encountered difficulties in getting them to continue well-structured training for 12 successive weeks, especially since our group was totally sedentary.

The fitness activities are of greater or lesser intensity to allow everyone to practice them. For a simple fitness, building up your abs or letting off steam at the end of the day, fitness helps you achieve your goals according to your needs and desires. Thus, those who like to let off steam to music on frenzied choreographies will opt for zumba or step, those who want to evacuate stress by toning up will prefer body combat and for deep but gentle body work, fitness sports. water sports are recommended. We think in particular of aquagym or aquacycling. (Madame.lefigaro, 2015).

Physical activity and sedentary lifestyle are two independent factors exerting an inverse effect on the risk of overweight (Schneider et al, 2007). The correlation between the level of sedentary activities (especially television, video games, computers) and obesity is now well established (Robinson, 1999; Carvalhal et al, 2007; Jouret et al, 2007; Lioret et al, 2007). The increase in sedentary activities in recent decades has a deleterious effect on energy balance, by reducing expenditure related to physical activity and increasing food caloric intake through an increase in snacking and the size of the portions consumed.

The sample of the present research experienced no significant improvement for all immunological parameters: white blood cells, lymphocytes, monocytes, neutrophils, eosinophils and basophils.

When obesity develops, fat cells or adipocytes trigger an inflammatory chain reaction that further disrupts metabolism and weakens the immune response. This inflammation in turn leads to a cascade of cellular responses that promote the comorbidities of obesity but also increase the risk of infections (including COVID-19).

This process reveals in particular how proteins of the immune system, type 1 interferons, trigger and mediate this vicious circle between obesity and immunity. (Chan, 2020, 11).

Immunometabolism is a central process for homeostasis in the body. This process is altered during the pathogenesis of obesity. This disease contributes to the installation of a chronic low-grade inflammation at the origin of comorbidities and characterized by the increase of inflammatory cells like pro-inflammatory T lymphocytes (LT) and a decrease in part of LT anti-inflammatories. (Le Garf, 2020, 1). Our results do not show any increase in immune cells following the obesity experienced by our sample.

Pro-inflammatory cytokines are secreted sequentially after intense exercise in sports subjects, because the immune system is altered and "stressed" in the hours following intense exercise. (Wallaert, 2022)

Many studies have brought to light the fact that following an intense and long effort, the immune system undergoes various modifications which make it less effective against attacks, up to 4 days after the end of the effort. (Veron, 2016, 128).

Exercise affects the immune system and its antiviral defenses (Campion, 2011, 256; Martin, 2009, 161). Experiments on animals administering influenza and herpes simplex virus 1 (HSV-1) into the respiratory tract have shown that moderate exercise, performed before training or after infection improves morbidity and infection mortality (Warren & al, 2015; Sim & al, 2009, 1437)

Conversely, preclinical studies have also shown that intense exercise leads to poorer results in response to viral respiratory infections (Davis & al, 1997, 1464; Murphy & al, 2008, 1153). Follow-up studies have elucidated some understanding of the mechanisms responsible for these observations (Lowder & al, 2005, 378)

Based on the foregoing discussions; physical activity has now been recommended as a therapy to fight against the mental and physical consequences of COVID-19 confinement (Benaki, 2021, 63)

An early epidemiological study suggested that intense and prolonged exercise was associated with an increase in upper respiratory tract infections. This work led to the concept of the inverted J theory, where moderate exercise reduces, and prolonged,

high intensity exercise increases susceptibility to infection (Nieman, 1994, 133).

## Conclusion :

The sedentary lifestyle nowadays is known by these direct and indirect consequences on health. Its prevalence at the international level continues to increase despite current therapeutic and educational proposals and the development of pathophysiological knowledge on the subject.

We carried out an experimental study with sedentary people aged 25-40 from Constantine, with the aim of determining the influence of the sports practice of fitness on their immunological aspect. Indeed, this sports practice does not cause any change in immune cells after twelve weeks.

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