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MEDICINE IN THE 21ST CENTURY

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PRESENTATION

The 21st century has brought profound transformations to the field of medicine. Scientific advances, technological innovation, and shifts in global health dynamics have collectively reshaped how we understand, teach, and practice healthcare. In this context of rapid and continuous change, this volume presents itself as a multidisciplinary platform for reflection, analysis, and the dissemination of knowledge.

The aim of this book is not to limit itself to specific topics, but rather to embrace the breadth and depth of contemporary medicine. From the evolution of medical education to the integration of digital technologies, from ethical debates to system-wide reforms, the articles gathered here seek to capture the complexity and diversity of the challenges and possibilities faced by modern healthcare.

This work is intended for a wide audience: students preparing for careers in health, educators seeking updated perspectives to enrich their teaching, and professionals who strive to remain aligned with the most recent trends and discussions in their fields. Through this collection, readers are invited to critically engage with the present and future of medicine, fostering a mindset of continuous learning and responsible innovation.

We hope that this volume serves not only as a source of knowledge, but also as a catalyst for dialogue, curiosity, and transformation in the ongoing journey toward a more effective, ethical, and human-centered medicine.

SUMMARY

CHAPTER 1

CONSERVATIVE TREATMENT OF UNCOMPLICATED ACUTE APPENDICITIS WITH ANTIBIOTICS: A GOOD ALTERNATIVE TO SURGERY?

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ABSTRACT: Uncomplicated acute appendicitis, traditionally treated with appendectomy, has conservative management with antibiotics as a viable alternative for selected patients. A literature review (PubMed, 2020-2025) analyzed three main studies: O'Leary et al. (2021) demonstrated success in 77% of cases treated with antibiotics alone, with a shorter recovery time; Brucchi et al. (2024) confirmed a lower complication rate (RR 0.77) in the non-surgical group, but with a recurrence rate of 27.4%; and Park et al. (2021) obtained 92.1% efficacy using strict radiological criteria (excluding appendicolith or perforation). The guidelines (ACS and EAES) recommend this approach for selected cases, highlighting the need for clinical follow-up due to the risk of recurrence (10.4% in 1 year). Although conservative treatment offers advantages such as lower morbidity and faster recovery, appendectomy remains the gold standard for complicated cases. Careful patient selection and access to surgical support are essential for the success of this strategy.

KEYWORDS: acute appendicitis, conservative treatment, antibiotic therapy, appendectomy, non-surgical management, patient selection.

RESUMO: A apendicite aguda não complicada, tradicionalmente tratada com apendicectomia, tem no manejo conservador com antibióticos uma alternativa viável para pacientes selecionados. Revisão de literatura (PubMed, 2020–2025) analisou três estudos principais: O'Leary et al. (2021) demonstrou sucesso em 77% dos casos tratados apenas com antibióticos, com menor tempo de recuperação; Brucchi et al. (2024) confirmaram menor taxa de complicações (RR 0,77) no grupo não cirúrgico, mas com recorrência de 27,4%; e Park et al. (2021) obtiveram 92,1% de eficácia usando critérios radiológicos rigorosos (excluindo apendicolito ou perfuração). As diretrizes (ACS e EAES) recomendam essa abordagem para casos selecionados, destacando a necessidade de acompanhamento clínico devido ao risco de recidiva (10,4% em 1 ano). Embora o tratamento conservador ofereça vantagens como menor morbidade e recuperação mais rápida, a apendicectomia permanece padrão-ouro para casos complicados. A seleção criteriosa de pacientes e o acesso a suporte cirúrgico são essenciais para o sucesso dessa estratégia.

PALAVRAS-CHAVE: apendicite aguda, tratamento conservador, antibioticoterapia, apendicectomia, manejo não cirúrgico, seleção de pacientes.

1. INTRODUCTION

Acute appendicitis is the most common abdominal surgical emergency in medical practice, with a high prevalence in emergency and emergency services. It is estimated that about 7% to 8% of the world population will develop appendicitis at some point in life, with a higher incidence in adolescents and young adults (BRASIL, 2019). Traditionally, surgical treatment by appendectomy has been considered the gold standard, with good clinical results and low complication rate when performed early.

With advances in imaging methods, such as ultrasonography and computed tomography, it has become possible to distinguish more accurately cases of complicated appendicitis—which involve perforation, abscess, or peritonitis—from those considered uncomplicated, in which there is no evidence of appendix rupture or extensive inflammation. This differentiation has driven the debate about the feasibility of a more conservative treatment in selected cases, using exclusively antibiotic therapy (CDC, 2021).

Non-operative treatment of uncomplicated acute appendicitis has been studied as a less invasive alternative, with the potential to reduce hospitalization time, hospital costs and risks associated with the surgical procedure. International guidelines, such as those of the American College of Surgeons, recognize that, in carefully selected patients, the use of antibiotics can be a safe and effective strategy, provided that there is rigorous clinical follow-up and facilitated access to surgery in case of therapeutic failure (ACS, 2020).

In this context, it is relevant to analyze the evidence available in the scientific literature and current clinical guidelines to understand the role of conservative antibiotic treatment in the management of uncomplicated acute appendicitis, as well as its indications, limitations and implications for medical practice.

2. GOAL

To analyze the conservative approach with antibiotics in the treatment of uncomplicated acute appendicitis, highlighting its efficacy, safety, indication criteria and support in current clinical guidelines, focusing on its applicability in medical practice.

3. METHODOLOGY

A literature review was carried out through a search in the PubMed database, from 2020 to 2025. Using the DeCS terms "Acute appendicitis", "Conservative treatment”and "Antibiotics", with the AND bobbing, adding filters for articles in English and with adults (over 18 years).

Twenty-six results were found and evaluated according to the inclusion criteria: evaluation of non-surgical treatment with antibiotics, population of adults with a confirmed diagnosis of uncomplicated acute appendicitis, randomized clinical trial, cohort, meta-analysis and studies with relevant clinical outcomes, such as treatment data, recurrence, complications and quality of life. We excluded studies such as narrative review, case reports, pediatric population, with surgical approach, unrelated to the topic and incomplete clinical data.

Through a guiding question on the conservative treatment of acute appendicitis uncomplicated with antibiotics and the inclusion and exclusion criteria, the articles were evaluated according to titles and abstracts. Thus, five articles were selected for full reading, and of these, three studies met the criteria. For the synthesis of data, a summary was elaborated with the most relevant information of each study selected to carry out the results.

4. RESULTS

The randomized clinical study conducted by O’Leary et al. (2021) evaluated 180 adult patients with uncomplicated acute appendicitis, confirmed by computed tomography (CT), comparing antibiotic-only treatment to standard surgical treatment by laparoscopic appendectomy. Patients were divided into two groups: the intervention group received intravenous antibiotic therapy with ceftriaxone and metronidazole, followed by oral treatment with ciprofloxacin and metronidazole; the control group underwent laparoscopic appendectomy according to institutional protocol.

At the end of 12 months of follow-up, it was observed that 77% of patients treated with antibiotics did not require surgery, with a therapeutic failure rate of 23%, defined as the need for subsequent appendectomy. Most cases of failure

occurred in the first weeks after initial treatment, and none evolved with serious complications such as perforation or abscess.

The quality of life, measured by the EQ-5D instrument, did not present statistically significant difference between the two groups after one year. In addition, patients in the group treated with antibiotics had shorter time away from work and daily activities, indicating a faster functional recovery compared to the surgical group.

Regarding complications, the operated group had a higher incidence of minor adverse events, such as surgical site pain and superficial wound infection. The group that received only antibiotics had a lower rate of general complications, reinforcing the safety of conservative management in selected cases.

In addition, the meta-analysis conducted by Brucchi et al. (2024) aimed to compare the efficacy and safety of non-operative antibiotic treatment in relation to appendectomy in cases of uncomplicated acute appendicitis, focusing exclusively on randomized clinical trials. The study included 16 randomized controlled trials (RCTs), totaling 6,808 patients, of which 3,401 were allocated to non-operative treatment and 3,407 to surgical intervention.

The analysis showed that antibiotic treatment had an initial success rate of 70.2%, that is, approximately 30% of patients required subsequent surgery during follow-up. Regarding appendicitis recurrence, a rate of 27.4% was observed in the non-operative group, with most cases being safely managed by subsequent surgery.

Regarding the general complication (including wound infection, abscesses, ileum and perforation), the group treated with antibiotics had a lower complication rate when compared to the surgical group, with a risk ratio (HR) of 0.77, indicating a statistically significant benefit for non-operative treatment in terms of adverse events.

The sequential analysis of the trials (trial sequential analysis) confirmed the robustness of the results, suggesting that the available evidence is sufficient to support the clinical non-inferiority of conservative management with antibiotics in well-selected patients. However, the authors emphasize that, although antibiotic treatment reduces the incidence of immediate complications and avoids surgery in many cases, there is a real risk of future need for appendectomy, which should be considered in the individualized clinical decision.

In this paradigm, the multicenter cohort study conducted by Park et al. (2021) aimed to evaluate the success rate of antibiotic-only treatment in patients with uncomplicated acute appendicitis, using new, more restrictive inclusion criteria for case selection. The survey was conducted in multiple centers in South Korea and included 241 adult patients diagnosed by computed tomography (CT), all eligible for conservative antibiotic treatment according to the proposed criteria.

In the study, patients with appendicolith, radiological signs of perforation, abscess, or contrast extravasation, as well as patients with advanced age, immunosuppressed or severe comorbidities were excluded. After applying these criteria, antibiotic treatment was successful in 92.1% of cases within 30 days, with only 7.9% of patients requiring appendectomy due to failure of initial treatment.

During the one-year follow-up, the rate of recurrence of appendicitis was 10.4%, considered acceptable by the authors. None of the cases evolved with severe complications, such as perforation or generalized peritonitis. Patients who underwent surgery after antibiotic treatment failure did not present higher operative risks compared to those who were initially operated.

The study also demonstrated that the use of more rigorous inclusion criteria is directly associated with increased success rate of conservative treatment, reducing both the need for surgery and associated complications. The authors concluded that careful patient selection, based on specific radiological and clinical criteria, is fundamental to ensure the safety and efficacy of non-operative management of uncomplicated acute appendicitis (PARK et al., 2021).

5. DISCUSSION

The conservative approach to uncomplicated acute appendicitis with the exclusive use of antibiotics has gained ground as a viable alternative to appendectomy, especially in selected patients. The study by O'Leary et al. (2021), for example, showed that approximately 77% of patients treated exclusively with antibiotics had clinical success in controlling appendicitis without the need for immediate surgery, and still had better short-term quality of life compared to those undergoing appendectomy. In turn, Park et al. (2021) reinforced the efficacy of conservative treatment, reporting a therapeutic success rate of 88.6% in the short term. However, recurrence remains a relevant

challenge: in the Korean study, 10.4% of the patients presented recurrence within one year, which highlights the need for prolonged follow-up and clinical surveillance.

In this context, the most current clinical guidelines provide technical support for the adoption of this management. The American College of Surgeons (2020) recommends antibiotic treatment as a safe alternative for patients with uncomplicated acute appendicitis, as long as they do not have important risk factors, such as advanced age, relevant comorbidities, or immunosuppression. The European Association for Endoscopic Surgery (EAES, 2020) specifies that conservative treatment should be reserved for patients without radiological signs of complications - such as perforation, abscess or presence of appendicolith - and reinforces the need for rigorous clinical reevaluation, especially in the first days after the antibiotic initiation.

Another relevant aspect evidenced in the literature is the functional recovery of patients. In the study by O'Leary et al. (2021), antibiotic therapy was associated with a faster return to daily activities, shorter hospitalization time and better subjective experience in the post-treatment. Such benefits are especially important in contexts where hospital cost reduction and optimization of care resources are needed.

On the other hand, conservative treatment is not without limitations. Therapeutic failure and the need for late surgery still occur in a proportion of patients, which requires careful clinical planning. Park et al. (2021) highlight that these cases may require subsequent appendectomy, often in the context of recurrence or worsening, making easy access to surgical support essential if necessary. Therefore, the guidelines reinforce the importance of an individualized approach, with careful evaluation of clinical and radiological characteristics, in addition to educating the patient about the warning signs and the possibilities of evolution of the condition.

On the other hand, surgery remains the preferred therapeutic option in cases of complicated appendicitis, as reinforced by the CHW guidelines. The presence of perforation, diffuse peritonitis or abscess, as well as clinical factors that increase the risk of non-operative treatment failure, still contraindicate conservative management.

Thus, antibiotic treatment for uncomplicated acute appendicitis is shown to be a safe and effective alternative in adequately selected patients, based on clinical, laboratory and imaging criteria. This strategy, although not completely replacing appendectomy, expands the available therapeutic options and may be particularly useful in situations of increased surgical risk, limited resources or patient preference.

6. CONCLUSION

Conservative antibiotic treatment for uncomplicated acute appendicitis has been shown to be an effective and safe alternative to appendectomy, especially in selected patients. Although surgical treatment remains the standard for complicated cases, the use of antibiotics offers a valid option, with advantages in terms of lower morbidity and faster recovery time. However, the possibility of recurrence and the need for constant clinical surveillance are aspects that require caution in adopting this approach.

It is essential that the therapeutic decision is personalized, taking into account the characteristics of the patient and the clinical context. Continuing research on long-term outcomes and improving patient selection criteria for conservative treatment are essential to further improve this approach. Thus, uncomplicated acute appendicitis can increasingly be treated in a more conservative and less invasive manner, balancing clinical efficacy and quality of life for patients.

REFERENCES

AMERICAN COLLEGE OF SURGEONS (ACS). Guidelines for the Management of Appendicitis. Chicago: ACS, 2020. Available at: https://www.facs.org. Accessed: 8 May 2025.

BRAZIL. Ministry of Health. Clinical Protocol and Therapeutic Guidelines: Acute Appendicitis. Brasilia: Ministry of Health, 2019. Available at: https://www.gov.br/saude. Accessed: 8 May 2025.

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC). "Appendicitis: Symptoms, Diagnosis, and Treatment. Atlanta: CDC, 2021. Available at: https://www.cdc.gov. Accessed: 8 May 2025.

O'LEARY, D.P., WALSH, S.M., BOLGER, J., BABAN, C., HUMPHREYS, H., O'GRADY, S., HEGARTY, A., LEE, A.M., SHEEHAN, M., ALDERSON, J., DUNNE, R., MORRIN, M.M., LEE, M.J., POWER, C., MCNAMARA, D., MCCAWLEY, N., ROBB, W., BURKE, J., SORENSEN, J., HILL, A.D.. A Randomized Clinical Trial Evaluating the Efficacy and Quality of Life of Antibiotic-only Treatment of Acute Uncomplicated Appendicitis: Results of the COMMA Trial. Ann Surg. 2021 Aug 1;274(2):240-247. doi: 10.1097/SLA.000000000004785. PMID: 33534226.

BRUCCHI, F., BRACCHETTI, G., FUGAZZOLA, P., VIGANÒ, J., FILISETTI, C., ANSALONI, L., DAL, M.A.S. F., COBIANCHI, L., DANELLI, P.. A meta-analysis and trial sequential analysis comparing nonoperative versus operative management for uncomplicated appendicitis: a focus on randomized controlled trials. World J Emerg Surg. 2024 Jan 13;19(1):2. doi: 10.1186/s13017-023-00531-6. PMID: 38218862; PMCID: PMC10787963.

PARK, S.S., KIM, M.J., KIM, J.W., PARK, H.C. Analysis of treatment success with new inclusion criteria for antibiotic therapy for uncomplicated appendicitis: A multicenter cohort study. Int J Clin Pract. 2021 Apr;75(4):e13840. doi: 10.1111/ijcp.13840. Epub 2020 Nov 30. PMID: 33211359.

EUROPEAN ASSOCIATION FOR ENDOSCOPIC SURGERY (EAES). EAES guidelines on laparoscopic appendectomy. 2020. Available at: https://www.eaes.eu/guidelines. Accessed: 8 May 2025.

CHAPTER 2

PRENATAL EVALUATION OF HIGH-RISK PREGNANCY IN PRIMARY AND SPECIALIZED OUTPATIENT CARE

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ABSTRACT: Objectives: to evaluate high-risk prenatal care and identify strategies for improving care. Methods: mixed study of a prospective cohort, with 319 postpartum women in a public maternity hospital, from October 2016 to August 2017, using a semi-structured instrument and interview. Analysis was performed using the Chi-Square Test (p≤0.05). The qualitative approach was carried out by interviewing 13 managers with guiding questions, at their workplace, between January and March 2020, analyzed under social phenomenology. Results: higher rates of inadequacy were identified for all criteria. However, when care was shared, a higher rate was observed for performing exams (p=0.023), consultations (p=0.002), risk classification (p=0.013) and emergency information (≤0.000). Weaknesses in the record evidenced impairment in communication and continuity of care. Final Considerations: shared care is a strategy for improving care, however there is a need to strengthen effective reference and counter-reference for continuity of care.

KEYWORDS: prenatal, high-risk pregnancy, primary care, secondary health care, health services management.

RESUMO: Objetivos: avaliar a assistência pré-natal de alto risco e identificar as estratégias para o aperfeiçoamento assistencial. Métodos: estudo misto de uma coorte prospectiva, com 319 puérperas em uma maternidade pública, de outubro de 2016 a agosto de 2017, utilizando-se instrumento semi estruturado e entrevista. Realizou-se análise por meio do Teste do Qui-Quadrado (p≤0,05). A abordagem qualitativa foi realizada por entrevista com questões norteadoras a 13 gestores, em seu local de trabalho, entre janeiro e março de 2020, analisadas sob a

fenomenologia social. Resultados: identificaram-se maiores taxas de inadequação para todos os critérios. Entretanto, quando a assistência foi compartilhada, observou-se maior taxa para realização de exames (p=0,023), consultas (p=0,002), classificação de risco (p=0,013) e informação de emergência (≤0,000). Fragilidades no registro evidenciaram prejuízo na comunicação e na continuidade assistencial. Considerações Finais: o cuidado compartilhado demonstra-se estratégia ao aperfeiçoamento assistencial, entretanto há necessidade do fortalecimento da referência e contrarreferência efetivas à continuidade assistencial.

PALAVRAS-CHAVE: pré-natal, gestação de alto risco, atenção primária, atenção secundária à saúde, gestão dos serviços de saúde.

1. INTRODUCTION

Prenatal care (PN) aims at gestational development, healthy newborn delivery and the absence of maternal health problems, combining psychosocial approaches and educational activities. In Brazil, PN has achieved broad coverage.

Maternal and child health policies have promoted access to safe and quality health care. Despite the advances achieved, maternal mortality remains a major public health problem worldwide. Complications related to pregnancy, childbirth and the puerperium are the main causes of death and disability among women of reproductive age.

In this context, even though access to prenatal care is universal, inadequate care is observed when the minimum recommendations advocated by the Prenatal and Birth Humanization Program (PHPN) and the Maternal and Child Care Network (RAMI) are analyzed together.

Therefore, it is important to ensure, in a timely manner, effective care for pregnant women with gestational risk, as well as access to high-risk outpatient services (AR), seeking to minimize the consequences for maternal and neonatal health.

There is a gap in the literature regarding studies that investigate the weaknesses and potentialities of prenatal care. The relevance of studies that comprehensively evaluate prenatal care is highlighted, according to recommended criteria, through public health policies, seeking improvements in care in high-risk prenatal care (PNAR).

2. DEVELOPMENT

In the search for the qualification of maternal and child health care, constant investments are observed in Brazil, such as the institution of the Humanization Program in Prenatal and Birth (PHPN), the implementation of the Stork Network and the recent National Policy for Comprehensive Child Health Care (PNAISC), which in addition to guiding practices for this population group, organize health services at a national level.

This ongoing effort to keep maternal and child health at the forefront of public policies has shown positive results for the country, such as a drop in

maternal and infant mortality above the world average between 1990 and 2012. However, these advances have not occurred uniformly across regions, highlighting the need to improve the quality of prenatal care.

In the context of the State of São Paulo, characterized by a traditional and wide-ranging primary health care (PHC) service network, better results can be observed in relation to many Brazilian states, represented, for example, by the progressive reduction in infant mortality rates (per thousand live births), including neonatal and early neonatal mortality - which fell, respectively, from 7.9 and 5.7 in 2012, to 7.5 and 5.4 in 2016.

Regardless of this downward trend in infant mortality indicators, their values still indicate the need for improvements in prenatal care, as expressed in the percentage of live births with low birth weight (9.1%) or cesarean deliveries (59.4%) in 2015.

Pregnancy care establishes prenatal monitoring as one of the main strategies of health services, which, through comprehensive and integrated care, highlight early initiation and shared care as actions that qualify assistance to the needs of each pregnant woman, reducing the occurrence of avoidable injuries.

This study allowed the characterization of care for high-risk pregnant women and the results showed that, in addition to the organizational model of the PHC - which was associated with the attributes “early start of prenatal care”and “shared care between PHC and AE”- individual characteristics of pregnant women, such as skin color, and prenatal care, such as home visits, exert a significant influence on the listed outcomes.

As identified in systematic review studies with national and state scope, the analysis of the path of pregnant women in this line of care allowed us to identify advances, such as early initiation of prenatal care, early referral to the high-risk outpatient clinic and access to medication within the scope of PHC. On the other hand, important weaknesses were identified in access to examinations, especially ultrasound. It is worth noting, although it was not maintained in the final model, the number of pregnant women who reported paying for examinations, which may indicate inequalities in the provision of services that are reflected in access.

Furthermore, an important marker of quality of care, which consists of knowledge of the maternity hospital where the birth will take place, showed a

critical situation. Close to the national values in which less than 60% of pregnant women were informed about the reference maternity hospital for the birth, this result made it possible to visualize issues such as the bond and the possible pilgrimage of pregnant women in search of a maternity hospital, which is worrying in the case of a pregnancy with a higher risk of complications.

The USF was the service that most referred pregnant women to EC. Contrary to the belief of pregnant women who trust the specialist doctor more, this result shows that both the general practitioner and the specialist adopt the same approach when identifying possible risks. However, it was observed that pregnant women have little information about the reasons for this referral, suggesting the need to involve them in the care process.

As already pointed out in the literature, there is an association between the implementation of the ESF and the improvement of the quality of prenatal care. When compared to traditional UBS services, the ESF stands out for presenting an organization that favors the identification of the population's health needs and greater integration with families and the community, expanding the service's link with the population. Examples of this organization are practices such as the delimitation of the coverage area, restriction of the size of the covered population, approach by a multidisciplinary team, home visits and the work of CHAs.

This association can be exemplified by the increase in the percentage of prenatal consultations in the city of São Paulo, which rose from 46.9% to 51.4% between 2011 and 2014, and was also evidenced in the present study by the positive influence of the USF on the timely start of prenatal care.

Considering that the active search carried out by the ACS, who makes up the family health team, favors the timely identification of pregnant women, the findings of this study are coherent and corroborate publications from several Brazilian states that indicate the USF as the service with the greatest chance of starting prenatal care early.

However, as already described in other studies, there is concern about reports of pregnant women who, despite receiving prenatal care at a USF, are unaware of the ACS or did not receive home visits during pregnancy, suggesting limitations regarding the link, in addition to failures in the organization of surveillance actions that would justify occurrences with a late onset.

The literature indicates that appropriate shared care, that is, maintaining coordinated communication between services, becomes an important differentiator in pregnancy care. Despite the significant number of shared care services identified in this study, it is noteworthy that there are pregnant women who did not take any information back to the PHC or only took it informally.

This communication carried out by the pregnant woman herself between the PHC and AE services was reported in a study carried out in Cuiabá, showing that this lack of coordination between services also occurs in other Brazilian states. It is worth highlighting that this finding reinforces the importance of using the pregnant woman's card as an important tool in this process and that, according to studies, it is little used by professionals or with incomplete notes.

The practice of home visits is recognized as an important strategy for PHC services to improve the quality of pregnancy care, especially in low- and middle-income countries.

Regarding home visits and their influence on shared care, advantages such as greater freedom and collective construction in the conduct of care stand out, in addition to favoring knowledge and experience in the user's context. Thus, care provided outside the health service allows the construction and consolidation of bonds, which could justify the significant permanence of the variable “Received home visit”as an inducer of shared care between PHC and AE.

It is worth highlighting that this result gains greater relevance in view of the changes in the National Primary Care Policy (PNAB), which reduces the number of ACS per service, making the team more flexible and restricting its activities to the most vulnerable areas.

Although not all characteristics of pregnant women, such as age and education, demonstrated, in isolation, a significant association with the study outcomes, the skin color variable differentiated the condition of use of the service offering, indicating the existence of inequities, especially in the early initiation of prenatal care.

These findings corroborate national and international studies that point to vulnerabilities related to skin color and highlight its importance as a marker of inequality that is directly related to the early start of prenatal care, that is, it represents a limiting factor for access, regardless of the PHC model used by pregnant women.

The influence of socioeconomic factors on health is unquestionable. Considering that skin color is understood as a proxy for these factors, it is worth noting that the limitations highlighted are more prominent, as Brazil as a whole is made up of a large number of mixed races, reinforcing the need for social inclusion and expansion in services.

The authors acknowledge the limitations of the study, as interviews were conducted in health services and the possible referrals made directly by emergency or urgent care services were not identified. Therefore, they may not reflect the reality of all high-risk pregnant women in the city. However, it is worth noting that even in the face of these limitations, the results presented are relevant, especially considering that difficulties are likely to worsen - as already observed by the increase in infant mortality - and thus aim to contribute evidence that favors well-applied investments directed towards actions with a greater impact on health indicators.

This study sought to contribute to the understanding of the advances and challenges that arise in improving pregnancy care. As already mentioned, the importance of implementing the USF model as a strategy for health equity has been highlighted. This organizational model has been shown to provide a greater chance for pregnant women to begin prenatal care early, in addition to maintaining shared monitoring during high-risk pregnancies.

However, regardless of the model operated in the PHC service, important issues that influence this result stand out, such as the individual vulnerabilities of pregnant women, especially in not having white skin color, and weaknesses identified in the path of pregnant women from PHC to AE, in particular, related to home visits.

These results reinforce the positive influence of the USF on pregnancy-related outcomes, the importance of building more inclusive health practices, and the potential of home visits to ensure expanded access and comprehensive care.

3. FINAL CONSIDERATIONS

The World Health Organization (WHO) defines as essential research on reproductive health related to sexuality, contraception and conception, including pregnancy, childbirth and the puerperium, proposing that the characteristic

factors of the sociocultural context, that is, values, beliefs, socioeconomic conditions, among others, are considered as important events by them.

Pregnancy is a biologically natural but special event in a woman's life and, as such, develops in a social and cultural context that influences and determines its evolution and occurrence (2). In order to investigate human reactions and gain a better understanding of this influence and complexity of experiences during the pregnancy-puerperal cycle, it is important to consider factors such as the pregnant woman's personal history and obstetric past, the context of the pregnancy, her age and relationship with her partner.

For many decades, women's health policies in Brazil focused exclusively on meeting the demands arising from pregnancy and childbirth, restricting attention to the reproductive process (4). They were based on the biological specificity of women and their social role as mothers and housewives. However, in the 1980s, with the alarming increase in AIDS and changes in procreative patterns, aspects such as sexuality and contraception gained relevance in relation to contraception, pregnancy and childbirth.

With these changes, the Ministry of Health has had difficulty in addressing women's health in a comprehensive manner, without disregarding serious and complex problems. Actions were directed to identify the biggest problems and how to change the reality observed - reducing mortality rates from preventable causes, enabling decision-making on reproductive rights and ensuring comprehensive and humanized care - in order to strengthen preventive actions and health promotion.

Despite these efforts, 21.3% of maternal deaths in Brazil in 1996-1997 were attributed to indirect causes, which involve pre-existing diseases complicated by pregnancy. Adequate perinatal care and guidance on family planning can contribute to reducing these deaths.

Approximately 20% of pregnant women have a higher probability of an unfavorable outcome, both for themselves and for the fetus, constituting the so-called "high-risk pregnant women”group. Understanding, from the perspective of these pregnant women, the event of conception, their planning and desire to have a child, even though they were aware that they had a condition prior to pregnancy, could help health professionals to improve the care and assistance provided to pregnant women.

REFERENCES

ANDREUCCI, C.B., CECATTI, J.G.. Desempenho de indicadores de processo do Programa de Humanização do Pré-natal e Nascimento no Brasil: uma revisão sistemática. Cad Saúde Pública 2011; 27:1053-64.

ANVERSA, E.T.R., BASTOS, G.A.N., NUNES, L.N., DAL PIZZOL, T.S.. Qualidade do processo da assistência pré-natal: unidades básicas de saúde e unidades de Estratégia Saúde da Família em município no Sul do Brasil. Cad Saúde Pública 2012; 28:789-800.

Coordenadoria de Planejamento de Saúde. Deliberação CIB nº 36, de 21 de setembro de 2011. Diário Oficial do Estado de São Paulo 2011; 22 set.

DOWSWELL, T., CARROLI, G., DULEY, L., GATES, S., GÜLMEZOGLU, A.M., KHAN-NEELOFUR, D., et al. Alternative versus standard packages of antenatal care for low-risk pregnancy. Cochrane Database Syst Rev 2010; (10):CD000934.

Fundação Sistema Estadual de Análise de Dados. Índice Paulista da Primeira Infância. http://www.ippi.seade.gov.br/frontend/#/ (acessado em 21/Set/2024). “http://www.ippi.seade.gov.br/frontend/#/

GBD 2015 Maternal Mortality Collaborators. Global, regional, and national levels of maternal mortality, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet 2016; 388:1775-812.

LIU, L., OZA, S., HOGAN, D., CHU, Y., ZHU, J.P.J., LAWN, J.E., et al. Global, regional, and national causes of under-5 mortality in 2000-15: an updated systematic analysis with implications for the Sustainable Development Goals. Lancet 2016; 388:3027-35.

LOURENÇO, E.C., GUERRA, L.C., TUON, R.A., SILVA, S.M.C.V., AMBROSANO, G.M.B., CORRENTE, J.E., et al. Variáveis de impacto na queda da mortalidade infantil no Estado de São Paulo, Brasil, no período de 1998 a 2008. Ciênc Saúde Colet 2014; 19:2055-62.

Ministério da Saúde. Manual prático para implementação da Rede Cegonha. Brasília: Ministério da Saúde; 2011.

Ministério da Saúde. Atenção ao pré-natal de baixo risco. Brasília: Ministério da Saúde; 2012. (Série A. Normas e Manuais Técnicos. Cadernos de Atenção Básica, 32).

Ministério da Saúde. Portaria nº 1.130, de 5 de agosto de 2015. Institui a Política Nacional de Atenção Integral à Saúde da Criança (PNAISC) no âmbito do Sistema Único de Saúde (SUS). Diário Oficial da União 2015; 6 ago.

Ministério da Saúde. Portaria nº 2.436, de 21 de setembro de 2017. Aprova a Política Nacional de Atenção Básica, estabelecendo a revisão de diretrizes para a organização da Atenção Básica, no âmbito do Sistema Único de Saúde (SUS). Diário Oficial da União 2017; 22 set.

MOTA, A., SCHRAIBER, L.B.. Atenção primária no sistema de saúde: debates paulistas numa perspectiva histórica. Saúde Soc 2011; 20:837-52.

SALA, A., MENDES, J.D.V.. Perfil de indicadores da atenção primária à saúde no Estado de São Paulo: retrospectiva de 10 anos. Saúde Soc 2011; 20:912-26.

SAMOTO, A.K., VENANCIO, S.I.. Avaliação da qualidade dos serviços de atenção básica, segundo modelo de atenção, na Região de Saúde do Rio Pardo-SP. BIS, Bol Inst Saúde 2014; 15 Suppl:23-31.

SANINE, P.R., CASTANHEIRA, E.R.L.. Explorando nexos entre a construção social da criança e as práticas de saúde. Hist Ciênc Saúde-Manguinhos 2018; 25:199-215.

SANINE, P.R., ZARILI, T.F.T., NUNES, L.O., DIAS, A., CASTANHEIRA, E.R.L.. Do preconizado à prática: oito anos de desafios para a saúde da criança em serviços de atenção primária no interior de São Paulo. Cad Saúde Pública 2018; 34:e00094417.

Secretaria Municipal de Saúde de São Paulo. TabNet. https://www.prefeitura.sp.gov.br/cidade/secretarias/saude/tabnet/index.php?p=6522 (acessado em 20/Set/2024). “https://www.prefeitura.sp.gov.br/cidade/secretarias/saude/tabnet/index.php?p=6522

VENANCIO, S.I., ROSA, T.E.C., SANCHES, M.T.C., SHIGENO, E.Y., SOUZA, J.M.P.. Efetividade da Estratégia Saúde da Família sobre indicadores de saúde da criança no Estado de São Paulo. Rev Bras Saúde Mater Infant 2016; 16:283-93.

VEGA, C.E.P., SOARES, V.M.N., NASR, A.M.L.F.. Mortalidade materna tardia: comparação de dois comitês de mortalidade materna no Brasil. Cad Saúde Pública 2017; 33:e00197315.

CHAPTER 3

SKULL AND FACE (CRANIOMAXILLOFACIAL) RECONSTRUCTIVE SURGERY FOR GUNSHOT WOUNDS (GW): A REVIEW OF CURRENT LITERATURE

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ABSTRACT: Firearm injuries to the face (FAF) in regions of the skull and face represent one of the greatest challenges in medical-surgical practice in Maxillofacial Surgery, due to their high anatomical complexity and the devastating impact they cause, compromising not only essential functions such as neurology, chewing, swallowing, breathing and speech, but also aesthetic elements that are fundamental to patients' identity and self-esteem. Treatment requires a complex multidisciplinary approach, ranging from emergency care and damage control to advanced stages of reconstruction and functional rehabilitation. Reconstructive surgery for facial firearm injuries (FAF) uses modern techniques such as microsurgery, autologous and alloplastic bone grafts, vascularized flaps and customized biomaterials. Medication management uses broad-spectrum antibiotics, corticosteroids to control edema and analgesics, all of which are essential to minimize complications and promote recovery. The article explores the fundamental principles, advanced surgical techniques and the critical role of interdisciplinarity, also highlighting the importance of psychological support and functional rehabilitation for a complete recovery and the patient's social reintegration.

KEYWORDS: gunshot wounds, facial reconstruction, oral and maxillofacial surgery, craniomaxillofacial surgery, medical therapy, microsurgical techniques, biomaterials.

RESUMO: Os ferimentos por arma de fogo na face (FAF) em regiões do crânio e face representam um dos maiores desafios na prática médico-cirúrgica em Cirurgia Maxilo Facial, devido à alta complexidade anatômica e ao impacto devastador que provocam, comprometendo não apenas funções essenciais, como neurológicas, mastigação, deglutição, respiração e fala, mas também elementos estéticos fundamentais para a identidade e autoestima dos pacientes. O tratamento requer uma abordagem multidisciplinar complexa, que inclui desde o atendimento emergencial e controle de danos até etapas avançadas de reconstrução e reabilitação funcional. A Cirurgia Reconstrutiva em ferimentos faciais por arma de fogo (FAF), utiliza técnicas modernas, como microcirurgia,

enxertos ósseos autólogos e aloplásticos, retalhos vascularizados e biomateriais personalizados. No manejo medicamentoso, utiliza-se terapeuticamente medicamentos da classe de antibióticos de amplo espectro, corticosteroides para controle de edema e os analgésicos, sendo todos fundamentais para minimizar complicações e promover a recuperação. O artigo explora os princípios fundamentais, técnicas cirúrgicas avançadas e o papel crítico da interdisciplinaridade, destacando também a importância do suporte psicológico e da reabilitação funcional para uma recuperação completa e a reintegração social do paciente.

PALAVRAS-CHAVE: ferimentos por arma de fogo, reconstrução facial, cirurgia bucomaxilofacial, cirurgia crâniomaxilofacial, terapia medicamentosa, técnicas microcirúrgicas, biomateriais.

1. INTRODUCTION

Head and facial gunshot wounds constitute a highly complex and serious medical emergency, due to the anatomical density of the facial region, which houses vital structures such as airways, large-caliber blood vessels, nerves essential for sensory and motor functionality and components of the musculoskeletal system.

Thus, injuries caused by high-energy projectiles in these anatomical regions can lead to severe sequelae and permanent disfigurement, requiring meticulous surgical treatment with high-tech resources for structural and functional reconstruction.

Gunshot injuries that affect the skull are considered highly complex, as they frequently involve a combination of bone trauma, brain damage and associated neurovascular complications.

Regarding the human face, we measured that in addition to its aesthetic and social importance, it has essential physiological functions for the patient's well-being and quality of life, including chewing, swallowing, verbal communication and emotional expression. The loss or impairment of these functions represents not only a technical challenge, but also a significant emotional impact, since personal identity is strongly associated with the integrity of the face.

The approach to gunshot wounds to the skull and face is therefore multifactorial, including emergency stabilization, detailed diagnosis, meticulous surgical planning and broad, interdisciplinary rehabilitation.

This article aims to review the main therapeutic approaches and reconstruction techniques, with emphasis on recent advances that have allowed greater precision and better functional and aesthetic outcomes.

2. PATHOPHYSIOLOGICAL ASPECTS AND INITIAL DIAGNOSIS

Gunshot wounds present a complex injury pattern that depends on variables such as the velocity and type of the projectile, the angle of entry, and the structures involved. In general, high-velocity projectiles cause a primary injury

at the entry site, as well as a temporary cavity that causes additional tissue destruction, rupturing bone structures, blood vessels, and nerves.

This type of trauma generates a series of inflammatory reactions, with a high risk of tissue necrosis and serious infections due to wound contamination.

Advanced Trauma Life Support (ATLS) principles, with priority given to airway control and patient stabilization. Airway maintenance may require emergency orotracheal intubation or tracheostomy, particularly in cases with obstruction caused by bone fragments, edema, or large hematomas.

The occurrence of intense bleeding, common in these cases, must be controlled immediately with surgical hemostasis techniques and volume replacement.

Imaging diagnosis is an essential pillar to define the extent of the injury and guide surgical planning, with computed tomography (CT) providing a detailed view of bone fractures, foreign bodies and associated tissue injuries.

In some situations, Angiography may be necessary to map critical vascular lesions, allowing the planning of endovascular interventions to control hemorrhages before surgical-reconstructive treatment.

3. APPROACHES TO CRANIOFACIAL RECONSTRUCTION SURGERIES BY FAF

Surgical treatment of gunshot wounds to the skull and face requires a multifactorial approach, with specific interventions to restore both function and aesthetics.

We can say that firearm injuries frequently result in massive tissue loss, bone destruction and exposure of vital structures, which demands the application of advanced microsurgery techniques, segmental reconstruction and the use of biomaterials.

In the management of severe cases, the sequence of surgical interventions needs to be carefully planned by the surgeon to maximize functional recovery and minimize the risk of infections and complications.

Initially, aggressive debridement will be essential for the success of local surgical reconstruction, since this technique removes devitalized tissue, reducing the risk of infection and preparing the surgical bed for grafts and flaps. To

optimize this step, the use of a precision scalpel and irrigation with sterile saline solution are often employed.

After local debridement, reconstruction of local skeletal structures is initiated, considering each affected region.

3.1 SURGICAL APPROACHES FOR RECONSTRUCTION OF COMPLEX SKULL WOUNDS BY FIREARM

Gunshot wounds to the skull are considered highly complex injuries due to the combination of bone trauma, brain damage, and possible associated neurovascular complications. These injuries can be classified as penetrating, perforating, or tangential, depending on the trajectory of the projectile and the involvement of cranial and cerebral structures.

Injuries caused by firearm projectiles to the skull are influenced by factors such as:

Bullet velocity: High-velocity bullets, such as rifle bullets, tend to cause greater tissue destruction due to secondary cavitation, which creates a larger area of damage around the bullet's path.

Caliber and kinetic energy: the greater the energy transmitted to bone and brain tissue, the greater the potential for bone fragmentation and brain laceration.

Trajectory: The entry and exit of the projectile determine the extent of the injury. A trajectory that crosses critical functional areas, such as the brainstem or diencephalon, is usually fatal.

3.1.1 Classification of gunshot wounds to the skull

Penetrating wounds: when the projectile enters the skull, but does not have an exit hole. These wounds are generally associated with the retention of bone or metal fragments within the brain parenchyma.

Puncture wounds: characterized by entry and exit holes, with a complete trajectory through the skull. Cavitation is extensive, and brain damage is usually more severe.

Tangential wounds: when the projectile glides across the cranial surface, causing fractures or bone loss, but without direct brain penetration.

3.1.2 Pathophysiology of gunshot wounds to the skull

The impact of the projectile on the bones of the human skull can cause numerous types of injuries, which can extend to internal structures of the brain, causing sequelae. post-traumatic and even leading to the patient's death.

Some types of injuries frequently observed are:

Skull fractures: linear or comminuted, depending on the force and angle of impact.

Primary brain damage: includes lacerations, intracranial hematomas (epidural, subdural, intracerebral), and hemorrhagic contusions.

Secondary damage: occurs due to inflammatory processes, ischemia, increased intracranial pressure (ICP) and infections.

In cases of confirmed gunshot wounds to the cranial region, some signs and symptoms are frequently observed, but they depend on the extent and location of the wound, and may include:

- Immediate loss of consciousness.
- Focal neurological deficits, such as hemiplegia or aphasia.
- Anisochoric pupils or signs of brain herniation.
- Active bleeding from the inlet or outlet.
- Rhinorrhea or otorrhea of cerebrospinal fluid, indicating basal skull fracture.

The initial diagnosis of FAFs in the skull is clinical, based on the mechanism of trauma and physical examination, followed by imaging tests, with Computed Tomography (CT) being the examination of choice to evaluate bone fractures, hemorrhages and the presence of foreign bodies. However, Angiotomography or cerebral angiography may be indicated in cases of suspected vascular injury, such as dissections or pseudoaneurysms.

3.2 SURGICAL APPROACHES FOR RECONSTRUCTION OF COMPLEX GUN WOUNDS TO THE FACE

Facial reconstruction in gunshot wounds is a complex approach that involves advanced and multidisciplinary surgical techniques. Initially, debridement is performed to remove necrotic tissue, followed by infection control. Bone stabilization (osteosynthesis) is performed using plates and screws, often associated with the use of autogenous bone grafts to reconstruct the facial anatomy. To cover extensive defects, skin grafts or microsurgical flaps can be used. Additionally, in cases that compromise functions, such as facial mimicry, functional resuscitation surgeries are performed, which may include nerve and muscle reconstruction.

In cases of irreparable loss of local structures, facial prostheses play an essential role in restoring both functionality and aesthetics. However, each case requires a personalized surgical plan, considering the severity of the injuries and the functional and aesthetic impact. In gunshot wounds (GW) involving the facial complex, rigid internal fixation (RIF) is an essential technique for restoring anatomy and functionality. Various types of plates can be used, depending on the extent of the fractures and the structures involved. Titanium miniplates are widely used due to their strength, biocompatibility and ability to provide stable fixation, and are indicated for fractures in areas such as the zygomatic arch and orbital rim. Microplates, on the other hand, are thinner and more delicate, and are preferred for regions with smaller and more sensitive bone structures, such as the orbits or nose. For fractures that require greater stability, such as those involving the maxilla or mandible, reconstruction plates are used, which are thicker and more robust, capable of supporting functional loads and are often combined with bone grafts.

In more complex cases, where the bone damage is extensive, custom plates designed with CAD/CAM (Virtual Prototyping) technology can be manufactured for precise anatomical adjustment. Therefore, the choice of plate type depends on the location, severity of the trauma and functional needs, always aiming at the functional and aesthetic rehabilitation of the patient. The titanium plates used in rigid internal fixation vary in thickness according to the anatomical region and the need for mechanical support.

The main thicknesses include:

- **Microplates:** They have a thickness of 0.6 mm to 1.0 mm, indicated for delicate regions, such as the orbit and nose.
- **Miniplates:** They have a thickness of 1.0 mm to 1.5 mm, widely used in areas such as the zygomatic arch, orbital rim and maxilla.
- **Reconstruction plates:** They have a thickness of 2.0 mm to 3.0 mm, used in mandibular fractures or larger bone defects that require greater structural resistance.

These variations ensure the adaptation of the plate to the specific trauma, promoting adequate stability without compromising the anatomy.

3.3 ADVANCED SURGICAL TECHNIQUES FOR FACIAL RECONSTRUCTION IN FAFS

Surgical planning for gunshot wounds to the skull and face involves a series of steps that include initial stabilization, assessment of viable tissue for reconstruction, and selection of the most appropriate surgical techniques for repairing damaged structures.

In the initial debridement phase, necrotic and contaminated tissue is removed to reduce the risk of infection and prepare the site for future reconstruction.

The debridement technique must be meticulous, preserving viable tissue as much as possible to optimize aesthetic and functional results.

Bone reconstruction is one of the most complex steps and frequently requires the use of autologous grafts, when possible, due to their excellent biocompatibility and integration capacity.

For cases of extensive bone loss, such as in maxillary or mandibular lesions, grafts taken from the iliac crest, tibia, or skullcap are often used.

For injuries involving the mandible, bone reconstruction can be performed with the microvascularized fibular flap.

This procedure allows the restoration of mandibular integrity with a vascularized bone segment, which facilitates osseointegration and supports the subsequent installation of dental implants for masticatory rehabilitation.

This technique requires detailed surgical planning, including the use of cutting guides and 3D molds to achieve accurate anatomical reconstruction.

In cases of multiple mandibular fractures with or without displacement, low-profile titanium fixation plates are applied to stabilize the bone fragments.

For injuries affecting the Zygomatic-Maxillary complex and the orbital region, reconstruction is even more complex due to the proximity to sensitive structures, such as nerves and ocular vessels.

In this scenario, microsurgery techniques and the use of molded titanium plates are essential to reestablish the appropriate facial contour.

In many cases, the Anterolateral Thigh Flap is used to cover exposed areas and provide vascularized soft tissue, which aids in healing and reduces the risk of scar retraction.

Flaps such as the Anterolateral thigh or the Latissimus Dorsi muscle are popular for their versatility and for offering excellent vascularization.

Microsurgery, in this context, is essential for the anastomosis of vessels and nerves, ensuring the survival of the flap and the functional recovery of the region.

Closure techniques with aesthetic sutures, the use of biological glues and artificial dermal matrices are also essential to minimize scars and improve aesthetic results.

In patients with extensive destruction of the palate and nasal cavity region, the use of microvascularized free flaps such as the antebrachial radial flap offers a solution to restore oronasal closure and rehabilitate swallowing and phonation function.

This flap is particularly advantageous due to its thickness and malleability, allowing it to adapt to irregular surfaces of the oral and nasal cavity.

When there is a need for greater structural support, the combination with bone grafts or synthetic biomaterials, such as hydroxyapatite plates, is indicated to promote rigidity and improve tissue integration.

3.4 SOFT TISSUE REPAIR AND SKIN GRAFT RECONSTRUCTION TECHNIQUES IN MAXILLOFACIAL SURGERY

Soft tissue repair represents one of the greatest challenges in facial gunshot injuries, and the choice of technique depends on the extent and depth of the wound, as well as the aesthetic and functional needs of the patient.

Local flaps, such as advancement and rotation flaps, are used to cover smaller defects with little bone exposure.

In more complex lesions, microsurgical free flaps are preferred due to their flexibility and ability to provide vascularized tissue to areas that are difficult to cover.

The use of tissue expanders is another important approach to create sufficient tissue for reconstruction, especially in large lesions in the zygomatic (malar) and periorbital region.

This technique involves inserting a balloon expander under intact skin, which is gradually filled with saline over weeks or months.

This process generates the recommended additional tissue, allowing for more natural and less visible coverage of scars and areas of tissue loss.

In cases where skin grafts are necessary, skin is harvested from donor areas, such as the scalp or groin area.

Thin and thick grafts can be applied depending on the depth of the defect and the need for mobility in the affected area, and the grafts are fixed using delicate suturing techniques and biological adhesives to prevent displacement and promote integration.

3.5 VASCULAR ANASTOMOSIS AND MICROVASCULAR RECONSTRUCTION TECHNIQUES

Vascular anastomoses (surgical technique for connecting vessels) are essential for the success of free flaps used in facial reconstruction.

The technique requires precision to join small diameter vessels, generally 1 to 3 mm, under microscope magnification.

Monofilament suture threads, such as 9-0 or 10-0 nylon, allows for a safe and leak-free approach of arterial and venous anastomoses.

Microvascular reconstruction is particularly important in injuries with large tissue loss, where blood perfusion is compromised.

Free fascia lata or latissimus dorsi muscle flaps are viable options for providing bulky, vascularized tissue, especially in extensive wounds in the mid and lower face.

These flaps are precisely fixed to the local vessels, ensuring the vitality of the transplanted tissue and promoting integration with the recipient bed.

4. POSTOPERATIVE PHARMACOLOGICAL MANAGEMENT AND THERAPY

In the postoperative period of Craniofacial Reconstructive Surgeries by FAF, drug management is essential to avoid complications and promote adequate healing.

Prophylactic antibiotic therapy is instituted according to the bacterial flora present at the site of intervention, generally using broad-spectrum antibiotics such as third-generation cephalosporins in association with metronidazole to cover anaerobic bacteria, mainly in places with an abundance of pathogenic microorganisms, such as the oral cavity.

Therefore, the dosage and duration of drug therapy are adjusted according to the patient's clinical condition and the initial response to treatment.

To control edema and inflammation, medications from the Corticosteroid class, such as Dexamethasone, are administered in the first 48 to 72 hours, reducing the inflammatory response and preventing severe edema that could compromise the immediate postoperative period.

Non-steroidal anti-inflammatory drugs (NSAIDs) complement the management of pain and inflammation, but their use should be cautious due to the potential for increased risk of bleeding.

For analgesia, medications from the Opioid class, such as Morphine and Tramadol, may be indicated in combination with non-steroidal anti-inflammatory drugs, such as Ketorolac, to provide effective pain relief.

Anticoagulation with low molecular weight heparin, such as enoxaparin, is considered for immobilized patients and those at high risk of thromboembolism.

In cases of tissue necrosis or risk of graft failure, Hyperbaric Oxygen Therapy may be a type of approach used to improve tissue oxygenation and stimulate Angiogenesis.

In cases where bone regeneration is difficult, some substances can be used, such as Platelet-Derived Growth Factors and Recombinant Factors, such as BMP-2, can be used locally to promote osteogenesis.

The administration of NMDA receptor blockers, such as low-dose Ketamine, has been studied as an alternative for neuropathic pain associated with peripheral nerve injuries, as a sequela of postoperative FAF trauma.

In cases of complex wounds, negative pressure therapy can also be used to promote exudate drainage and improve local healing.

5. TECHNOLOGICAL ADVANCES, REGENERATIVE MEDICINE AND FUTURE PERSPECTIVES

Technological advances have played a fundamental role in the evolution of facial reconstructive surgeries in gunshot wounds (GW), improving both aesthetic and functional outcomes.

As already mentioned, the introduction of technologies such as 3D printing for surgical planning and the use of personalized biomaterials has opened up new possibilities for highly individualized treatments.

In this context, 3D printed anatomical models are used to simulate complex procedures, allowing greater precision in bone reconstruction and restoration of facial symmetry.

These models also assist in the manufacture of titanium plates and implants adapted to the patient's specific anatomy, reducing surgical time and improving tissue integration.

Another significant advance is the integration of augmented reality (AR) and artificial intelligence (AI) into surgical planning.

Augmented reality (AR) allows surgeons to visualize internal structures in real time during the procedure, increasing precision when repositioning bone fragments or performing vascular anastomoses in microsurgeries.

Artificial intelligence (AI), in turn, is used to analyze large volumes of data, identifying patterns and proposing evidence-based treatment plans, which can be personalized for each case.

The use of innovative biomaterials has also revolutionized facial reconstruction, as materials such as Hydroxyapatite, biodegradable polymers and laboratory-grown bone matrices are among the most widely used materials. These biomaterials promote tissue regeneration, minimize rejection and accelerate structural integration. In addition, research with mesenchymal stem cells is expanding the possibilities of bone and soft tissue regeneration, allowing the reconstruction of large areas without the need for autologous grafts.

The use of mesenchymal stem cells and platelet-derived growth factors is also being explored as a regenerative approach to repair significant tissue loss. These treatments aim to accelerate osteogenesis and angiogenesis, promoting faster and more effective recovery of affected tissues.

Mesenchymal stem cells can be obtained from bone marrow or adipose tissue and are applied to the defect site together with biodegradable scaffolds to improve bone and soft tissue regeneration.

In the field of Microsurgery, robotics has shown highly promising potential in Maxillofacial Surgeries, where Surgical Robots such as the *da* Vinci system allow precise movements in restricted anatomical areas, facilitating the performance of vascular anastomoses and nerve reconstructions.

These systems also reduce surgeon fatigue in long and complex procedures, increasing efficiency and safety.

6. CRANIO-MAXILLO-FACIAL FUNCTIONAL, PSYCHOLOGICAL AND AESTHETIC REHABILITATION

Rehabilitation after gunshot craniofacial reconstruction (FCR) is a long and often extensive process that requires the collaboration of a multidisciplinary team to restore the patient's functionality and appearance.

Physiotherapy monitoring is essential to prevent contractures and restore mobility of the Temporomandibular Joint (TMJ).

For ocular or orbital injuries, ophthalmological interventions may be necessary to correct visual changes and restore facial symmetry.

Medical-dental intervention is essential in lesions of the lower and middle third of the face for masticatory and aesthetic rehabilitation, using osseointegrated implants when feasible.

Psychological and psychiatric support is an integral part of the recovery process, where patients with facial gunshot wounds often develop Post-traumatic Stress Disorder - PTSD, anxiety and depression, and continuous monitoring is important to facilitate social readaptation and acceptance of the new body image.

7. ETHICAL AND LEGAL IMPLICATIONS IN RECONSTRUCTIVE SURGERY FOR FIREARM WOUNDS (FAFS)

Facial reconstruction of gunshot wounds raises complex ethical considerations, ranging from assessing the patient's intent and realistic expectations, to the social and psychological impact of the sequelae.

Surgeons should consider patient autonomy when discussing the possibilities and limitations of reconstructive surgical techniques, emphasizing the expected results of each procedure and the risks involved.

Furthermore, legal issues related to the care of victims of violence are equally relevant, and communication with the competent authorities is important, especially in the context of gunshot wounds.

To protect the patient and the surgeon, detailed and accurate documentation is essential, recording all interventions performed and informed consent for each stage of treatment.

Confidentiality must also be maintained, respecting patient rights while cooperating with legal investigations.

8. CONCLUSION

Facial reconstruction surgeries for gunshot wounds is a field that combines high technical complexity with complex approaches that require rigorous planning and in-depth knowledge of advanced Microsurgery, Grafting and Biomaterials techniques.

Successful treatment of these patients depends not only on precise surgical execution, but also on an integrated therapeutic approach that

encompasses functional rehabilitation, psychological support and social monitoring.

Technological innovations, such as 3D printing and the development of new biomaterials, have expanded the possibilities of surgical reconstruction, allowing an increasingly personalized and effective approach.

We can say that this field is still evolving, with continuous research focused on tissue regeneration, application of stem cells and biological therapies, which represent the future of Craniomaxillofacial Reconstructive Surgeries for the Maxillofacial Surgeon.

With the integration of new technologies and techniques, the ability to restore facial functionality and appearance to patients with traumatic injuries is expected to continue to improve, offering a greater quality of life and social reintegration for these individuals.

Facial Gunshot Injury Reconstructive Surgery (FAG) exemplifies the potential of modern medical and surgical sciences to transform complex trauma into pathways to recovery, providing survivors with a second chance to rebuild their lives.

REFERENCES

ELLIS, E.; MORABITO, D.. **Management of facial gunshot wounds: A review of 40 cases** Journal of Oral and Maxillofacial Surgery v 59 n 8 p 936-943 2001

GOH, B. K.; TAN, S.S.; TAN, K. H.; TAN, B. Y.. **Gunshot injuries to the facial skeleton: A 10-year review of management and outcome** The Journal of Craniofacial Surgery v 19 n 5 p 1186-1190 2008.

HAUG, R. H.; MCALLISTER, J. M.. **Management of gunshot wounds to the face and neck** Oral and Maxillofacial Surgery Clinics of North America v 25 n 4 p 531-540 2013

KABAN, L. B.; MULLIKEN, J. B.. **Surgical management of facial trauma in children** Journal of Pediatric Surgery v 32 n 4 p 664-667 1997

LEVIN, L.; EYAL, A.; SHAPIRA, J.; SOLOMON, M.. **A review of traumatic maxillofacial injuries and treatment outcomes** The Journal of Craniofacial Surgery v 28 n 3 p 717-721 2017

MONASTERIO, G.; AYALA, F.; CORDERO, S.; LEMOS, R.. **Gunshot injuries to the maxillofacial region: A five-year study** Journal of Oral and Maxillofacial Surgery v 48 n 3 p 290-294 1990

ZOCCOLI, M. A.; BAUMANN, A. S.; MANNING, S. C.. **Reconstructive strategies for facial injuries caused by firearm trauma** Plastic and Reconstructive Surgery v 126 n 6 p 2126-2133 2010

CHAPTER 4

ETHNOBOTANICAL STUDY AND ANTIMICROBIAL ACTIVITY OF *GALPHIMIA GLAUCA* CAV.

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ABSTRACT: *Galphimia glauca* (Malpighiaceae) has been widely used in traditional Mexican medicine. This study is the first to report on the root´s antimicrobial activity based on traditional knowledge from Xochipala, Guerrero. Two preliminary interviews were conducted with key informants. Final surveys were then prepared and distributed in three schools in the community. The information was organized in a hierarchical list according to importance and frequency of use to apply the Friedman index. The antibacterial and antifungal activity of the extracts were evaluated using the double serial dilution method in agar. Four main plants were reported for the treatment of skin pimples. *G. glauca* or "Tespancolole"was the most frequently used (54.9 %), followed by *Hintonia latifolia* or "Copalchi"(27.4 %), *Dorstenia drakena* or "Gallito"(0.87 %), and *Ziziphus amole* or "Corongoro"(7.83 %). The antimicrobial effect of the methanolic and dichloromethane extracts on *Trichophyton. rubrum* and *T. menthagrophytes* was observed at a concentration of 4 µg/mL. Growth inhibition was higher when compared to miconazole, the reference drug used, which was evaluated at 8 µg/mL. This study supports the traditional knowledge of the community of Xochipala, Guerrero that uses the root of *G. glauca*, showing antimicrobial activity for the treatment of dermal lesions that may be due to infectious agents such as *Staphylococcus. aureus*, *T. rubrum*, and *T.menthagrophytes*.

KEYWORDS: antifungal, traditional medicine, medicinal plants, *Trichophyton menthagrophytes*, *Trichophyton rubrum*.

RESUMO: *Galphimia glauca* (Malpighiaceae) tem sido amplamente utilizada na medicina tradicional mexicana. Este estudo é o primeiro a relatar a atividade antimicrobiana da raiz com base no conhecimento tradicional de Xochipala, Guerrero. Foram realizadas duas entrevistas preliminares com informantes-chave. Os inquéritos finais foram então distribuídos a três escolas da comunidade. As informações foram organizadas em uma lista hierárquica de acordo com a importância e frequência de utilização para aplicação do índice de Friedman. A atividade antibacteriana e antifúngica dos extratos foi avaliada pelo método de dupla diluição seriada em ágar. Quatro plantas principais foram relatadas para o tratamento de espinhas na pele. *G. glauca* ou “Tespancolole”foi a mais utilizada (54.9%), seguida de *Hintonia latifolia* ou “Copalchi”(27.4%), *Dorstenia drakena* ou “Gallito”(0.87%) e *Ziziphus amol* ou “Corongoro”(7.83%). O efeito antimicrobiano dos extratos metanólico e diclorometano em *Trichophyton. rubrum* e *T. menthagrophytes* foi observado na concentração de 4 µg/mL. A inibição do crescimento foi maior em comparação ao miconazol, medicamento de referência utilizado, que foi avaliado em 8 µg/mL. Este estudo corrobora o conhecimento tradicional da comunidade de Xochipala, Guerrero que utiliza a raiz de *G. glauca*, mostrando atividade antimicrobiana para o tratamento de lesões dérmicas que podem ser causadas por agentes infecciosos como *Staphylococcus aureus, T. rubrum e T. Menthagrophytes.*

PALAVRAS-CHAVE: antifúngico, medicina tradicional, plantas medicinais, *Trichophyton menthagrophytes, Trichophyton rubrum.*

1. INTRODUCTION

Medicinal plants have always been an important resource for humanity. Around 70-95% of people worldwide use medicinal plants to meet their health needs (Robinson and Zhang, 2011). In Latin America, especially among indigenous populations, the use of medicinal plants is deeply rooted as it is component of health care and an important element in rituals within indigenous cultures (Montenegro and Stephens, 2006). In Mexico, a country recognized for its high biodiversity, it is estimated that there are around 3,000 to 4,500 plants with medicinal uses (CONABIO, 2020). The utilization of plant extracts in developing countries is based not only on traditional herbal knowledge but also on a growing body of preclinical and clinical research. The elderly population of Xochipala has a deep herbal knowledge. Xochipala community is located in the state of Guerrero, Mexico, and belongs to the municipality of Eduardo Neri. It has a territorial extent of 1,289 km^2 and is characterized by an average annual temperature of 25 °C with 684 mm of rainfall.

There are two main types of vegetation in the region surrounding Xochipala, including tropical deciduous forest and *Quercus* forest, with trees reaching heights of 10 to 15 m (Rzedowski, 1978; Jiménez *et al.* 2003). The total number of inhabitants is 3,989, mostly children from 0 to 14 years old. Economic activities include agriculture, mainly maize production and livestock (INEGI, 2020). The community has an outpatient unit and private medical offices (INEGI, 2020). However, patients also go to nearby cities such as Iguala or Chilpancingo for medical attention (Barrera and Chino, 2001). The most common medical conditions reported include dermatological, gastrointestinal, respiratory infections, malnutrition, and dengue.

The deep herbal knowledge is no longer shared by younger generations. González (2012) reported 77 species with medicinal uses grouped in 35 botanical families, including *Galphimia glauca*.

Galphimia glauca (Malpighiaceae), known locally as “calderona amarilla”or “arnica roja”, is a 1 to 3 m high shrub (Figure 1). The leaves are ovate or elongated, green above and bluish green below. The yellow flowers appear in clusters (Biblioteca de la Medicina Tradicional Mexicana, 2009).

Figure 1: *Galphimia glauca*

Source: Photography Margarita Aviles

Previous studies showed the effectiveness of *G. glauca* for the treatment of anxiety and depression (Guzmán-Gutiérrez *et al*. 2005; Herrera-Arellano, 2007; Sharma *et al*. 2012). *G. glauca* main component with sedative and relaxant properties is β-galphimine. Dorsch *et al*. (1992) reported the use of the methanolic extract for the treatment of bronchial reactions to allergens and as an anti-asthmatic agent. *G. glauca* has also exhibited anti-inflammatory effects (Sharma *et al*. 2012).

In Xochipala, Gómez (1981) reported four plants with hypoglycemic properties, including *G. glauca*. The root, bark and flowers are used to treat pimples on the penis and vagina. The treatment is carried out by applying vaginal washes with the boiled root. The washes with boiled root are also used to treat wounds caused by childbirth (Flores, 1990).

Ethnobotanical research was carried out in the community of Xochipala, Guerrero to gather information on the medicinal use of *G. glauca* as well as to determine the plants used in the community for the treatment of infectious diseases of the reproductive system (skin pimples). The antimicrobial activity of crude extracts of the root was also evaluated.

2. MATERIALS AND METHODS

2.1 PLANT MATERIAL

The root of *G. glauca* was collected in April in the archaeological zone "La Organera"(17° 47' 478"N; 99° 37' 877"W). The material was dried in a place at room temperature and kept in a box to avoid degradation of the photosensitive compounds. Specimens were prepared and deposited at this institution under the code (registration number 0001782), Faculty of Sciences (FCME), UNAM.

Plant roots were shade-dried at room temperature, powdered material was extracted sequentially using Soxhlet equipment with polarity gradient solvents such as n-hexane, dichloromethane, and methanol (40 g per 1000 mL) each for 8 hours at room temperature were performed. The extracts were evaporated under reduced pressure using a rotary evaporator (BUCHI B490). Finally, the resulting crude extracts were stored at -20 °C until they were tested.

For the aqueous extract, 40 g of dried and grounded root was added to 1 L of water for 10 hours, protected from light at room temperature. The resulting liquid was filtered using a funnel, a Kitasato flask, and cotton. A total volume of 800 ml filtrate was obtained, which was distributed into six ball flasks and frozen with dry ice. The frozen solution was lyophilized and the aqueous extract was stored at 4 ºC.

2.2 ETHNOBOTANIC METHOD.

For the collection of ethnobotanic information, we followed the approach proposed by Gispert *et al*. (1971). Two preliminary interviews were conducted with key informants. Final surveys were then prepared and distributed in three schools in the community. Home visits were conducted to clarify any ambiguous information in the answers. A database was prepared for data analysis and the preparation of graphs.

The informants were asked to describe the uses and names of plants used for the healing of pimples and skin wounds. The information was organized in a hierarchical list according to importance and frequency of use to apply the Friedman index (Friedman *et al.* 1986). This index indicates the potentially most

effective plant species. The Friedman index is expressed from 0 to 100, with a high value indicating the high effectiveness of the plant. The Friedman index is computed as follows:

$$FL = (Ip / It)\, x\ 100$$

where:

Ip is the number of informants mentioning a species with medicinal use (frequency of mention), and *It* is the total number of informants (Friedman *et al.* 1986).

2.3 ANTIMICROBIAL ACTIVITY

The microorganisms used for the antimicrobial evaluation from the American Type Culture Collection (ATCC, Rockville, MD) were obtained from the microbiology laboratory of the Centro de Investigación Biomédica del Sur CIBIS, IMSS (Xochitepec, Morelos). The bacterial strains used were *Staphylococcus aureus* (ATCC 29213), *Enterococcus faecalis* (ATCC 29212), *Escherichia coli* (ATCC 25922), *Proteus mirabilis* (ATCC 43071), and *Salmonella Typhi* (ATCC 06539). The fungal strains were *Candida albicans* (ATCC 10231), *Trichophyton mentagrophytes* (ATCC 28185), and *Trichophyton rubrum* (ATCC 28188). The antibacterial and antifungal activity were evaluated using the double serial dilution method in agar suggested by Rojas and collaborators (2001).

The hexanic, dichloromethane, methanolic and water extracts were individually dissolved in 2% dimethylsulfoxide (DMSO Merck). Further two-fold dilutions of each extract were performed using sterile distilled water and were added to melted agar culture medium in 100 mm x 15 mm Petri dishes (Falcon) at the final concentration of 4 and 8µg/mL. Agar culture medium and DMSO 2% were used as negative controls.

2.4 ANTIBACTERIAL ACTIVITY

Bacterial suspensions for each bacterium were prepared by transferring five or six colonies, chosen after overnight growth on Tryptic Soy agar, to 5 mL

of Mueller-Hinton broth (MHB Merck). Cultures were incubated at 36 ºC until they were visibly turbid, and the suspensions were then diluted until the turbidity matched the 0.5 McFarland standard turbidity equivalents (108 colony-forming units (CFU)/ mL). Microbial suspensions were further diluted 1:10 to obtain a concentration of 10^7 CFU/mL. The diluted inoculum of each bacterium was applied with a loop calibrated to deliver 0.002 mL, resulting in a spot covering a circle of 5 to 8 mm diameter and containing 10^4 CFU/mL. The plates were incubated for 24 h at 36 ºC. Gentamicyn (Sigma) was used as reference standard. Observations were performed in duplicate and results expressed as the lowest concentration of plant extract that produced a complete suppression of colony growth, the minimal inhibitory concentration (MIC).

2.5 ANTIFUNGAL ACTIVITY

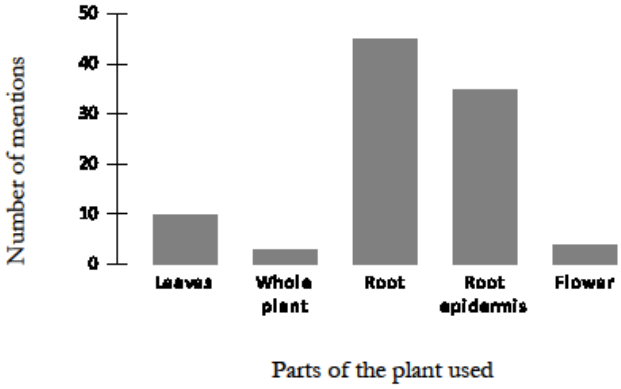
C. albicans inoculum was prepared by diluting the yeast suspension (adjusted to McFarland 0.5 scale) in 0.85% NaCl solution to a final concentration of 105 cell/mL. The filamentous fungi inoculums were prepared by diluting the scraped cells mass in 0.85% NaCl to a final concentration of 106 spore/mL. The diluted inoculums were delivered on the top of the solidified agar with a loop calibrated to deliver 0.005 mL. The plates were incubated at 29°C. Fungal growth was checked both in control plates prepared without any test sample and in experimental plates; the time at which fungal growth was checked was either 24, 48, or 72 h, depending on the incubation time required for a visible growth; 24 h for *C. albicans*, and 72 h for the dermatophytes. Experiments were duplicated and results expressed as MIC. Positive controls were prepared with Myconazol (Sigma) and Nystatin (Merck).

3. RESULTS

A total of 126 interviews of the inhabitants of Xochipala, Guerrero were analyzed. The best-known names for *Galphimia glauca* include “tespancolole”(51.1 %), “flor de estrella”(34.4 %) and “zompancolole”(14.4 %).

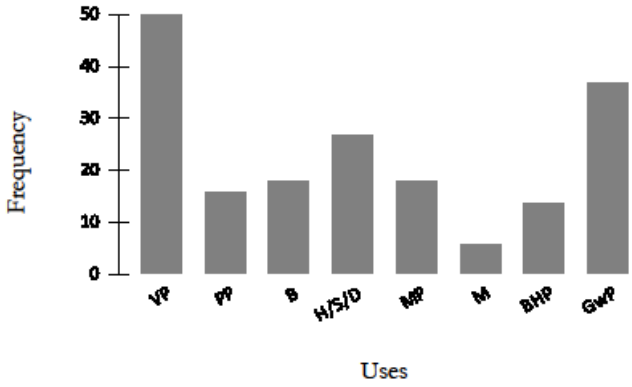
The most used parts of the plant are the root and its epidermis (Figure 2), which are used to treat vaginal pimples, pimples with pus, and pimples caused by heat, soil and/or dirty water in any part of the body (Figure 3).

Figure 2: Parts used of *G. glauca* in Xochipala, México



Source: Authors

Figure 3: Main *Galphimia glauca´*s dermal uses reported. VP: vaginal pimples, PP: penile pimples, B: waders' bites, H/S/D: pimples caused by heat, soil, and/or dirty water, MP: mouth pimples, M: mites, BHP: pimples in babies' heads, and GwP: pimples with pus.



Source: Authors

Four main plants were reported for the treatment of skin pimples. *G*. *glauca* or "tespancolole"was the most frequently used (54.9 %), followed by *Hintonia latifolia* or "copalchi"(27.4 %), *Dorstenia drakena* or "gallito"(0.87 %), and *Ziziphus amole* or "corongoro"(7.83 %).

The antifungal effect of the methanolic and dichloromethane extracts on *T. rubrum* and *T. mentagrophytes* was observed at a concentration of 4 µg/mL (Table 1). Growth inhibition was higher when compared to miconazole, the reference drug used, which was evaluated at 8 µg/mL. The minimum inhibitory concentration (MIC)

in the other microorganisms was 8 µg/mL or higher in all evaluated extracts compared to the broad-spectrum antibiotic gentamicin (5 µg/mL).

Table 1. Antimicrobial activity of *G. glauca* root extracts (µg/mL). H: hexanic extract, D: dichloromethanic extract, MT: methanolic extract, A: aqueous extract, G: gentamicin, MC: miconazole, NA: not applicable. SA: *Staphylococcus aureus*, EF: *Enterococcus faecalis,* EC: *Escherichia coli*, PM: *Proteus mirabilis*, ST: *Salmonella typhi*, CA: *Candida albicans*, TM: *Trichophyton mentagrophytes,* and TP: *Trichophyton rubrum.*

	Extract	Minimum inhibitory concentration (MIC) in µg/mL							
		Bacteria					Fungi		
		SA	EF	ST	EC	PM	TR	TM	CA
	H	8	> 8	> 8	> 8	> 8	8	8	> 8
	D	>8	>8	> 8	> 8	> 8	4	4	> 8
	MT	8	8	> 8	> 8	> 8	4	4	> 8
	A	8	> 8	> 8	> 8	> 8	>8	>8	> 8
G		5					NA		
MC		NA					8		

Source: Authors

4. DISCUSSION

Based on the conducted interviews, *G. glauca* is the most effective plant, followed by *Hintonia latiflora (Rubiaceae)*, for the treatment of skin diseases and/or skin lesions in the community of Xochipala, Guerrero.

G. glauca is mainly known as "Tespancolole", with the root being the most used part of the plant to treat pimples or dermal vaginal eruptions, which may be caused by sexually transmitted diseases.

However, it is difficult to identify the causative agent as skin symptoms can be caused by bacteria, viruses, protozoa, or parasites. Currently, more than 30 pathogens are known to cause about 50 clinical symptoms on the skin (Domingo, 2017). The different dermal lesions for which this plant is used can be caused by factors such as heat, soil, and water, as well as mites (Trombiculidae family) and bacterial and/or fungal infections.

This study is the first report on the antimicrobial activity of *G. glauca* root extracts with promising antifungal properties against *T. rubrum and T. mentagrophytes*. Fungal skin infections refer to those caused by dermatophytes.

Dermatophytes are fungi with the particularity of developing in the keratin, the protein making up stratum corneum, hair, nails and/or mucous membranes (Sánchez-Saldaña *et al.* 2009). Some dermatophytes belong to the genus *Trichophyton,* specifically *T. rubrum* and *T. mentagrophytes,* which cause athlete's foot and onychomycosis, conditions that are difficult to treat (Brillowska-Dabrowska *et al.* 2007; Rezusta *et al.* 1990; Romero *et al.* 2009). Topical treatment may fail due to a lack of treatment compliance, the presence of other dermatological conditions (psoriasis, contact eczema, etc.) or concomitant bacterial infections, and/or because topical treatment is not possible (Molina, 2011).

The antifungal activity of *G. glauca* has been reported using the aerial parts of the plant. The hexane extract showed activity for *T. rubrum* and *T. mentagrophytes* at a minimum concentration of 4.0 and 8.0 mg/mL, respectively (Navarro *et al.* 2003), while in the present study, the MIC was observed at 4µg/mL. This discrepancy may be due to the different collection sites since metabolites and their quantities vary according to the place where the plant is collected (García-Granados *et al.* 2019), as well as the collection date and the plant's reproductive stage at the time of collection, another factor may be the part of the plant use (Sepúlveda-Vázquez *et al.* 2018). Navarro and collaborators (2003) used aerial parts, whereas the root was used in the present study. The plants used in both studies were subjected to different environmental factors, such as temperature, precipitation, competition for nutrients, and predation, therefore, the type and number of secondary metabolites may vary (Sépulveda-Jímenez *et al.* 2003). In each organ, tissue, or cell type of the plant, specific synthesis of secondary metabolites can take place. Also, there are metabolites that are synthesized in all organs and tissues of the plant but are stored in organs or tissues different from the place where they were synthetized (Ojito and Portal, 2017).

The effect of the dichloromethanic and methanolic extracts, which are extracted using medium and high polarity solvents, was observed on *T. rubrum* and *T. mentagrophytes*. Cetto (1995) reported the presence of flavonoids in the methanolic extract of the root of *G. glauca* by colorimetric tests.

According to the literature, flavonoids have anti-inflammatory, antimicrobial, antiallergic, antitumor, anticancer, and antioxidant properties (Escamilla *et al.* 2009). Some of the flavonoids reported in *G. glauca* are

quercetin, kaempferol, and beta-sitosterol (Prieto and Monturiol, 2016), which could be the cause of the antimicrobial effect.

Bacterial skin infections located in the epidermis, dermis and/or subcutaneous cellular tissue are related to a broad group of clinical conditions of diverse etiology, pathogenesis, and prognosis (Sánchez-Saldaña and Sáenz-Anduaga, 2006). *S. aureus* growth, associated with pathogenic situations such as pimples, boils, scalded skin syndrome and pustules, is responsible for 30-90% of wound infections (Madigan, 2001; Mantilla *et al.* 2009). The hexanic, methanolic, and aqueous extracts of *G. glauca* root showed activity against *S. aureus* at an MIC of 8 µg/mL.

5. CONCLUSION

This study supports the traditional knowledge of the community of Xochipala, Guerrero that uses the root of *G. glauca,* showing antimicrobial activity for the treatment of dermal lesions that may be due to infectious agents such as *S. aureus*, *T. rubrum,* and *T. mentagrophytes*. The doors are open for new research to characterize and quantify the secondary metabolites in the root as well as the antiviral effect of *G. glauca* on sexually transmitted diseases such as herpes type I and II, which have a prevalence of 18.2% to 29.8% in Mexico (Gayet, 2015). Based on the present research, we can highlight the promising pharmacological use of the root of *G. glauca* for the treatment of athlete's foot and onychomycosis caused by *T. rubrum* and *T. mentagrophytes*.

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REFERENCES

BARRERA, R. CHINO, H. 2001. **Monografía de Xochipala, Guerrero,** México. CONACULTA- Unidad Regional de Culturas Populares. 117p.

BIBLIOTECA DE LA MEDICINA TRADICIONAL MEXICANA. 2009. **Atlas de las plantas de la medicina tradicional mexicana: Galphimia glauca cav.** Mexico. http://www.medicinatradicionalmexicana.unam.mx/apmtm/termino.php?l=3&t=galphimia-glauca (Accessed May 19, 2021).

BRILLOWSKA-DABROWSKA A, Saunte DM, Arendrup MC. 2007. Five-hour diagnosis of dermatophyte nails infections with specific detection of **Trichophyton rubrum**. **J Clin Microbiol**; 45. DOI: https://dx.doi.org/10.1128%2FJCM.02072-06.

CETTO, A. 1995. **Ethnobotanical and phytochemical study of useful plants in the region of Xochipala, Guerrero. For the control of type 2 diabetes**. MSc. Thesis. Faculty of Sciences, UNAM.

CONABIO [National Commission for the Knowledge and Use of Biodiversity]. 2020. **Plantas medicinales [Medicinal plants]**. Mexico City, Mexico. https://www.biodiversidad.gob.mx/diversidad/medicinal/plantas. (Accessed February 12, 2021).

DOMINGO, P. 2017. Sexually transmitted infections. **Comprehensive Pediatrics** 21.

DORSCH W., BITTINGER, M., KAAS, A., MÜLLER, A., KREHER, B., WAGNER, H. 1992. Antiasthmatic effects of Galphimia glauca, gallic acid, and related compounds prevent allergen-and platelet-activating factor-induced bronchial obstruction as well as bronchial hyperreactivity in guinea pigs. **Int. Arch. Allergy Immunol.** DOI: https://doi.org/10.1159/000236088.

ESCAMILLA, C., MARTÍNEZ, C. and GUEVARA, J. 2009 Flavonoids and their antioxidant actions. **Rev Fac Med.** 52.

FRIEDMAN, J., YANIV, Z., DAFNI, A., PALEWITCH, D. 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. **Journal of Ethnopharmacology, 16.** DOI: https://doi.org/10.1016/0378-8741(86)90094-2.

GARCÍA-GRANADOS, R., CRUZ-SOSA, F., ALARCÓN-AGUILAR, F., NIETO-TRUJILLO, A. & GALLEGOS-MARTÍNEZ, M.A. 2019. Análisis fitoquímico cualitativo de los extractos acuosos de **Thalassia testudinum** banks ex Köning **et** sims de la localidad de Champotón, Campeche, México, durante el ciclo anual 2016-2017. **Polibotánica,** 48. ISSN electrónico: 2395-9525.

GISPERT, M. M. N., DIEGO, J., JIMÉNEZ, A., GÓMEZ, J. M.. Quintanilla and L. García. 1971. A New Approach to Ethnobotanical Methodology in Mexico. **Medicina Tradicional II** 7.

GONZÁLEZ, A. 2012**. Ethnobotany: factors of change in the traditional use of the flora of Xochipala, Guerrero.** MSc. Thesis. Institute of Anthropological Research, UNAM.

GUZMÁN-GUTIÉRREZ, S.L, REYES-CHILPA, R, BONILLA-JAIME, H. 2014. Medicinal plants for the treatment of "nervios", anxiety, and depression in Mexican traditional medicine**. Rev. Bras. Farmacogn. 24.** DOI: https://doi.org/10.1016/j.bjp.2014.10.007
HERRERA-ARELLANO A., Jiménez-Ferrer E., Zamilpa A., Morales-Valdéz M., García-Valencia C.E., Tortoriello J. 2007. Efficacy and tolerability of a standardized herbal product from **Galphimia glauca** on generalized anxiety disorder. A randomized, double-blind clinical trial controlled with lorazepam. **Planta Med**. **73.** DOI: https://doi.org/10.1055/s-2007-981539.

INEGI [National Institute of Statistics and Geography]. 2020. **Population and Housing Census 2020: Xochipala, Guerrero.** Mexico. https://www.inegi.org.mx/app/areas geograficas/?ag=12 (Accessed February 02, 2021).

JIMÉNEZ, J; MARTÍNEZ, M; VALENCIA, S; CRUZ, R; CONTRERAS, J.L MORENO, E; CALÓNICO, J. 2003. Floristic study of the municipality of Eduardo Neri, Guerrero. **Annals of the Institute of Biology, UNAM, Botanical Series 74**. ISSN: 0185-254X

MADIGAN M.T; MARTINKO, J.M; PARKER, J. 2001. **Brock. Biology of Microorganisms.** Prentice Hall. ISBN: 968-880-325-1.

MANTILLA J, VÁSQUEZ, A. DÍAZ, J 2009. Cutaneous manifestations of fulminant Staphylococcus aureus sepsis. An autopsy study. **Rev Asoc Col Dermatol.** 17.

MOLINA, A. 2011. Clinical, diagnostic and therapeutic aspects of dermatophytosis. **Enferm Infecc Microbiol Clin 29.** DOI: 10.1016/S0213-005X(11)70025-8.

MONTENEGRO, P., & Stephens, C. 2006. Indigenous health in Latin America and the Caribbean. **The Lancet**, **367.** DOI: https://doi.org/10.1016/S0140-6736(06)68808-9

NAVARRO V.N., González A., Fuentes M., Avilés M., Ríos M., Zepeda G., Rojas M. 2003. Antifungal activities of nine traditional Mexican medicinal plants. **J. Ethnopharmacol;** 87 DOI: https://doi.org/10.1016/s0378-8741(03)00114-4.

OJITO, K., PORTAL, O. 2017. **Plant secondary metabolites, an alternative for disease management in crops of economic interest**. Spain. Spanish academic publishing house. ISBN: 978-620-2-25008-5.

PRIETO, M., MONTURIOL, C. 2016. Antiallergic and anxiolytic potential of **Galphimia glauca**. **Journal of Phytotherapy** 16. ID: ibc-155718.

REZEDOWSKI, J..1978. **The vegetation of Mexico**. México. Limusa. ISBN: 978-968-1-80002-4

REZUSTA, A; RUBIO, M.C., ALEJANDRE, M.C.. 1990. Differentiation between **Trychophyton mentagrophytes** and **T. rubrum** by Sorbitol Assimilation. **Journal of Clinical Microbiology** 29. DOI: https://doi.org/10.1128/jcm.29.1.219-220.1991.

ROBINSON, M., M & ZHANG, X. 2011. **The world medicines situation 2011 Traditional medicines: Global situation, issues and challenges**. Geneva: World Health Organization. http://digicollection.org/hss/documents/s18063en/s18063en.pdf. (Accessed March 15, 2021).

ROJAS, G., LÈVARO, J., TORTORIELLO, J., NAVARRO, V. 2001. Antimicrobial evaluation of certain plants used in Mexican traditional medicine for treatment of respiratory diseases. **Journal of Ethnopharmacology.** 74. DOI: https://doi.org/10.1016/s0378-8741(00)00349-4.

ROMERO, C., RAMOS, R., ZAMILPA, A., FERRER, J., ROJAS, G., TORTORIELLO, J. 2009. Clinical trial to compare the effectiveness of two concentrations of the Ageratina pichinchensis extract in the topical treatment of onychomycosis. **Journal of Ethnopharmacology 126.** DOI: https://doi.org/10.1016/j.jep.2009.08.007.

SÁNCHEZ-SALDAÑA, L., MATOS-SÁNCHEZ, R., KUMAKA H. 2009. Superficial fungal infections. **Peruvian Dermatology 19.**

SÁNCHEZ-SALDAÑA L. SÁENZ-ANDUAGA, E.. 2006. Bacterial skin infections. **Dermatología Peruana** 16.

SEPÚLVEDA-JIMÉNEZ, G., PORTA-DUCOING, H., ROCHA-SOSA, M. (2003). La Participación de los Metabolitos Secundarios en la Defensa de las Plantas. **Revista Mexicana de Fitopatología.** México; 21(3): 355-363.

SEPÚLVEDA-VÁZQUEZ, J., TORRES-ACOSTA, J., SANDOVAL-CASTRO, C., MARTÍNEZ-PUC, J. & CHAN-PÉREZ, J. (2018). La importancia de los metabolitos secundarios en el control de nematodos gastrointestinales en ovinos con énfasis en Yucatán, México. **Journal of the Selva Andina Animal Science**. Bolivia; 5(2): 79-95.

SHARMA A., CARDOSO-TAKETA, A., CHOI, Y.H., Verpoorte R., Villarreal M.L. 2012. A comparison on the metabolic profiling of the Mexican anxiolytic and sedative plant **Galphimia glauca** four years later. **J. Ethnopharmacol.** 141. DOI: https://doi.org/10.1016/j.jep.2012.03.033.

CHAPTER 5

ARE MUNICIPAL POLICE OFFICERS EMOTIONALLY INTELLIGENT TO DEAL WITH OCCUPATIONAL STRESS AND AVOID BURNOUT?

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ABSTRACT: This article analyses how Emotional Intelligence (EI) can moderate the effects of two occupational stress variables (role conflict and role ambiguity) on the dimensions of Burnout Syndrome, based on interviews with 83 employees of the Oeiras Municipal Police. The results show that both role conflict and role ambiguity are positively related to exhaustion and depersonalization, and negatively to personal accomplishment, indicating that higher levels of conflict and ambiguity increase the risk of Burnout. Only three dimensions of EI-understanding the emotions of others, self-encouragement and self-control in the face of criticism-showed an association with the syndrome. Furthermore, EI moderated the impact of role conflict, which was more pronounced among individuals with higher EI.

KEYWORDS: burnout, emotional intelligence, Municipal Police, stress.

RESUMO: Este artigo visa analisar como a Inteligência Emocional (IE) pode moderar os efeitos de duas variáveis de stress ocupacional (conflito de funções e ambiguidade de funções) nas dimensões da síndrome de *Burnout*, com base em entrevistas a 83 funcionários da Polícia Municipal de Oeiras. Os resultados mostram que tanto o conflito quanto a ambiguidade de funções estão positivamente relacionados à exaustão e despersonalização, e negativamente à realização pessoal, indicando que maiores níveis de conflito e ambiguidade aumentam o risco de *Burnout*. Apenas três dimensões da IE: compreensão das emoções dos outros, autoencorajamento e autocontrole diante de críticas, mostraram uma associação

com esta síndrome. Além disso, a IE moderou o impacto do conflito de funções sendo mais pronunciado entre indivíduos com maior IE.

PALAVRAS-CHAVE: *burnout*, inteligência emocional, Polícia Municipal, stress.

1. INTRODUCTION

According to (Cooper, 1998), the growing interest in stress, especially occupational stress, is linked to rapid social changes. In recent decades, the world of work has undergone significant transformations, driven by changes in the global economy, social and political relations, technology and productive organization (Bansal, 2023). (Jiménez, 2005) This has led organizations to adapt to these changes, resulting, for example, in phenomena such as *downsizing* and increased working hours, which have a strong impact on the health and quality of life of workers (Roberts, 2002). The sources of stress (Almeida, et al., 2016)have been evaluated not only for their effects on the organizational environment - such as reduced productivity, job dissatisfaction, absenteeism and costs for companies - but also for their emotional impact on workers. In this context, (de Castro, 2007)it is stated that the phenomenon of burnout emerges as a result of prolonged involvement in emotionally draining situations and the difficulty in dealing with stress (Ahmady, 2007).

Both stress and burnout *are* significant issues that have been studied in a variety of professions (such as police officers, doctors, nurses, and teachers), especially those that involve direct contact with the public. This study highlights municipal police forces, whose main function is to cooperate in maintaining public order and protecting local communities (Paiva, 2011).

It is crucial to investigate these processes due to their high incidence, as they are associated with physical and mental illness among workers, resulting in high costs for companies and the government, related to low productivity and absenteeism (Maslach C. , 2001).

We cannot neglect another relevant concept, which is Emotional Intelligence. For a long time, emotions were excluded from the organizational environment (de Moura Abdalla, 2020), and it was common for workers to not associate personal matters with professional ones. However, according to (Mayer J. D., 2011), it is impossible to ignore emotions at work.

Hundreds of studies have been conducted, indicating that managers with high scores, including municipal police officers, in EI show less stress, better performance and physical and psychological well-being (Veras, 2022). These findings are confirmed by (Bar-On R. B., 2000), who observed that police officers

with greater self-awareness and awareness of others deal better with stressful events, using more effective coping strategies. Thus, Emotional Intelligence can act as a protective or moderating factor in the relationship between stress and burnout, allowing better adaptation to stressful work environments (Pires, 2019).

2. THEORETICAL FRAMEWORK

It is undeniable that the number of police institutions has increased in Portugal. This situation is mainly due to the intervention of the State in society, whose social assets increasingly need police protection. It is from this perspective that the Municipal Police Forces emerged, which constitute the main focus of this article.

However, given this need, other concepts arise that must be presented here in order to understand the magnitude and scope of the study developed. Thus, a survey of the concepts cited below was carried out, based on scientific articles, theses and dissertations. Therefore, a theoretical framework of the following concepts will be presented: Municipal Police, stress, burnout, depression, emotional intelligence and emotions.

2.1 MUNICIPAL POLICE

The importance of the Municipal Police in improving the safety of citizens, measuring this reality through contributions from the Municipal Police of Oeiras. The IV Constitutional Revision, in 1997, allowed Portuguese municipalities to create administrative police forces. These services, called Municipal Police, have been gradually emerging in several municipalities (Pereira A. , 2010).

Currently, the Municipal Police have their fundamental legal regulation in Law No. 19/2004, of May 20 (República, 2024), which, in accordance with the Constitution of the Portuguese Republic, establishes that they must be seen as municipal services, which operate in a territorially delimited space, which corresponds to the municipality to which each one belongs.

Under the terms of article 237, paragraph 3, of the Constitution (Republica, 2024), the Municipal Police are municipalized services, which must cooperate in maintaining public order and protecting local communities, exercising, in cooperation with the security forces, public security functions.

The concept of safety has become increasingly important among the population. It is also unquestionable to say that, currently, the issues of occupational stress and burnout are among the biggest.

In order to find adequate answers, we found that there are not many studies on this issue. In order to be able to make our contribution, we looked into this subject, having had the support of the responses from members of the Oeiras Municipal Police, in the preparation of this study. Thus, based on a survey, we consulted, as privileged actors, the officers of the Oeiras Municipal Police, in order to understand their perceptions regarding the security problems they face, in the context of occupational stress and burnout.

The genesis of the Municipal Police and the granting of security powers to municipal police forces did not emerge from the 20th century, since the origin of the police itself, in a historical-geographical framework, is related to its local and/or municipal vision (Valente 2014, 76). The origin of the Municipal Police was markedly urban: for example, in the 19th century, the Royal Police Guard of Lisbon and Porto stood out, which were under the command of the General Superintendent of Police (Barreto 1979, 117).

In the second half of the 19th century, with the publication of the 1867 Charter, the existence of rural guards dependent on the municipality was determined (Castro 2003, 150). Their existence was made mandatory in all municipalities, except in Lisbon, and they were appointed by the Municipal Councils, with the role of civil police agents, whose responsibility was to "*enforce all municipal and administrative regulations and bylaws, fine offenders, issue fines and report transgressions to the Public Prosecutor's Office so that it could request the application of penalties in court* "(Castro 2003, 170).

DL nº 4116/18, of April 29, was another important moment for entities with police functions. The Municipal Police forces of each municipality carried out administrative, judicial, security and rural police tasks under the direction of a Municipal Police Chief, directly reporting to the general (district) police chief. Thus, the Municipal Police functions are performed by employees, obeying orders from the central administration, leaving the administrators of the municipalities to exercise police functions (Castro 2003, 151).

The Administrative Code of 1936/40171 granted police powers to municipalities. Therefore, long before the current constitutional provision, more

specifically during the validity of the 1933 Constitution, municipalities were granted police powers, which at that time were considered to be powers of security of people and property (Caetano 1994, 328 and 330). This diploma included the police among the competences of the Municipal Councils, distinguishing from them the development, public supply, culture, assistance and public health.

2.2 STRESS AND THE TRANSACTIONAL AND INTERACTIONAL MODELS

The concept of stress has existed since the 14th century and its definition has been the subject of debate. Elliot and Eisdorfer, citing (Lazarus R. S., 1984), (Folkman, 2020)mention that to date no one has managed to create a definition of stress that would please most researchers. Despite the differences of opinion about the term, it is important to remember that the definition of stress influences the way research is conducted and the way results are presented (Cooper C.L., 2001).

The study of stress has grown over the years, with hundreds of research studies in areas such as medicine, psychology, economics, social policy and education. According to (Cooper C.L., 2001), each discipline investigates stress from its own perspective, which contributes to the lack of consensus on terminology. Some approaches view stress as a stimulus (independent variable), while others view it as a response (dependent variable).

In (Levi, 1987)(p.10), we can read the definition of stress as: "*The interaction, or mismatch, between environmental opportunities and demands and individual needs, abilities and expectations, which provoke reactions. When environmental demands exceed a person's capacity to respond, when expectations are not met, or when abilities are overtaxed or underutilized, the organism reacts with various pathogenic mechanisms. These can be cognitive, emotional, behavioral and/or physiological, and under certain conditions of intensity, frequency or duration, and in the presence or absence of certain interactive variables, can lead to precursors of disease*".

In turn, (Lazarus R. S., 1984)and (Folkman, 2020), defend a more relational view of stress, that is, they see stress as an interaction between the individual and the environment, considering that stress is not confined only to the individual or the environment, but in the relationship between both (Sara Rivero Baeza, 2023).

Regarding the transactional model, we should note that it focuses on the dynamics of the psychological processes of assessment and coping (Dias, 2009), seeking to understand the adaptation process. This model is different from the international model, which focuses on the structural characteristics of the interaction between the person and the environment (Cooper C.L., 2001). In the transactional model, stress is seen as the interaction between the person and the environment, and not just as something of the person or the environment (Lazarus R. S., 1990).

It can be read in (Lazarus R. S., 1984), that there is a cognitive dimension that considers a situation as threatening (evaluation), followed by a mental effort to deal with this situation, called coping. Thus, stress is seen as a response that includes physical reactions (such as increased blood pressure and heart rate), cognitive (evaluation and perceived control), behavioral (actions of escape or confrontation) and emotional (fear, anxiety, denial, excitement).

In summary, we can mention that this model suggests that stress is a dynamic mental state and is widely used in psychology. It offers a comprehensive explanation of stress processes, considering situational and personal mediation.

2.2.1 Occupational stress and its occupational stress meta-model

Second (Fernandes, 2023), work stress occurs when there is a gap between what a person can do and what the job demands, and this can affect the person's behavior and the organizational environment. This type of stress can be caused by several factors, such as the person, the characteristics of the job, the role in the organization, interpersonal relationships, the career, the organizational climate, and external factors such as family and personal interests (Cooper C.L., 2001).

These authors also say that stress can be costly for organizations and lead to uncertainty, especially during change (Uchoa, Costa, Silva, & Silva, 2021). For this reason, many companies now hold workshops on stress and time management to improve employee performance (Cooper C.L., 2001). They (Saxena, 2020) define stress at work as the expectations that bosses and colleagues have of an employee. Stress occurs when a person feels pressure to meet these expectations.

(Purnomo, 2021)describes that “*roll conflict*” (role conflict) and “*role ambiguity*” (role ambiguity) are the main causes of stress at work. "Role *conflict* “is when a person receives conflicting expectations and “*role ambiguity”* is when a person is not clear about their tasks and objectives at work (Karimi, 2014), describing four types of “*role conflict”*:

- *Intrasender roll conflict* - when a supervisor gives incompatible expectations.
- *Intersender roll conflict* - when multiple people give incompatible expectations.
- *Person roll conflict* - when a person's expectations conflict with those of the organization.
- *Inter roll conflict* - when a person has two or more roles with conflicting expectations.

Despite the various factors indicated, in this investigation we will only represent two stress factors (conflict and role ambiguity), as they are common problems for people who work directly with the public, such as municipal police officers.

Regarding the model, the “Meta-model of occupational stress”was created from several existing theories and research, and is called a meta-model because it combines many others and is compatible with previous theories on stress at work. It considers that stress factors at work are part of the environment (organizational/occupational) and that the impact of stress on the individual (tension) is part of the consequences on the human system. Therefore, stress factors and tensions are the two variables necessary to define a stressful situation at work.

Including the uncertainty theory of stress at work, which suggests that the experience of stress is a combination of uncertainty, importance and duration, also based on the theory of motivation by expectancy, where the worker is seen as proactive and his behaviors are based on the perception of his efforts and performance, and on the relationship between performance and results.

(Jacomossi, 2018) refers to how role conflict and role ambiguity are seen as stress factors in the workplace that cause uncertainty about the performance of tasks or the results that depend on good performance, and in the case of role

conflict, the worker does not know how to direct his effort to perform well, as he receives expectations that conflict.

While it is clear that good work is valued, when the work is very simple, the worker may doubt whether he will ever feel fulfillment and pride, as it is not so evident that he feels this way when performing simple tasks well. (Cooper C.L., 2001)

2.2.2 Control theory of the stress process at work

A model has been developed to assess stress at work, focusing on two dimensions: psychological demands and control. Demands include workload and task difficulty, while control refers to autonomy and creativity at work. This model describes stress as the result of an imbalance between job demands and the worker's ability to control it. Stress at work can cause health problems, such as (Vilela, 2014) burnout syndrome. (Cardoso, 2017). Control is one of the six risk factors in the workplace, along with overwork, reward, community, fairness, and values (SOARES, 2020).

The biggest control problem occurs when there is role conflict, and there are studies that demonstrate a strong relationship between role conflict and burnout, and the same happens with role ambiguity, but less consistently (Cordes C. L., 1993).

The models suggest that the mismatch between the work environment and the person's characteristics is the main source of stress, stress results from the interaction between the work environment, the individual and external factors and the discrepancies between the environment and the person affect personal well-being, leading to behaviors to reduce these discrepancies.

2.3 BURNOUT

The study of burnout began in the 1970s in the United States, with the first articles written by Freudenberger in 1975, with clinical and social psychology having a significant influence on the first studies, focusing on the symptoms and implications for mental health and relationships between people (Pereira A. M., 2015).

In the 1980s, research became more practical and quantitative, using questionnaires. (Maslach C. &., 1981) created the MBI (Maslach Burnout Inventory), a tool to measure burnout, initially aimed at people working in humanitarian services. Later, versions were developed for other professions, such as the MBI-ES for education and the MBI-GS for other areas (Demerouti, Nachreiner, Bakker, & Schaufeli, 2001). Thus, burnout *is a reaction to chronic stress at work, especially in professions that provide services to other people, and the* burnout syndrome is defined by three dimensions: exhaustion, cynicism and ineffectiveness (da Silva Schuster, 2015).

Emotional exhaustion refers to a lack of energy and difficulty facing a new day. It is usually caused by overwork and personal conflicts. Depersonalization/ cynicism represents indifference toward clients and coworkers, an attempt to distance oneself. Reduced personal fulfillment refers to feelings of incompetence and lack of productivity, often due to a lack of social support and opportunities for professional development. These three components help to understand burnout more broadly, compared to previous definitions that focused only on the individual's response to stress.

2.3.1 Causes and consequences of burnout syndrome

To better understand burnout, it is important to know that its causes are more linked to the work environment than to individual characteristics. According to (Evers, 2002), burnout results from a mismatch between the person and their work in six areas:

Overwork: Too much work can lead to burnout. Organizations often reduce headcount while increasing tasks. Lack of Control: Policies that limit worker autonomy, reducing their ability to make decisions. Inadequate Rewards: Inadequate pay and lack of recognition demotivate workers. Loss of Community: Job uncertainty and an excessive focus on short-term profits weaken teamwork.

Lack of Justice: Injustices in promotions and evaluations generate emotional exhaustion and cynicism. Conflict of Values: Differences between job demands and personal principles can cause ethical dilemmas.

These factors help explain why burnout is a significant problem in the workplace. (Carlotto, 2015)argues that the relationship between burnout and

stress is long-term, with burnout being caused by stress over time. However, few long-term studies have been done. Equity theories say that people try to balance what they give and receive, and adjust their behavior when they perceive injustice. Burnout can occur when workers feel that their social and organizational interactions are unfair. Factors such as role *conflict conflict)*, lack of clarity about what is expected (*role ambiguity)* and overwork (*role overload)* can be seen as a lack of equity, leading to burnout. Studies show that role stress, especially role conflict and role ambiguity, predict burnout.

(Cordes C. L., 1993) together with (Lee R. T., 1996) found that role conflict is related to emotional exhaustion (r = 0.53) and depersonalization (r = 0.37), but negatively to personal accomplishment (r = -0.21). Role ambiguity showed correlations with exhaustion (r = 0.21), depersonalization (r = 0.34), and personal accomplishment (r = 0.11). Role stress is associated with emotional exhaustion and depersonalization, but not with personal accomplishment, as emotional exhaustion occurs when workers feel they have no more emotional resources, and many use depersonalization as a defense (Lee R. T., 1996). Other studies also show that role stress predicts emotional exhaustion, depersonalization, and personal accomplishment (Tamayo, 2002).

Working conditions can be divided into demands (physical, psychological, social, organizational) and resources (social, psychological, physical, organizational) that help reduce the costs of these demands. The most important resources are job autonomy and social support. Demands become stressful when they have negative costs, such as depression and burnout.

In short, burnout is not just physical and emotional exhaustion from work overload. It also involves lack of interpersonal support and bureaucratic problems (*role conflict* and *role ambiguity)* that affect performance and achievement at work. To understand burnout, it is necessary to consider all of these stressors in the workplace.

2.3.2 Intelligence emotional

The concept of Emotional Intelligence (EI) was first defined to describe the mental processes used in recognizing, using, understanding, and managing the emotional states of oneself and others (Salovey, 1990). This concept was based

on social intelligence, identified by Thorndike in 1920, which is the ability to understand and manage people in social interactions. (Davis, 2011) In his theory of multiple intelligences, he included intrapersonal and interpersonal intelligence as components of social intelligence, referring to self-evaluation and understanding of one's own feelings, and the ability to understand and respond to the desires of others.

The different approaches to EI can be divided into two groups: 1 - Capability Models: Define EI as a set of cognitive abilities related to emotional functioning (da Silva, 2016) and Mixed Models: Incorporate personality characteristics and other traits (Oliveira, 2023).

Mixed models, such as (Bar-On R. , 1997), define EI as a set of non-cognitive skills that help deal with various life situations. The model identifies five main areas: self-awareness, interpersonal skills, adaptability, stress management, and general mood. These models do not include personality traits directly related to understanding and managing one's own emotions and reject the inclusion of cognitive abilities, considering EI as a personality characteristic.

(Mayer J. D., 1997) present a more theoretical model, defining EI as the ability to perceive, express, assimilate, understand and regulate emotions. They divide these abilities into several areas: perception, evaluation and expression of emotions; use of emotions to facilitate thinking; understanding and analyzing emotions; and regulation of emotions to promote well-being (Mayer J. D., 2004).

This view assumes a cooperation between intelligence and emotion (Ciarrochi, 2000). EI is considered a "hot intelligence", related to social, practical and emotional issues important to the individual.

Instruments for measuring EI can be divided into two groups: Self-reports: In which individuals report their level of EI, but are vulnerable to social desirability; and Performance Measures: These directly assess the individual's performance on specific tasks. Although self-report measures capture many aspects of personality, they are often used to assess EI as an ability.

2.3.3 Occupational stress, emotional intelligence and burnout

Stress is a relationship between a person and their environment and can be measured by people's perception of their ability to control situations and

feelings. Feeling in control is important for dealing with stressful situations. (Beck, 1976)said that a sense of control is associated with well-being, and other studies show that control also brings therapeutic benefits and physical well-being.

Individuals with a greater sense of control need less mental effort and use more complex defense mechanisms, such as sublimation, to solve emotional problems. They are also less prone to deviant and self-destructive behaviors, such as alcohol and drug abuse. He (Pellitteri, 2002)argues that the evaluation and regulation of emotions, components of Emotional Intelligence (EI), can prevent emotional exhaustion, which is the first manifestation of burnout.

Therefore, EI, by allowing better emotional interpretation and regulation in different social contexts, can moderate the relationship between work stress and burnout.

3. SAMPLE

A total of 83 questionnaires were sent out, representing the entire universe of the Oeiras Municipal Police. The sampling was for convenience, with data collected according to availability and accessibility through a survey sent electronically, thus ensuring complete confidentiality. We obtained 51 responses, representing approximately 61% of the sample.

Instruments: To operationalize the variables, a questionnaire with demographic data and items from three previously validated independent instruments was used:

- Role Stress: The *Role Distress Scales were used* to (Siegall, 2000) complement the scale (Rizzo, 1970), increasing it to 28 items. Two subscales were created: *role conflict* (12 items, e.g., “I have received incompatible requests from one or more people”) and *role ambiguity* (16 items, e.g., “I know exactly what is expected of me”). Responses range from 0 (never) to 6 (every day). The scale has been translated and validated for the Brazilian population.
- Burnout: The scale used was the Maslach Burnout Inventory (MBI) (Lee R. T., 1990) with 22 items (excluding the “Engagement” subscale). It includes items such as: “I feel fatigued after a day’s work”, “I feel indifferent to people because of my work” and “I can easily create a relaxed

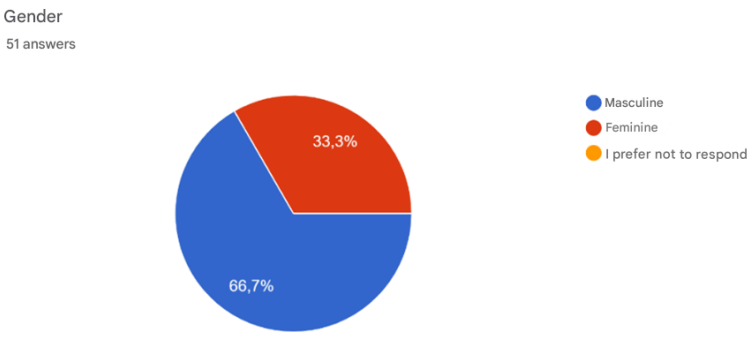
environment with residents". Responses range from 0 (never) to 6 (every day). The scale has been validated for the Portuguese population(Lúcia Cunha Dornelles, et al., 1996)

- Emotional Intelligence: The Emotional Intelligence scale was used (Rego A. &., 2005), consisting of six subscales: understanding one's own emotions, self-control in the face of criticism, self-help, emotional self-control, empathy and understanding the emotions of others. Examples of items include: "I understand my feelings and emotions" and "When a friend of mine wins an award, I feel happy for him/her". The questionnaire contains 23 items, with responses ranging from 1 (does not apply to me at all) to 7 (completely applies to me). The authors tested the predictive value of EI for health and life satisfaction, obtaining 14% and 26% of explained variance, respectively. The model proved to be satisfactory with adequate internal consistencies.(Rego A. &., 2005)

3.1 ANALYZING DEMOGRAPHIC VARIABLES

33.3% of respondents are women and 66.7% are men.

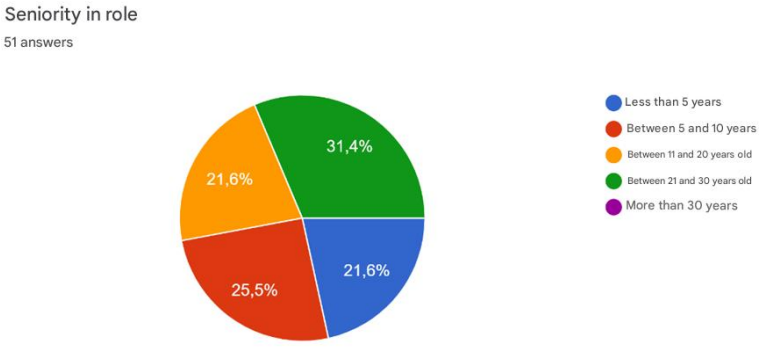
Figure 1 - Gender



Source: Authors.

Regarding seniority in the role, it can be seen that 31.4% are between 21 and 30 years, 21.6% between 11 and 20 years, 25.5% between 5 and 10 years and finally 21.6% with less than 5 years.

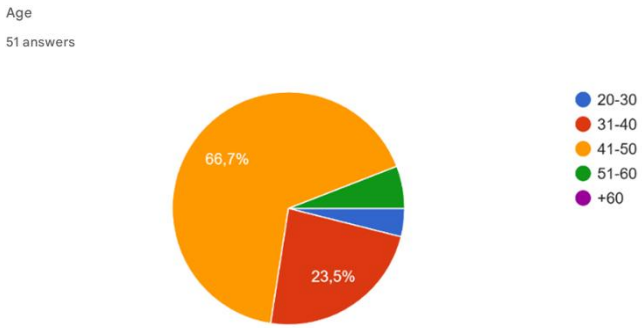
Figure 2 – Seniority in the role



Source: Authors.

The sample is relatively old, with the majority over 41 years old (66.7%), and only 3.9% between 20 and 30 years old.

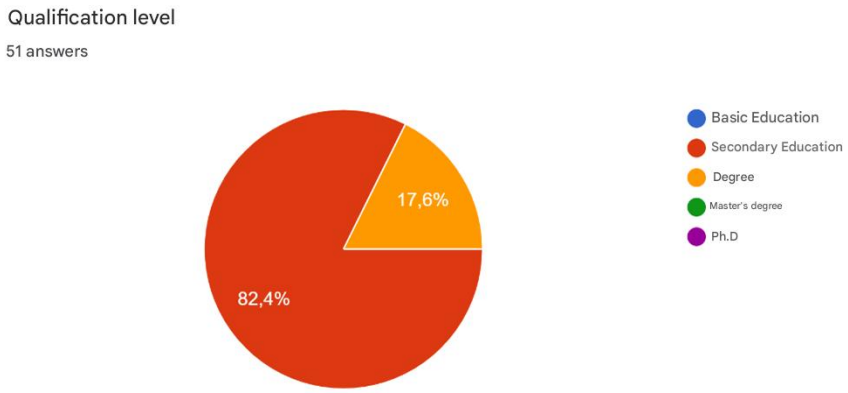
Figure 3 - Age



Source: Authors.

Regarding education, 82.4% have completed high school and 17.6% have a degree.

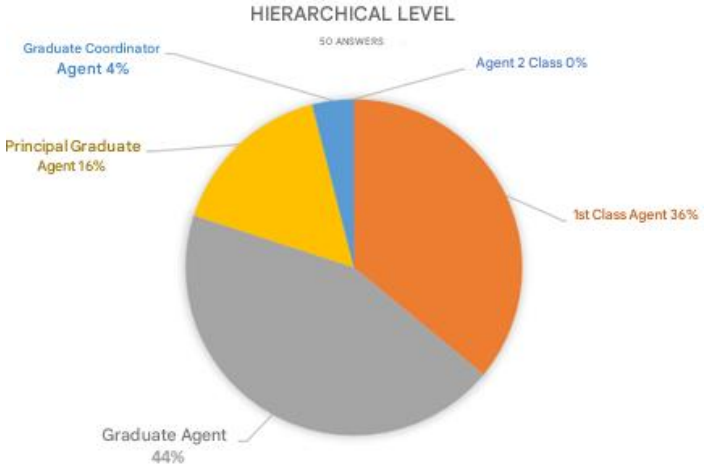
Figure 4 – Level of qualifications



Source: Authors.

Regarding the hierarchical level, we can see that the vast majority of the sample shows that 44% of the police force holds the hierarchical level of Graduate Agent, followed by 36% of 1st class Agent, 16% of Main Graduate Agent and only 4% of Graduate Coordinating Agents.

Figure 5 – Hierarchical level



Source: Authors.

3.2 ANALYSIS OF DESCRIPTIVE STATISTICS

Regarding the responses obtained to the following questions, based on this scale, we can report the results detailed below.

Figure 6 – Results

Nothing really applies to me	In general, it doesn't apply to me	Little is applied	Something applies	It applies a lot	Too much applies	It applies completely to me

No.	Question
1	I understand my feelings and emotions.
2	I don't deal well with criticism.
3	When a friend of mine wins an award, I feel happy for him.
4	I react calmly when I'm under pressure.
5	I am indifferent to the happiness of others.
6	I can remain calm even when others get angry.
7	I feel good when a friend of mine receives a compliment.
8	When I'm defeated in a game, I lose control.
9	I experience my friends' problems as if they were my own.
10	I understand the causes of my emotions.
11	I strive to understand other people's points of view.
12	I am actually able to control my own emotions.
13	I have difficulty talking to people who do not share the same views as me.
14	I usually encourage myself to do my best.
15	I get irritated when people criticize me even though I know other people are right.
16	In general, I am aware of my feelings.
17	I try to understand the feelings of the person I am listening to.
18	I can understand my friends' emotions and feelings by seeing their behavior.
19	I do my best to achieve the goals I set for myself.
20	When I'm sad, I know the reasons why
21	It's hard for me to accept criticism
22	I generally set goals for myself.
23	I know exactly what I feel.

Source: Authors.

In general observations, we can see that the following sets of analyses stand out:

- Empathy and Understanding: The responses indicate a high level of empathy and understanding of the feelings of others, with many positive responses to questions related to feeling happy for friends and understanding the feelings of others.
- Self-control and Resilience: The responses show a good capacity for self-control and resilience, especially in situations of pressure and criticism.
- Self-awareness: There is a strong awareness of one's own feelings and emotions, with many responses indicating that the municipal police officers under study understand their emotions and their causes well.

Regarding the statistical summary, we can see that statistically, there are two sets of questions regarding the level of agreement, as follows:

Questions with the highest agreement:

- Question 3: “When a friend of mine wins an award, I feel happy for him”– 31 answers “This completely applies to me.”
- Question 7: “I feel good when a friend of mine receives a compliment”– 32 responses “Completely applies to me.”
- Question 19: “I do my best to achieve the goals I set for myself”– 20 answers “This completely applies to me.”

Questions with least disagreement:

- Question 5: “I am indifferent to the happiness of others”- 24 answer “It strictly does not apply to me at all.”
- Question 8: “When I am defeated in a game, I lose control”- 22 answer “It strictly does not apply to me at all.”
- Question 13: “I have difficulty talking to people who do not share identical views to mine”- 16 response “None of this strictly applies to me.”

The analysis and construction of a correlation table were also carried out, and it was possible to obtain a positive correlation in values close to 1 indicating a strong positive correlation. For example, “Absolutely nothing applies to me” and “Generally it does not apply to me” have a correlation of 0.78 and a negative correlation in values close to -1 indicates a strong negative correlation. For example, “Absolutely nothing applies to me” and “It applies completely to me” have a correlation of -0.76.

Figure 7 - Correlation table

	Nothing really applies to me	In general, it doesn't apply to me	Little is applied	Something applies	It applies a lot	Too much applies	It applies completely to me
Nothing really applies to me	1	0,78	0,09	-0,62	-0,75	-0,71	-0,76
In general, it doesn't apply to me	0,78	1	0,09	-0,62	-0,75	-0,71	-0,76
Little is applied	0,09	0,09	1	-62	-0,75	-0,71	-0,76
Something applies	-0,62	0,062	-0,62	1	-0,75	-0,71	-0,76
It applies a lot	-0,75	-0,75	-0,75	-75	1	-0,71	-0,76
Too much applies	-0,71	-0,71	-0,71	-0,71	-0,71	1	-0,76
It applies completely to me	-0,76	-0,76	-0,76	-0,76	-0,076	-0,76	1

Source: Authors.

It was also possible to obtain results that show some interesting correlations, namely:

1. Strong Positive Correlation: There is a strong positive correlation between “Absolutely none of this applies to me” and “Generally speaking, it does not apply to me” (0.78). This makes sense, since both responses indicate disagreement with the statement.
2. Strong Negative Correlation: The response “Not at all applicable to me” and “Completely applicable to me” have a strong negative correlation (-0.76). This is also expected, as they are opposite responses.
3. Surprises: One possible surprise is the relatively low correlation between “Applies to a Little” and other responses. This may indicate that people have more polarized responses, tending to either strongly agree or strongly disagree, rather than choosing a response somewhere in between. These correlations can help identify patterns in responses and better understand how people perceive their emotions and reactions.

Regarding the analysis of the distribution, we can see some observations: questions with extreme answers: some questions, such as “I am indifferent to the happiness of others” and “When I am defeated in a game, I lose control”, have many answers in “It does not apply to me at all”, indicating that most people strongly disagree with these statements; and questions with high agreement: questions such as “When a friend of mine wins a prize, I feel happy for him” and “I feel good when a friend of mine receives a compliment” have many answers in “It applies completely to me”, showing high agreement.

Descriptive statistics were performed with detailed analysis by question, in which the following was found:

Figure 8 - Descriptive statistics with detailed analysis by question

	Media	**Median**	**Standard Deviation**	**Minimum**	**Maximum**
1- I understand my feelings and emotions	4,02	5	1,73	0	6
2- I don't handle criticism well	1,86	1	1,6	0	6
3- When a friend of mine wins an award, I feel happy for them	5,06	6	1,41	0	6
4- I react calmly when under pressure	3,41	4	1,67	0	6
5- I'm indifferent to the happiness of others	0,82	0	1,24	0	6

Source: Authors.

Regarding question 1, we found that most municipal police officers in the sample consider themselves aware of their feelings, but there is considerable variation among the municipal police officers surveyed, indicating significant individual differences in emotional self-perception. In question 2, it was found that many municipal police officers have difficulty dealing with criticism, with a low average and variability that shows that some people feel particularly affected while others do not. In turn, in question 3, most municipal police officers feel happy when friends win awards, showing high empathy and joy for other people's achievements. In question 4, we can see that the ability to remain calm under pressure varies greatly, with a moderate average indicating that while some municipal police officers can deal with it well, others have more difficulty. Finally, in this set of questions, we can also see that in question 5, most municipal police officers are not indifferent to other people's happiness, which suggests a general tendency towards empathy.

Continuing the analysis, some subtleties were found in the responses of the municipal police officers surveyed. We can observe that the questions related to empathy and understanding the feelings of others (e.g.: questions 3, 5, 7, 17) tend to have high averages and smaller variations, indicating a high degree of empathy, while the items related to emotional control and reaction to criticism (e.g.: questions 2, 8, 15, 21) present lower averages and greater variability, suggesting an area for improvement.

Emotional Security and Personal Development: Considering these two concepts, it was found that the data provided reveals several areas that can be explored both to identify strengths and to discover opportunities for growth. Below are some ways in which this can be done:

1. High Empathy and Understanding of Others: questions such as "When a friend of mine wins an award, I feel happy for him" and "I try to understand the feelings of the person I am listening to" have high averages and low variations, indicating that most municipal police officers have a strong capacity for empathy and understanding.
2. Emotional Awareness: Questions such as "I understand my feelings and emotions" and "I know what I feel" show that many municipal police officers have a good awareness of their own emotions, which is crucial for personal development and mental health.

As for opportunities for development:

1. Dealing with Criticism: Questions such as "I do not deal well with criticism" and "It is difficult for me to accept criticism" have low mean and high variance scores, suggesting that many municipal police officers have difficulty dealing with negative feedback. Focusing on developing skills in accepting constructive criticism may be an important goal.
2. Emotional Control: Questions such as "I can remain calm even when others are angry" and "I react calmly when under pressure" indicate that some municipal police officers have difficulty remaining calm in stressful situations. Stress management strategies and *mindfulness techniques* may be beneficial.
3. Resilience: Difficulty in dealing with defeat or pressure (e.g., "When I'm defeated in a game, I lose control") suggests a need to develop emotional and mental resilience, which helps to better deal with failures and challenges.

Emotional Security, Personal Development and Burnout, adding the Burnout *variable* the following was found:

1. Emotional Safety: Emotional safety refers to the feeling of being protected and supported in an environment, whether at work, at home, or in social settings. When people feel emotionally safe, they are more likely to express their emotions and opinions without fear of criticism or negative judgment.

Table 1 - Identification of areas of emotional safety

Identifying Areas of Emotional Safety:
High Empathy and Social Connectivity:
Question 3: When a friend of mine wins a prize, I feel happy for him/her (Mean: 5.06, Median: 6) *Question 7: I feel good when a friend of mine receives a compliment* (Mean: 5.06, Median: 6) *Question 17: I try to understand the feelings of the person I am listening to* (Average: 4.90, Median: 5)
These questions demonstrate that many participants have a high degree of empathy and are happy for their friends' achievements and happiness, which indicates an environment of support and mutual understanding.

Source: Authors.

2. Personal Development: Personal development involves practices and strategies to improve individual aspects, including emotional and social skills. Self-knowledge and the ability to manage emotions are key components for personal growth.

Table 2 - Personal Development

Personal Development
Opportunities for Development:
Criticism Management and Self-Control
Question 2: I don't deal well with criticism (Average: 1.86, Median: 1) *Question 15: I get irritated when people criticize me even though I know other people are right* (Mean: 1.55, Median: 1)
Many participants have difficulty dealing with criticism, which suggests a significant area for development. Development programs could include training in constructive feedback and resilience techniques.
Emotional Control in Stressful Situations
Question 4: I react calmly when under pressure (Mean: 3.41, Median: 4) *Question 6: I can remain calm even when others are angry* (Mean: 3.61, Median: 4)
These areas indicate that there is a need to improve the ability to remain calm under pressure, through *mindfulness* and stress management techniques.

Source: Authors.

3. Burnout: is a state of exhaustion caused by chronic stress. It can affect the mental and physical health of municipal police officers, especially in environments where emotional support and personal development are lacking.

Table 3 - Burnout Indicators

Burnout Indicators :
Difficulty Accepting Criticism:
Question 21: It is difficult for me to accept criticism (Mean: 2.71, Median: 2)
Difficulty accepting criticism can contribute to feelings of inadequacy and stress, factors that can lead to burnout.
Negative Emotional Reactions:
Question 8: When I am defeated in a game, I lose control (Mean: 0.96, Median: 0) *Question 15: I get irritated when people criticize me even though I know other people are right* (Mean: 1.55, Median: 1)
These reactions indicate a low tolerance for failure and criticism, factors that can increase stress levels and the risk of burnout.

Source: Authors.

Based on the analysis carried out, we extracted the following aspects about the municipal police officers in the sample, highlighting their strengths and areas for improvement:

Table 4 - Strengths and areas for improvement

Forces
1. Empathy and Altruism:
Questions such as *"When a friend of mine wins an award, I feel happy for him"*(Mean: 5.06) and *"I feel good when a friend of mine receives a compliment"*(Mean: 5.06) indicate a high degree of empathy and mutual support. This suggests that police officers have a strong ability to take joy in the accomplishments of others, which is essential for teamwork and building positive relationships with the community.
2. Emotional Awareness:

Questions like *"I understand my feelings and emotions"* (Average: 4.02) and *"I know well what I feel"* (Average: 4.84). They show that many police officers have good emotional self-awareness, which is crucial for making balanced decisions and reacting appropriately in high-stress situations.
3. Dedication and Commitment:
The high average in the question *"I do my best to achieve the goals I set for myself"* (Average: 5.20). It indicates that police officers are dedicated and committed to their goals, a vital trait for effectiveness and fulfillment on the job.
Areas for Improvement
1. Acceptance of Criticism:
Questions like *"I don't deal well with criticism"* (Average: 1.86) and *"It's hard for me to accept criticism"* (Average: 2.71) They suggest that many officers have difficulty dealing with negative feedback. Development programs that focus on skills in accepting criticism and emotional resilience may be beneficial.
2. Stress Management: The ability to *"React calmly under pressure"* (Average: 3.41) and *"Remain calm even when others get angry"* (Average: 3.61) varies greatly. Suggesting the need to improve stress management. *Mindfulness techniques* and stress management training could be introduced to help police officers better cope with challenging situations.

Source: Authors.

3.3 CONSIDERATIONS ABOUT BURNOUT

The data suggests that while there are strong emotional and empathetic capacities, some areas such as accepting criticism and managing emotions under stress need attention to prevent burnout. Continuous exposure to stress without adequate tools to cope can lead to burnout, which would negatively affect both the health of police officers and their efficiency at work.

Based on the table provided, we can also analyze stress and burnout among municipal police officers, observing the responses related to stress response, ability to deal with criticism and other emotional variables. The focus was on questions that indicate stress levels and possible signs of burnout.

Table 5 - Stress levels and possible signs of burnout

Burnout Analysis
Stress Indicators
1. React Calmly Under Pressure:
Question 4: I react calmly when under pressure (Mean: 3.41, Median: 4, Standard Deviation: 1.67) The moderate mean and variability suggest that some officers are able to remain calm under pressure, but others have significant difficulty. The ability to cope with stress varies among participants, indicating that it may be a significant stressor.
2. Stay Calm Even When Others Are Angry:
Question 6: I can remain calm even when others are angry (Mean: 3.61, Median: 4, Standard Deviation: 1.60).

Similar to the previous question, the average response indicates that many police officers are able to remain calm, but a significant proportion are unable to do so. This can increase stress levels in conflict situations.
3. Acceptance of Criticism:
Question 2: I don't deal well with criticism (Mean: 1.86, Median: 1, Standard Deviation: 1.60) *Question 21: It is difficult for me to accept criticism* (Mean: 2.71, Median: 2, Standard Deviation: 1.52) Difficulty dealing with criticism can be a significant source of stress. Data suggests that many police officers feel uncomfortable with criticism, which can negatively impact their mental health.
Burnout Indicators
1. Emotional Exhaustion:
Question 15: I get irritated when people criticize me even though I know other people are right (Mean: 1.55, Median: 1, Standard Deviation: 1.27) *Question 8: When I am defeated in a game, I lose control* (Mean: 0.96, Median: 0, Standard Deviation: 1.41) Low averages and high variances suggest that some police officers become easily irritated and lose control in adverse situations, potential indicators of burnout.
2. Depersonalization:
Question 13: I have difficulty talking to people who do not share the same views as me (Mean: 1.33, Median: 1, Standard Deviation: 1.22) Difficulty interacting with different points of view may indicate depersonalization, a symptom of burnout where the individual feels disconnected from others.
3. Reduction in Personal Fulfillment:
Question 10: I understand the causes of my emotions (Mean: 4.33, Median: 5, Standard Deviation: 1.52) *Question 12: I am truly able to control my own emotions* (Mean: 4.55, Median: 5, Standard Deviation: 1.42) The moderate average suggests that while many officers feel able to control their emotions, there is significant variability. Those who cannot may experience reduced personal accomplishment, contributing to burnout.

Source: Authors.

3.4 STATISTICAL ANALYSIS OF VARIABLES

Based on the following questions, the following results were obtained for the set of variables: Conflict rules, Ambiguity rules, Self-help, Self-control in the face of criticism, Understanding the emotions of others, Emotional exhaustion, Depersonalization and Personal fulfillment.

Table 6 – Results for the set of variables

Never	**A few times a year**	**Once a month**	**A few times a month**	**Once a week**	**A few times a week**	**Every day**
No.	**Question**					
1 a).	I feel confident about the authority I have.					
b).	I know how to use my authority to get what I want at work.					
2 a).	There are clear, planned and objective goals in my work.					
b).	The goals and objectives of my work limit my actions too much.					
3 a).	I know I have been allocating my time appropriately.					
b).	The way I have been distributing my time will help me to be rewarded.					
4 a).	I know what my responsibilities are.					
b).	I'm not sure how to fulfill my responsibilities.					

5 a).	I know exactly what is expected of me.
b).	Of course, what rewards will I receive if I do exactly what is expected of me?
6 a).	The explanation is clear about what needs to be done.
b).	I'm not sure what I'll get if I do what needs to be done.
7 a).	I have to do things that should be done differently.
b).	I have strong feelings about how things should be done.
8 a).	I was given a task, without the ability to complete it.
b).	When I don't have the manpower to complete a task, it affects my ability to achieve personal goals, which I think are important.
9 a).	I have to ignore a rule or policy in order to complete a task.
b).	I would be in trouble if my boss found out I ignored the rules.
10 a).	Working with two or more groups that operate differently
b).	These same groups are very powerful.
11 a).	I received incompatible orders from two or more people.
b).	I really want these people to think well of me.
12 a).	I do things that are likely to be accepted by one person and not accepted by others.
b).	By doing things that are accepted by one person and not by others, it affects the type of rewards I receive.
13 a).	I was given a task without the proper resources and materials to complete it.
b).	When I don't have the right resources and materials, it reduces my ability to get what I want out of the job.
14 a).	I work on unnecessary things.
b).	There are other activities at work that I should be doing that are more important to me.
15.	In my work I don't feel emotions.
16.	I feel tired at the end of a day's work.
17.	I feel tired when I get up in the morning and have to go to work.
18.	I easily understand what the citizens feel.
19.	I feel like I treat some citizens as if they were impersonal objects.
20.	Working with people every day causes me stress.
21.	I deal effectively with the problems of the citizens.
22.	My work leaves me exhausted.
23.	I feel that through my work I positively influence people's lives.
24.	I feel indifferent to people because of my work
25.	I'm worried because this service has made me emotionally tougher.
26.	I feel very energetic.
27.	I feel frustrated at work.
28.	I feel like I'm working too hard.
29.	I don't care what will happen to some residents.
30.	Working directly with people causes me a lot of stress.
31.	I can easily create a relaxed atmosphere with the residents.
32.	I feel happy after being with the citizens.
33.	In my work I can do things of value.
34.	I feel “on the edge of the abyss”.
35.	In my work I deal very calmly with emotional problems.
36.	I feel like the citizens blame me for some of their problems.

Source: Authors.

The following table presents a general list of questions according to the respective variable: Conflict rules, Ambiguity rules, Self-help, Self-control in the face of criticism, Understanding the emotions of others, Emotional exhaustion, Depersonalization and Personal fulfillment.

Table 7 – General list of questions according to the respective variable

Conflict Rules:
Ambiguity Rules:
Related questions: 1a, 1b, 2a, 2b, 4a, 4b Analysis: These questions measure the clarity of goals and responsibilities in your work and how ambiguity can impact your effectiveness.
Self help:
Related questions: 5a, 5b, 6a, 6b Analysis: These questions assess your ability to self-motivate and how you feel about the rewards and expectations at work.
Self-Control When Dealing with Criticism:
Related questions: 7a, 7b, 8a, 8b Analysis: These questions measure how you handle criticism and challenges at work, and your ability to maintain control in difficult situations.
Understanding Others' Emotions:
Related questions: 18a, 18b, 21a, 21b Analysis: These questions assess your empathy and ability to understand and deal with the emotions of others in the workplace.
Emotional Exhaustion:
Related questions: 16a, 16b, 22a, 22b, 27a, 27b Analysis: These questions measure the level of emotional exhaustion you feel due to your work.
Depersonalization:
Related questions: 19a, 19b, 24a, 24b, 30a, 30b Analysis: These questions assess how often you feel depersonalized or indifferent toward others at work.
Personal Achievement :
Related questions: 23a, 23b, 33a, 33b Analysis: These questions measure your sense of accomplishment and personal satisfaction at work.

Source: Authors.

In the following table, the average and respective frequencies were calculated, in relation to the set of questions related to the variable, obtaining the following results:

Table 8 – Calculation of the mean and respective frequencies

Variable	Media	Frequency (Never)	Frequency (A few times a year)	Frequency (Once a month)	Frequency (A few times a month)	Frequency (Once a week)	Frequency (a few times a week)	Frequency (Every day)
Conflict rules								
Question 9a	3.5	10	11	7	7	8	4	4
Question 9b	3.0	14	9	5	4	3	9	7
Question 11a	3.0	15	8	7	7	7	2	5
Question 11b	2.5	16	7	5	2	4	7	10
Ambiguity rules								
Question 1a	5.0	1	2	0	2	4	17	25
Question 1b	4.9	1	3	1	3	3	18	22
Question 2a	3.5	1	5	9	9	7	13	7
Question 2b	3.9	1	4	2	13	8	13	10
Question 4a	6.0	0	2	0	2	3	10	34
Question 4b	1.9	20	8	6	2	5	9	1
Self-encouragement								
Question 5a	4.7	1	3	1	4	11	17	14
Question 5b	2.8	13	9	3	6	8	6	6
Question 6a	3.4	5	4	7	13	11	7	4
Question 6b	3.5	5	6	5	6	5	15	9
Self-control in the face of criticism								
Question 7a	3.4	5	10	3	9	11	10	3
Question 7b	4.8	1	4	1	3	8	21	13
Question 8a	1.8	16	13	8	4	5	5	0
Question 8b	3.0	9	8	7	2	10	10	5
Understanding the Emotions of Others								
Question 18a	4.8	0	7	1	5	7	21	10
Question 18b	3.0	30	10	2	1	3	2	3
Question 21a	4.8	0	3	2	8	7	17	14
Question 21b	3.0	11	13	5	0	6	11	5
Emotional exhaustion								
Question 16a	3.5	5	15	4	5	3	12	7
Question 16b	3.0	8	12	8	2	2	11	8
Question 22a	3.0	11	13	5	0	6	11	5
Question 22b	3.0	5	7	3	2	11	15	8
Question 27a	3.0	6	13	9	6	1	8	8
Question 27b	3.0	6	5	7	6	5	15	9
Depersonalization								
Question 19a	3.0	30	10	2	1	3	2	3
Question 19b	3.0	14	9	5	4	3	9	7
Question 24a	3.0	23	14	5	0	2	5	2
Question 24b	3.0	10	13	4	4	4	7	9
Question 30a	3.0	10	15	10	3	5	5	3
Question 30b	3.0	10	15	10	3	5	5	3
Personal fulfillment								
Question 23a	4.8	0	2	3	4	7	20	15
Question 23b	3.0	16	8	5	5	8	5	4
Question 33a	4.8	1	2	1	2	14	19	12
Question 33b	3.0	16	8	5	5	8	5	4

Source: Authors.

Rule Conflict: This variable assesses how often you experience rule conflicts at work and how this affects your performance and well-being. For the question about having to ignore a rule or policy to complete a task, the mean was

3.5, with most responses falling between “a few times a year” and “a few times a month.” When asked if you would be in trouble if your boss found out you ignored the rules, the mean was 3.0, indicating a similar distribution.

Rules of Ambiguity: This variable measures the clarity of goals and responsibilities in your work and how ambiguity can impact your effectiveness. For the question about feeling certain about the authority you have, the mean was 5.0, with most responses being “every day”. When asked if you know how to use your authority to get what you want at work, the mean was 4.9, again with many responses being “every day.” The questions about clear and objective goals at work had lower means, indicating greater variability in responses.

Self-help: This variable assesses your ability to self-motivate and how you feel about the rewards and expectations at work. For the question about knowing exactly what is expected of you, the average was 4.7, with many responses of “a few times a week” and “every day”. However, clarity about the rewards to be received had a lower average of 2.8, indicating uncertainty among the municipal police officers analyzed.

Self-Control in the Face of Criticism: These variable measures how municipal police officers deal with criticism and challenges at work, and their ability to maintain control in difficult situations. For the question about having to do things differently, the mean was 3.4, with responses ranging from “a few times a year” to “a few times a week.” When asked about having strong feelings about how things should be done, the mean was 4.8, indicating a high frequency of responses of “a few times a week” and “every day.”

Understanding Others’ Emotions: This variable assesses your empathy and ability to understand and deal with the emotions of others in the workplace. For the question about easily understanding what citizens feel, the average was 4.8, with many responses of “a few times a week” and “every day”. However, the question about treating some citizens as impersonal objects had a lower average, indicating that this occurs rarely.

Emotional Exhaustion: This variable measures the level of emotional exhaustion that municipal police officers feel due to their work. For the question about feeling fatigued at the end of a workday, the average was 3.5, with responses ranging from “a few times a year” to “a few times a week.” The question

about feeling tired when waking up in the morning had an average of 3.0, indicating a similar distribution.

Depersonalization: This variable assesses the frequency with which municipal police officers feel depersonalized or indifferent toward others at work. For the question about treating some residents as impersonal objects, the mean was 3.0, with most responses being “never.” The question about feeling indifferent toward people because of work had a similar mean, indicating that this occurs rarely.

Personal Fulfillment: This variable measures your sense of fulfillment and personal satisfaction at work. For the question about feeling that you positively influence people’s lives through your work, the average was 4.8, with many responses of “a few times a week” and “every day.” The question about doing things of value at work had a similar average, indicating a high frequency of positive responses.

4. CONCLUSION

The analysis of the data reveals important insights into the perceptions and experiences of municipal police officers regarding several dimensions of the work environment. The variables analyzed include rules conflict, rules ambiguity, self-help, self-control in the face of criticism, understanding others’ emotions, emotional exhaustion, depersonalization, and personal accomplishment. The results indicate that rules conflicts are a moderate concern among municipal police officers. The mean responses suggest that officers occasionally face situations where they need to ignore rules to complete tasks, and there is moderate concern about the consequences of these actions. Clarity of goals and responsibilities in the job presents significant variability. While many officers feel certain about the authority they have and know how to use it, there is considerable uncertainty about goals and objectives, which can limit their actions and affect effectiveness.

In turn, in the case of self-help, the data show that municipal police officers generally know what is expected of them and feel motivated. However, there is uncertainty about the rewards associated with meeting expectations, which can impact motivation in the long term. However, in self-control regarding criticism, municipal police officers demonstrate a reasonable ability to deal with criticism

and challenges at work. They have strong feelings about how things should be done, but they also face situations where they need to adjust their approaches.

Empathy and the ability to understand the emotions of others are strengths among municipal police officers. They are generally able to understand and manage the emotions of their fellow citizens, which is crucial to a positive and collaborative work environment. However, emotional exhaustion is a moderate concern. Many municipal police officers report feeling fatigued at the end of the day and tired upon waking in the morning, which may indicate the need for stress management and well-being strategies in the workplace. This can lead to relatively low levels of depersonalization, with most municipal police officers rarely treating their fellow citizens in an impersonal manner. However, a small percentage of municipal police officers feel indifferent about their work, which may be a sign of burnout. Municipal police officers generally feel that their work is valuable and that they positively impact people's lives. This sense of personal accomplishment is a positive aspect that can contribute to job satisfaction and retention.

Using the analysis of the data collected, we can clearly identify the areas where municipal police officers feel most emotionally safe and where there are opportunities for personal development. Addressing these areas can help reduce the risk of burnout, promoting a healthier and more productive environment.

In terms of variability in Resilience to Stress: There is significant variation in the ability of municipal police officers to deal with stress and criticism, indicating that not everyone has the same coping tools. There is also a potential for burnout through signs of irritability, difficulty in accepting criticism and negative interactions with colleagues, which may be indicative of imminent burnout.

4.1 RECOMMENDATIONS

In view of the work carried out, we have verified that the researched topic has all the value to continue being developed since it can be an added value not only for the academy, but also for the municipal police itself.

We leave open some proposals for future work:

Clarification of Goals and Objectives, improving communication about work goals and objectives to reduce ambiguity and increase efficiency.

Recognition and Rewards, establish clear systems of recognition and rewards to increase motivation and self-help.

Stress Management, implement wellness and stress management programs to address emotional exhaustion and prevent burnout.

Empathy Training, continuing to promote empathy and understanding of others' emotions to maintain a positive work environment.

Promote Healthy Work and Study Environments: by creating a culture of support and respect and offering constructive feedback and regular recognition.

Focus on Personal Development, through the implementation of emotional and social development programs, offering training in resilience and stress management.

Foster Resilience, promote *mindfulness practices* and facilitate leisure activities and regular breaks.

Using the information in the table, we can clearly identify areas where participants feel most emotionally safe and where there are opportunities for personal development. Addressing these areas can help reduce the risk of burnout, promoting a healthier and more productive environment.

A proactive approach to dealing with stress and burnout can significantly improve the well-being of municipal police officers, increasing their effectiveness and job satisfaction.

REFERENCES

AHMADY, S. C. (2007). Organizational role stress among medical school faculty members in Iran: dealing with role conflict. **BMC medical education,** 7 (14).

ALMEIDA, H., BRITO-COSTA, S., ALBERTY, A., GOMES, A., LIMA, P., & CASTRO, FV (2016). Occupational Stress Models: Systematization, Analysis and Description. **International Journal of Developmental and Educational Psychology,** 435-454.

BANSAL, R. (2023). **Perspectives on Stress and Wellness Management in Times of Crisis.** United States: IGI Global. Retrieved from https://books.google.com/books?id=tAu4EAAAQBAJ&printsec=frontcover&hl=pt-PT&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

BAR-ON, R. (1997). The emotional quotient inventory (EQ-I). **Technical manual.**

BAR-ON, R. B. (2000). Emotional expression and implications for occupational stress; and application of the Emotional Quotient Inventory (EQ-I). **Personality and individual differences,** 28, 1107-1118.

BECK, A. T. (1976). Cognitive therapy and the emotional disorders.. **New York: International Universities Press.**

CARDOSO, HF (2017). (2017). Burnout syndrome: analysis of national literature between 2006 and 2015. **Journal of Psychology, Organizations and Work,,** 17(2), 121-128.

CARLOTTO, MS (2015). The mediating role of self-efficacy in the relationship between work overload and the dimensions of Burnout in teachers. **Psico-usf,,** 20, 13-23.

CIARROCHI, J. V. (2000). A critical evaluation of the emotional intelligence concept. **Personality and individual differences**, 28, 539-561.

COOPER C.L., D. P. (2001). Organizational Stress. A review and critique of theory, research and applications. **Thousand Oaks: Sage Publications**, 1-39.

COOPER, C. L. (1998). **Theories of organizational stress.** Manchester: Oxford University press. Obtido de https://books.google.pt/books?hl=pt-PT&lr=&id=ahfJ16b-BdUC&oi=fnd&pg=PR14&dq=Theories+of+organizational+stress.+Manchester:+Oxford+University+press.&ots=O0bqSBuAvZ&sig=4fKksEysv4DMCebqC6B2gfmMO3U&redir_esc=y#v=onepage&q&f=false

CORDES, C. L. (1993). A review and an integration of research on Job Burnout. **Academy of Management Review,** 18, 621-656.

CORDES, C. L. (1993). A review and an integration of research on job burnout.. **Academy of management review,** 18(4), 621-656.

DA SILVA SCHUSTER, M. d. (2015). Validation of the MBI-GS scale: a general survey investigation on employees' health perception. **REGE-Revista de Gestão,** 22(3), 403-416.

DA SILVA, PL (2016). Emotional Intelligence and Leadership: the importance of the leader's emotional competence as a differentiator of success.. **Revista Marítima Brasileira,** 136(04/06), 130-144.

DAVIS, K. C. (2011). The theory of multiple intelligences. I. **n RJ Sternberg & SB Kaufman (Eds.), Cambridge Ha.**

DE CASTRO, FG (2007). Burnout syndrome and the project of being. **Notebooks of social psychology of work,,** 10(2), 17-33.

DE MOURA ABDALLA, CD (2020). **Burnout and the organizational environment in the public sector: a case study in Brazilian public administration.** University of Lisbon (Portugal).

DEMEROUTI, E., NACHREINER, F., BAKKER, A., & SCHAUFELI, W. (2001). The Job Demands–Resources Model of Burnout.. **Journal of Applied Psychology.,** 86, 499-512.

DIAS, CC (2009). Emotions, stress, anxiety and coping: a qualitative study with elite athletes. Portuguese Journal **of Sports Sciences,** 9 (1).

EVERS, W. J. (2002). Burnout among teachers: theoretical definition, top-down innovation, and social relations.. **[Thesis, entirely internal, Universiteit van Amsterdam].**

FERNANDES, AM (2023). **Stress at work: the case of teachers and education assistants in a daycare center and preschool.** Doctoral dissertation. Retrieved from https://comum.rcaap.pt/bitstream/10400.26/48545/1/Tese.pdf

FOLKMAN, S. (2020). Stress: appraisal and coping. In Encyclopedia of behavioral medicine. **Cham: Springer International Publishing.,** 2177-2179.

JACOMOSSI, FS (2018). Effects of budgetary participation on the relationship between role ambiguity and conflict and managerial performance. **Advances in Scientific & Applied Accounting,,** 11(3).

JIMÉNEZ, C.J. (2005). Analyzing downsizing as a psycho-social phenomenon. **Revista de Psicología del Trabajo y de las Organizaciones,** 21(3), 181–206.

KARIMI, R. O. (2014). The influence of role overload, role conflict, and role ambiguity on occupational stress among nurses in selected Iranian hospitals.. **International Journal of Asian Social Science,** 4(1), 34-40.

LAZARUS, R. S. (1984). Stress, appraisal, and coping. **Springer.,** (Vol. 464)..

LAZARUS, R. S. (1990). Theory-based stress measurement. **Psychological inquiry**, 1(1), 3-13. Obtido de https://doi.org/10.1207/s15327965pli0101_1

LEE, R. T. (1990). On the meaning of Maslach's three dimensions of burnout.. **Journal of applied psychology**, 75(6), 743.

LEE, R. T. (1996). A meta-analytic examination of the correlates of the three dimensions of Job Burnout. **Journal of Applied Psychology,**, 81, 123-133.

LEVI, L. (1987). Definitions and the conceptual aspects of health in relation to work. Psychosocial factors at work and their relation to health.. **Geneva: World Health Organization**, 9-14.

Langlois, P. (19996). Evaluation of hexaploid wheat genotypes for tolerance to aluminum toxicity. Ci. **Rural,** 26 (1).

MASLACH, C. &. (1981). The measurement of experienced burnout. **Journal of Occupational Behavior,,** 2, 99-113.

MASLACH, C. (2001). A multidimensional theory of job burnout. **In CL Cooper, PJ Dewe, & MP O'Driscoll. Organizational Stress. A review and critique of theory, research and applications,** 1-39.

MAYER, J. D. (1997). What is emotional intelligence? In P. Salovey & D. Sluyter (Eds.), Emotional development and emotional intelligence: Educational implications. **New York: Basic Books,** 3–31.

MAYER, J. D. (2004). Emotional Intelligence: Theory, Findings, and Implications.. **Psychological Research,,** 15, 197-215.

MAYER, J. D. (2011). **Emotional Intelligence.** Cambridge University Press.

OLIVEIRA, TD (2023). **Emotional Intelligence in the Work of Certified Public Accountants: An Exploratory Study.** (Master's thesis, Instituto Politecnico do Cavado e do Ave (Portugal)).

PAIVA, FM (2011). **Policing in bathing areas: the case of the Cascais line.** (Doctoral dissertation). Retrieved from https://comum.rcaap.pt/handle/10400.26/24495

PELLITTERI, J. (2002). The relationship between emotional intelligence and ego defense mechanisms. **The Journal of Psychology,** 136(2), 182-194.

PEREIRA, A. (2010). **Are Municipal Police Officers Emotionally Intelligent to Deal with Occupational Stress and Avoid Burnout?** Lisbon: ISCTE.

PEREIRA, AM (2015). Development and validation of the ISB: inventory for assessing burnout syndrome. **Psychology Bulletin,,** 65(142), 59-71.

PIRES, DA (2019). Dimensions of burnout, coping strategies and time of practice as a federated athlete in professional soccer players. **Cuadernos de Psicología del Deporte,** 19(2), 175-185.

PURNOMO, K. S. (2021). The effect of role conflict, role ambiguity and job stress on employee performance.. **Economic Education Analysis Journal,,** 10(3), 532-542.

REGO, A. &. (2005). Emotional intelligence: Additional contributions to the validation of a measurement instrument. **Psychology,** 19(1/2), 139-167.

REGO, A. &. (2005). Emotional intelligence: Additional contributions to the validation of a measurement instrument.. **Psychology,** 19(1/2), 139-167.

REPUBLIC, A. d. (October 2024). **https://diariodarepublica.pt/dr/detalhe/lei/19-2004-270386.** Retrieved from Diario da Republica: https://diariodarepublica.pt/dr/detalhe/lei/19-2004-270386

REPUBLICA, D. d. (October 14, 2024). **Constitution of the Portuguese Republic - CRP - Article 237.** Retrieved from Official Gazette No. 86/1976, Series I of 1976-04-10: https://diariodarepublica.pt/dr/legislacao-consolidada/decreto-aprovacao-constituicao/1976-34520775-49566175

RIZZO, J. (1970). Role conflict and ambiguity in complex organizations.. **Administrative Science Quarterly.**

ROBERTS, R.D.-M. (2002). Emotional intelligence: a scientific construct **?**

SALOVEY, P. &. (1990). Emotional intelligence. Imagination, cognition and personality,. **Sage Journals**, 9(3), 185-211. doi:https://doi.org/10.2190/DUGG-P24E-52WK-6CDG

SARA RIVERO BAEZA, R. d. (2023). Training in personal defense techniques and its influence on the stress threshold of students. **Brazilian Journal of Development**.

SAXENA, T. &. (2020). A STUDY OF ROLE EFFICACY PROFILES OF DOCTORS SERVING IN PRIVATE SECTOR HEALTH SERVICE ORGANIZATION OF UTTAR PRADESH (INDIA): AN ORGANIZATIONAL DEVELOPMENT INTERVENTION.. **European Journal of Molecular & Clinical Medicine,**, 7(10).

SIEGALL, M. (2000). Putting the stress into role stress: improving the measurement of role conflict and role ambiguity.. **Journal os Managerial Psychology**, 15, 427-434.

SOARES, FR (2020). **Work organization related to risk factors that cause stress in security guards in the transportation of valuables.** (Master's thesis, Federal University of Pernambuco).

TAMAYO, Á. (. (2002). Emotional exhaustion at work. Journal of Administration. **Journal of Administration, São Paulo,** v.37, n.2, p.26-37.

UCHOA, G., COSTA, A., SILVA, A., & SILVA, A. &. (2021). Educational psychology intervention for teachers' mental health. **Brazilian Journal of Development.** doi:DOI:10.34117/bjdv7n2-605

VERAS, J. &. (2022). Importance of meaning in life and well-being for mental health in adults.. **International Journal of Developmental and Educational Psychology.,** 1(2), 51–60. Retrieved from https://doi.org/10.17060/ijodae

VILELA, CS (2014). **Anxiety, cognitive assessment and burnout in sports training: a study with young athletes.** (Master's thesis, University of Minho (Portugal)).

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