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## Abstract

Background:

Aim:

Methods:

Results:

Conclusions:

**Keywords**:

# Introduction

## 2. Materials and Methods

**2.1. Study Design:** This cross-sectional, descriptive correlational study will evaluate the functional capacity of older adults living in the region of Magallanes using the short physical performance battery (SPPB), while seasonal sensitivity will be measured with the Spanish adaptation of the Seasonal Pattern Assessment Questionnaire (SPAQ), seeking to establish a relationship between both groups of data.

## 2.2. Participants: This study involved 77 older adults living at high southern latitudes in the Magallanes region of Chile (48°36' to 56°30' south latitude) with ages ranging from 50 to 89 years. Inclusion criteria: Resident of the XII Region of Magallanes and Chilean Antarctica; not using drugs and/or drugs that increase physical performance; not using anxiolytic drugs and/or sleeping pills.

## Exclusion criteria:

## Having any congenital heart disease; being under medical treatment or presenting pain over VAS 5. Presenting any musculoskeletal injury at the time of the evaluation or using any technical aid for displacement; not attending at least 80% of the evaluation sessions; having moderate cognitive impairment onwards or having any pathology of neuromotor characteristic.

**2.3. Ethics**

**2.4. Measures**

**2.4.1. Seasonal Pattern:** Spanish adaptation of the Seasonal Pattern Assessment Questionnaire (SPAQ) in the adult versions: It is a scale to measure seasonality, that is, changes in mood and behavior according to the seasons, treated as a cyclical pattern of depressive episodes with criteria of major depression that appeared in the autumn-winter period and tended to present with atypical symptoms, such as hypersomnia, hyperphagia and appetite for carbohydrates. The Spanish version of the Seasonality Assessment Questionnaire presents adequate reliability and internal consistency values for its use in epidemiological and clinical research (Goikolea et al., 2003).

**2.4.2. Estres Percibido**

Escala de Estrés Percibido, Versión española (2.0). Se evaluará el estrés percibido a través de la versión española 2.0 de la Escala de Estrés Percibido adaptada por Dr. Eduardo Remor (Cohen, S., Kamarck, T., & Mermelstein, R. 1983). Esta escala es un instrumento de auto informe que evalúa el nivel de estrés percibido durante el último mes. Consta de 14 ítems con un formato de respuesta de una escala de cinco puntos.

### 2.4.3. Physical Performance: Short Physical Performance Battery: The Short Physical Performance Battery (SPPB) is a tool that assesses three aspects of mobility: balance, walking speed, and strength of limbs or lower extremities to get up from a chair. It is useful to support the probable detection of adverse outcomes such as mortality and institutionalization and their association with disability (J. Guralnik, 1994).

### 2.4.4. Morphological measures

Body mass (kg) and the total body fat (%) were assessed by bioimpedance using the Tanita BC-558 Ironman Segmental Body Composition Monitor (Tanita Ironman, Arlington Heights, IL 60005 USA), with a concordance 89.3% compared to the Dual X-ray Absorption test using standard measurement protocols (19,20). Height was measured by CHARDER® HM230M manual height rod (Charder Electronics Co., Ltd. No.103, Guozhong Rd., Taiwan, R.O.C.). The body mass index (BMI) and the fat-free mass index (FFMI) were calculated as follow, BMI: [body weight] / [height]2 (kg/m2)

**2.4.5. Cardiac autonomic modulation**

Cardiac autonomic modulation was determined via a recording of RR intervals. The volunteers remained seated in the chair before and after evaluating the physical performance parameters with SPPB. The RR intervals were continuously recorded during the last 10 min of rest, and 5 min were analyzed. Artifacts and ectopic heartbeats (which did not exceed 3% of the recorded data) were excluded (22). The time-domain parameters considered for the analysis were the square root of the mean squared differences of the successive RR intervals (RMSSD, expressed in ms.), which reflect the parasympathetic influence (23) and the standard deviation of the RR intervals (SDNN), which is believed to reflect the total variability, that is, the sympathetic and parasympathetic contribution of the autonomic nervous system on the heart (24,25). The frequency domains considered were the high frequency (HF) power band that reflects the parasympathetic influence and respiratory sinus arrhythmia (26), the low frequency (LF) band associated with baroreflex activity (27), and the very low-frequency band (VLF), which is intrinsically generated by the heart, whose oscillations are modulated by efferent sympathetic activity (28). Finally, all the data obtained were digitized and analyzed using the software Kubios HRV® (29).

**2.5. Procedures**

Sujeto llega, se estabiliza su frecuencia cardiaca durante 5 minutos, luego se instala el HRV…10 minutos de medida, para escoger 5 minutos limpios para el analisis estadistico. Luego pasan a evaluacion antropometrica y SPPB, posterior a SPPB nuevamente HRV 10 min

**2.6. Statistical Analysis**

In order to describe numerical variables, median and interquartile range (IQR) were used, and relative frequencies (%) were used for for discrete variables. Given the assymetric distribution observed in continuous distributions, non-parametric statistics were used to better describe the underlying associations between variables. In this sense, Spearman’s rho (ρ), a rank-based correlation statistic, was used to describe the associations between HRV, SPPB and psychological variables.

We defined a type I error rate at 5% (⍺ = 0.05) as our threshold for null hypothesis significance testing. All analysis and computations were performed using the R programming language (4.3.3).

**3. Results**

**Participant Characteristics**

The study encompassed a sample compossed with 22.1% males and 77.9% females. BMI analysis revealed that 1.3% fell into the Insufficient category, while 9% were within the Normal range. Overweight status was observed in 45.5%, with 39% presenting obesity. Further classification unveiled 2.6% as obesity type I and 1.3% as obesity type II. Moreover, the BMI of 1.3% remained indeterminable.

**Seasonal Patterns**

Examination of seasonal patterns elucidated distinct observations. Notably, 20.8% exhibited no seasonal patterns, mirroring the percentage with a Summer pattern, indicating improved well-being from December to February. In contrast, a Winter pattern, indicative of reduced well-being from June to August, was evident in 10.4% of participants. Significantly, 48% displayed a duality of patterns—Winter-related discomfort and Summer-related well-being. SSI unveiled that 55.8% demonstrated an average score. Nonetheless, 24.7% exhibited "Winter Blues," while 19.5% reached the cut-off score for SAD, signifying that 44.2% of older adults at higher southern latitudes underwent emotional changes influenced by seasonal shifts.

**Sleep and Heart Rate Variability (HRV)**

Examination of the relationship between sleep duration and the VLF component in HRV exposed noteworthy findings. Negative correlations were observed across different seasons: Winter (ρ = -0.32, p = 0.005), Fall (ρ = -0.31, p = 0.005), Summer (ρ = -0.3, p = 0.007), and Spring (ρ = -0.28, p = 0.013). These associations suggest that reduced sleep time correlated with VLF post-test in the HRV domain.

**Functional Capacity**

Concerning the functional capacity of the older adult participants, the majority (77.9%) demonstrated minimal functional limitations. A slight limitation was evident in 6.5%, while 7.8% exhibited a moderate limitation. An equivalent proportion faced a severe functional limitation.

**Stress and Performance Associations**

Correlation analyses yielded intriguing insights into stress-performance dynamics. Initial stress levels exhibited positive correlations with performance in the SPPB test (ρ = 0.26, p = 0.023). Conversely, inverse relationships were identified with baseline SDNN (ρ = -0.25, p = 0.026) and VLF (ρ = -0.27, p = 0.016) components in HRV. Elevated perceived stress corresponded to heightened HF (ρ = 0.23, p = 0.044), LF (ρ = 0.3, p = 0.007), and RMSSD (ρ = 0.23, p = 0.043) HRV components during the test. Furthermore, the link between post-test stress and diminished perceived stress during assessments was evident (ρ = -0.26, p = 0.025), hinting at the intricate interplay between stress perception and physiological stress modulation.

These findings invite reflection on stress modulation mechanisms in older adults. The potential under-perception of actual stress levels could contribute to reduced efficacy in stress-modulating mechanisms, thereby sustaining physiological stress levels.

**4. Discussion.**

**Stress and Functional Autonomy**

The present study establishes a compelling connection between the antecedent stress levels exhibited by older adults and their subsequent enhanced functional autonomy. This association prompts a salient inquiry into the intricate interplay of physiological stress within the framework of preserving autonomy among elderly individuals. The study underscores the argument for the existence of an optimal stress threshold, one that is functionally imperative for the older adult demographic. In this context, the prudent modulation of stress warrants careful consideration in shaping public policies and care programs, facilitating a balanced equilibrium between stress exposure and the preservation of autonomy.

The Spearman's rank correlation analysis further illuminates the association between baseline stress levels, ascertained prior to intervention, and the ensuing performance on the SPPB. The discerned positive correlation accentuates the multifaceted role of stress in influencing functional autonomy. Intriguingly, an optimal stress level emerges as a contributing factor to heightened functional independence among older adults. While the quantitative delineation of this optimal threshold remains beyond the study's scope, the salient inference underscores the pivotal influence of stress on autonomy maintenance.

Consequently, the contention arises that a judicious dosage of stress, rather than its outright absence, emerges as pivotal for preserving autonomy and functionality. This insight underscores the necessity for an attuned approach to stress exposure within the elderly demographic, acknowledging stress's multifaceted utility while preserving its role as an autonomy-facilitating factor.

**Physiological Stress Response and Coping**

A notable revelation surfaces as the study delves into the physiological stress response and its correlation with perceived stress. Older adults displaying heightened perceived stress simultaneously exhibit an elevation in the HF component of HRV. This component is widely regarded as an indicator of cardiac parasympathetic modulation. The synchronous elevation in perceived stress and the HF-HRV component presents an intriguing proposition, alluding to the potential role of parasympathetic modulation in mediating stress responses and aiding coping mechanisms during evaluation.

Moreover, a pertinent observation emerges, a reciprocal relationship between post-test physiological stress and the perception of stress. This reciprocity suggests an intricate interplay wherein physiological stress response, triggered by the evaluative setting, subsequently influences a lower perception of stress. This dynamic underscores the potential feedback mechanism through which physiological stress could regulate perceived stress levels during demanding situations.

Collectively, these findings not only enrich our understanding of the intricate interplay between stress, autonomy, and physiological responses but also offer a compelling narrative for the incorporation of nuanced stress management strategies. This discourse underscores the importance of tailored care models and well-informed public policies, both of which recognize and harness the nuanced dynamics of stress within the older adult demographic. By considering stress modulation as an essential facet of preserving functional autonomy, we advocate for a refined approach that optimally leverages stress's role in the well-being of older adults.

**5. Conclusions**

Our study elucidates the intricate relationship among stress, functional autonomy, and physiological responses in older adults. The positive correlation between baseline stress levels and improved functional independence suggests a functional role for stress, emphasizing the need for balanced stress exposure in care programs and policies. The concurrent elevation of perceived stress and the HF component of HRV underscores physiological stress responses and coping mechanisms. Additionally, the reciprocal association between post-test physiological stress and perceived stress emphasizes the interplay between physiological and psychological stress realms. These findings advocate for a nuanced approach that acknowledges stress's multifaceted impact on older adults' well-being, urging targeted stress modulation strategies to enhance functional autonomy and overall quality of life in this population.

**Acknowledgments**

**Author Contributions**: Conceptualization, L.H., and C.N.-E.; methodology L.H. and C.N.-E.; formal analysis, M.C.-A.; investigation, L.H., M.C.-A., and C.N.-E.; resources, C.N.-E.; writing—original draft preparation, L.H., J.H.L., K.H.K., and C.N.-E.; writing—review and editing, L.H., J.H.L., K.H.K., A.C., M.P.C. A.D.S. and C.N.-E.; visualization, M.C.-A., and C.N.-E.; supervision, C.N.-E.; project administration, C.N.-E.; funding acquisition, C.N.-E. All authors have read and agreed to the published version of the manuscript.

# Funding: This work was funded by ANID Proyecto Fondecyt Iniciación N°11220116.

# Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by The Ethics Committee of the University of Magallanes (code: xxxxxxxx).

# Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

# Data Availability Statement: The raw data supporting the conclusions of this article are available from the authors without undue reservation.

# Conflicts of Interest: The authors declare that the research was conducted without any commercial or financial relationships construed as a potential conflict of interest.

# References