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Biochemical and Functional Characteristics of Elderly Female Residents in the Rural and Urban Sectors of Yumbe, Chile

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Abstract: This study aimed to evaluate and compare functional capacity and biochemical factors among elderly women living in the urban and rural sectors of Yumbe, Chile. The sample consisted of 2 groups of elderly women from the province of Ñuble, from the eighth region of Chile, divided into urban elderly (UE) (n = 20) with a mean age of 67.57 ± 3.4 years, and rural elderly (RE) (n = 20), with a mean age of 71.25 ± 2.2 years. The following biochemical variables were analyzed: glycemic index a, and triglycerides levels and cholesterol levels. The test battery used to assess functional capacity was the Senior Fitness Test. It was found that the UE group presented better indices than the RE group for all variables except glycemia, for which the RE group presented better indices. In the functional capacity, in particular, the upper and lower body strength is significantly lower in the RE. The functional capacity and the biochemical parameters studied have shown that the elderly women of different social conditions in the Yumbe-Chile region do not present a good degree of functionality, and also show high levels of cholesterol and triglycerides, which might be the cause of the increased prevalence of health problems in this population.

Keywords: Aging, Functional capacity, Health

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1. Introduction

Constant and rapid changes in demographic and epidemiological profiles suggest the need for studies on the health of the elderly population. Chile has the highest average life expectancy of all Latin American countries (80.5 years), and has the second highest life expectancy of all countries in the American continents, after Canada (82.2 years), according to data from the World Health Organization [1]. The region of Bío-Bío, Chile, contains 16.8% of the elderly population of the country; 22.8% of residents of the community of Yumbe, a rural area linked to this region, are aged 60 or over, with a large portion of this population being women [2]. While living longer remains a public health goal, the preservation of factors that involve independent and functional life during old age is more important. These factors are directly related to the quality of life [3]. With aging, changes can be observed that progressively interfere with the functional condition of the elderly population. These changes vary from individual to individual and depend on how one lives [2, 4].

Functional capacity can be defined as the potential of an elderly person to perform their daily functions like self-care autonomously and independently, and activities of daily life, making it possible to adapt to the environment that they live in [5, 6]. In this context, all the data generated through functional capacity tests enable the profile of elderly individuals to be known and can become instruments in the definition of health promotion strategies, aiming at preventing and / or delaying disabilities for this population [7, 8]. Another factor of great relevance in the health promotion strategies of elderly individuals is the monitoring of biochemical changes involved in the aging process since these can cause increased functional impairments due to any chronic illness [9]. From the point of view of policy on aging, it is interesting to identify the characteristic changes old age, and the specific difficulties faced by older people living in different conditions of a community, such as urban and rural areas. Therefore, this study aims to evaluate and compare functional capacity and biochemical factors among elderly women living in the urban and rural sectors of Bío-Bío, Chile.

2. Methods

2.1 Samples

The samples for the present study consisted of 2 groups of elderly women from the province of Ñuble in the eighth region of Chile. The 2 groups were divided into urban elderly (UE) (n = 20), with a mean age of 67.57 ± 3.4 years and rural elderly (RE) (n = 20), with a mean age of 71.25 ± 2.2 years. All study volunteers signed the free and informed consent form. The study was conducted in accordance with the ethical standards of the Helsinki resolution, 1989.

2.2 Study design

The analyzed variables were divided into 2 groups: A) Biochemical and B) Functional Capacity (Figure 1).

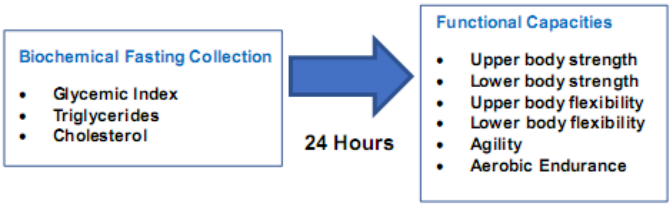

Figure 1 Study Design.

2.3 Procedures

A) Biochemical: Biochemical analyses were performed with the volunteers under fasting conditions. The biochemical variables glycemic index, triglycerides, and cholesterol were analyzed through the reflective photometry method, using the instrument Accutrend Plus Roche®. Each analysis was performed with a specific enzymatic reagent strip for each of the studied variables. For the analysis of each variable, 25 µl of fingertip blood was collected. The blood was previously sterilized and despized the first drop in order to avoid contact with metabolic remnants of the sterilization. Blood collection was performed by trained personnel. All collections were individualized, and the evaluator always used surgical gloves.

B) Functional Capacity: The senior fitness test was used for measuring the functional fitness of participants in this study [10]. This test is based on a functional fitness framework that measures the ability to perform everyday activities and requires the ability to perform functional movements, such as walking, stair climbing, and standing up. The tests are: Upper Body Strength, Lower Body Strength, Upper Body Flexibility, Lower Body Flexibility, Agility, and Aerobic Endurance.

2.4 Statistics

To verify the normality and the homogeneity of the variances, Shapiro-Wilk and Levene tests were adopted. To clarify the assumptions of normality and homogeneity of variance, the Mann-Whitney U test was applied to compare between the biochemical variables and between the functional capacities of the groups. Effect size (ES) was calculated using Cohen's d, according to the following criteria: 0,2 small; 0.50 moderate; and 0,8 strong. The significance level (α) was set at 5%, and all statistical analyses were performed using SPSS software (20.0, IBM, Armonk, USA).

3. Results

The purpose of this study was to evaluate and compare biochemical variables and the functional capacity among a group of elderly women from the urban and rural areas of the city of Yumbe, Chile. We found that the UE group presented better indices than the RE group for all variables except for glycemia, for which the RE group presented better indices.

Table 1 shows the comparison of biochemical variables between the groups studied. The glycemic index was significantly different between the UE and the RE; however, when the effect size analysis is considered, this significance was small in all the analyzed variables d ≤0.2.

When analyzing the distribution data of the biochemical variables, we identified that IR represented a greater part of the sample with values above normal, and 90% of the IRs presented cholesterol levels above the average value. It is also worth noting that 70% of the IUs exhibited high cholesterol levels (Table 2).

Aging is a natural human process that is accompanied by natural deleterious bio psychophysiological variables that accompany the loss of quality of life [2, 6, 11]. Identifying, comparing, and accompanying these changes are fundamental for adequate intervention by the public authorities to ensure healthy aging of the population. Based on this assertion, our study emphasizes the importance of the control of intervening variables of the aging process, and comparison of different socioeconomic situations.

Based on the biochemical variables, we identified a high index of the sample with results above normal. These indexes are justified by physiological and socioenvironmental factors. Aging brings a reduction of muscle and bone mass, and an increase in fat mass. Based on these findings [12, 13], the increase in biochemical variables found in our study is justifiable. Studies with urban and rural populations in other countries have also found significant increases in glycemic, triglycerides, and cholesterol in the elderly [14], reflecting a high risk of chronic degenerative diseases. Socio-environmental interferences are another justification for explaining the increase in the analyzed variables. Elderly individuals, during a large part of their lives, had less access to recent public health improvements [15]. This has led to a pattern of less physical inactivity and poorer diet among these individuals. This effect is enhanced with the arrival of more advanced ages [16], co-opting the arrival of the loss of physiological variables as a decrease of the basal metabolic rate, loss of mass, and muscular strength [17, 18]. The results of the functional capacity tests are shown in Table 3. We identified significant differences always in favor of the UE group, in the upper body strength, lower body strength, lower body flexibility, and aerobic endurance. Cohen's d of the cited variables was small, with the exception of the aerobic endurance, which was average.

Table 1 Biochemical Variables

Variables	Urban Elderly (n=20)	Rural Elderly (n=20)	p	Effect Size (d)
Glycemic Index	106,85 (± 47,25)	67,80 (± 24,29) *	0,01	0,221
Triglycerides	293,95 (± 143,73)	210,85 (± 99,42)	0,081	0,106
Cholesterol	218,75 (± 27,61)	206,50 (± 49,75)	0,620	0,024

* Significant difference in glucose between Urban Elderly and Rural Elderly p < 0.05

Table 2 Percentage of Distribution of Biochemical Variables

Biochemical		Group	
		Urban Elderly (n=20)	Rural Elderly (n=20)
Glycemic Index	Above%	40	10
	Average%	60	90
Triglycerides	Above %	70	50
	Average %	30	50
Cholesterol	Above %	90	70
	Average%	10	30

Table 3 Functional Capacities

Variables	Urban Elderly (n=20)	Rural Elderly (n=20)	p	Effect Size (d)
Upper Body Strength (n)	20,55 (± 4,13)	16,15 (± 6,03)*	0,02	0,160
Lower Body Strength (n)	15,65 (± 2,87)	10,20 (± 4,89)*	0,01	0,369
Upper Body Flexibility (cm)	-6,30 (± 10,37)	-17,45 (±17,70)*	0,03	0,134
Lower Body Flexibility (cm)	-3,70 (± 10,37)	-10,27 (± 13,28)	0,157	0,084
Agility (s)	7,60 (± 2,00)	11,37 (± 4,35)*	0,03	0,137
Aerobic Endurance (n)	96,00 (±19,89)	51,45 (± 21,00)*	0,01	0,543

* Significant difference in functional capacity between Urban Elderly and Rural Elderly $p < 0.05$

Table 4 Criterion-reference standards (CRS) in the Functional Capacities

Variables	Classificação CRS	
	Urban Elderly	Rural Elderly
Upper Body Strength (n)	Good	Regular
Lower Body Strength (n)	Regular	Very Weak
Upper Body Flexibility (cm)	Very Weak	Very Weak
Lower Body Flexibility (cm)	Weak	Very Weak
Agility (s)	Very Weak	Very Weak
Aerobic Endurance (n)	Regular	Weak
Total	Regular	Weak

In the functional capacity, we identified a better performance in the UE group when compared to the RE group. The interpretation of these results is limited by the fact that we did not study the levels of physical activity to justify the differences found among the elderly population of the urban and rural areas, since it is known that a lower level of physical activity leads to detrimental effects in the health of elderly individuals, such increase in fat mass, decrease in bone mineral density, and consequent decrease in quality of life [19, 20].

Table 4 presents the classification of functionality. It was observed that the individuals in the UR group have a lower level than those in the UE group.

The functional capacity levels found in the study were lower than those found in a sample of Brazilian, Colombian and Polish elderly women [8, 21, 22]. According to the normative references of Rikli and Jones [10], the elderly women in our study had below-normal results in an index between weak and very weak. We elaborated on the CRS to establish the degree of functionality of the elderly individuals in the study and found a low value, which represents a high degree of functional dependence. These findings corroborate with studies that have proven that high values of biochemical parameters lead to an important functional dependence that can lead to lower life expectancy, and an increase in health expenses in the sample studied [11, 12].

Our findings show that the sample of elderly women from different socio-environmental situations in the Yumbe region of Chile has a low functional capacity and high values of health-related biochemical parameters. This study has several limitations; we only studied a small sample of elderly women and did not assess the level of physical activity of the sample.

4. Conclusions

The functional capacity and the biochemical parameters studied showed that elderly women of different social conditions of the Yumbe region of Chile do not present a good degree of functionality and had high levels of cholesterol and triglycerides. These findings indicate the possibility of problematic life expectancies in this sample. Further studies are needed to assess the socioeconomic status of each group, in addition to the level of physical activity in each group. Our results point to an immediate need for intervention by the Chilean public authorities to improve the criteria studied, and the quality and life expectancy of this population.

References

[1] John Bear., Alana Officer. AC. Informe mundial sobre el envejecimiento y la salud. 2015.

[2] G. Libertini, G. Rengo, N. Ferrara, Aging and aging theories, Journal of Gerontology and Geriatrics, 65 (2017) 59–77.

[3] A. Lacroix, T. Hortobágyi, R. Beurskens, U. Granacher, Effects of Supervised vs. Unsupervised Training Programs on Balance and Muscle Strength in Older Adults: A Systematic Review and Meta-Analysis, Sports Medicine, 47 (2017) 2341-2361.

http://dx.doi.org/10.1007/s40279-017-0747-6

[4] S.J. Allison, K.B. Wavell, J. Folland, High and odd impact exercise training improved physical function and fall risk factors in community-dwelling older men, Journal of Musculoskeletal and Neuronal Interactions, 18 (2018) 100–107.

[5] M. Sanhueza Parra, M. Castro Salas, Y.J.M. Escobar, Adultos mayores funcionales: un nuevo concepto en salud functionals elders: a new concept in health, 11 (2005) 17–21.

http://dx.doi.org/10.4067/S0717-95532005000200004

[6] A. Oliveira, P. Nossa, A. Mota-Pinto, Assessing functional capacity and factors determining functional decline in the elderly: A cross-sectional study, Acta Medica Portuguesa, 32 (2019) 654–660.

[7] C. Jessie Jones, Roberta E. Rikli, Fitness of older adults, Journal on Active Aging, 2002; 24–30.

[8] G.Z. Mazo, D.R. Petreça, P.F. Sandreschi, T.R.B. BENEDETTI, Valores Normativos Da Aptidão Física Para Idosas Brasileira De 60 a 69 Anos De Idade, Revista Brasileira de Medicina do Esporte, 21 (2015) 318–322.

https://doi.org/10.1590/1517-869220152104134470

[9] C. Sartor-Glittenberg, S. Lehmann, M. Okada, D. Rosen, K. Brewer, R. Curtis Bay, Variables explaining health-related quality of life in community-dwelling older adults, Journal of Geriatric Physical Therapy, 37 (2014) 83–91. https://doi.org/10.1519/JPT.0b013e3182a4791b

[10] R.E. Rikli, C.J. Jones, Development and validation of criterion-referenced clinically relevant fitness standards for maintaining physical independence in later years, Gerontologist, 53 (2013) 255–267.

https://doi.org/10.1093/geront/gns071

[11] M.R. Silva, C.L. Alberton, E.G. Portella, G.N. Nunes, D.G. Martin, S.S. Pinto, Water-based

aerobic and combined training in elderly women: Effects on functional capacity and quality of life, Experimental Gerontology, 106 (2018) 54–60. https://doi.org/10.1016/j.exger.2018.02.018

[12] T.G. Papaioannou, K. Karatzi, T. Psaltopoulou, D. Tousoulis, Arterial ageing: Major nutritional and life-style effects, Ageing Research Reviews, 37 (2017) 162–163.

https://doi.org/10.1016/j.arr.2016.10.004

[13] L.M. Pérez, H.P. Galeano, F.S. Gomar, E. Emanuele, A. Lucia and B.G. Gálvez, ' Adipaging ': ageing and obesity share biological hallmarks related to a dysfunctional adipose tissue, Journal of Physiology, 594 (2016) 3187–3207. https://dx.doi.org/10.1113%2FJP271691

[14] J.C. Rigo, J.L. Vieira, R.R. Dalacorte, C.C. Reichert, Prevalência de síndrome metabólica em idosos de uma comunidade: comparação entre três métodos diagnósticos, Arquivos Brasileiros de Cardiologia, 93 (2009) 85–91.

https://doi.org/10.1590/S0066-782X2009000800004

[15] N. Martínez-Velilla, E.L. Cadore, Á. Casas-Herrero, F. Idoate-Saralegui, M. Izquierdo, Physical Activity and Early Rehabilitation in Hospitalized Elderly Medical Patients : Systematic Review of Randomized Clinical Trials, Journal of Nutrition, Health and Aging, 20 (2016) 738–751. https://doi.org/10.1007/s12603-016-0683-4

[16] T. Abe, R.S. Thiebaud, J.P. Loenneke, Forearm muscle quality as a better indicator of physical performance than handgrip strength in older male ground golf players aged 70 to 89, Journal of Musculoskeletal and Neuronal Interactions, 16 (2016) 296–301.

[17] C. Pistea, E. Lonsdorfer, S. Doutreleau, M. Oswald, I. Enache, A. Charloux, Maximal aerobic capacity in ageing subjects: actual measurements versus predicted values, ERJ Open Research, 2 (2016) 00068-2015.

https://doi.org/10.1183/23120541.00068-2015

[18] J. Grgic, A. Garofolini, J. Orazem, F. Sabol, B.J. Schoenfeld & Z. Pedisic, Effects of Resistance Training on Muscle Size and Strength in Very Elderly Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials, Sports Medicine, Epub ahead of print 2020. https://doi.org/10.1007/s40279-020-01331-7

[19] M. Turpela, K. Häkkinen, G.G. Haff, S. Walker, Effects of different strength training frequencies on maximum strength, body composition and functional capacity in healthy older individuals, Experimental Gerontology, 98 (2017) 13–21.

https://doi.org/10.1016/j.exger.2017.08.013

[20] A.S. Ribeiro, J.P. Nunes, B.J. Schoenfeld, Selection of Resistance Exercises for Older Individuals: The Forgotten Variable, Sports Medicine, 50 (2020) 1051–1057.

http://dx.doi.org/10.1007/s40279-020-01260-5

[21] Z. Ignasiak, T. Sławinska, A. Skrzek, K. Rożek, S. Kozieł, P. Posłuszny, R.M. Malina, Functional capacities of Polish adults of 60–87 years and risk of losing functional independence, Annals of Human Biology, 44 (2017) 502-509.

http://dx.doi.org/10.1080/03014460.2017.1328071

[22] C. Cortés-Muñoz, D. Cardona-Arango, Á. Segura-Cardona, O.M. Garzon-Duque, Factores físicos y mentales asociados con la capacidad funcional del adulto mayor, Antioquia, Colombia, 2012, Revista de Salud Pública, 18 (2016) 167–178. http://dx.doi.org/10.15446/rsap.v18n2.49237

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Conflict of interest

The authors declare that they have no actual or potential conflict of interest, including financial, personal or other relationships with people or organizations that could have inappropriately influenced this work.

Informed consent

All participants gave written informed consent to participate in this study.

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