CIÊNCIAS DA VIDA E DA SAÚDE
LIFE AND HEALTH SCIENCES
CIENCIAS DE LA VIDA Y LA SALUD

millenium 27

Millenium, 2(2), 27-36.

IMPACTO DO ESTILO DE VIDA DO IDOSO NA CONCENTRAÇÃO PLASMÁTICA DE VITAMINA D E PTH

LIFESTYLE IMPACT ON SERUM LEVEL OF VITAMIN D AND PTH, IN ELDERLY

IMPACTO DEL ESTILO DE VIDA DEL IDOSO NA CONCENTRACIÓN PLASMÁTICA DE VITAMINA D E PTH

Marta Ribeiro[1]
João Figueiredo[1]
António Gabriel[1]

[1]Instituto Politécnico de Coimbra, Escola Superior de Tecnologia da Saúde, Departamento de Ciências Biomédicas e Laboratoriais, Coimbra, Portugal

Marta Ribeiro - martapereiraribeiro@gmail.com | João Figueiredo – jpfigueiredo1974@gmail.com | António Gabriel – agabriel@estescoimbra.pt

Autor Correspondente
Marta Ribeiro
Estrada Nacional nº1, São Jorge, 2480-062, Calvaria de Cima, Leiria, Portugal
martapereiraribeiro@gmail.com

RECEBIDO: 05 de setembro de 2016
ACEITE: 12 janeiro de 2017

Ribeiro, M., Figueiredo, J. & Gabriel, A. (2016). Lifestyle impact on serum level of vitamin D and PTH, in elderly. *Millenium, 2*(2), 27-36.

RESUMO

Introdução: O processo de envelhecimento é responsável pelo declínio progressivo da saúde geral do idoso que, poderá culminar na dependência e consequente institucionalização. A PTH e a vitamina D são as principais hormonas responsáveis pela regulação da fisiologia óssea.

Objetivos: O presente estudo objetiva avaliar as hormonas envolvidas na regulação do cálcio em idosos institucionalizados e, nos que habitam em zona rural, com estilo de vida independente e ativo.

Métodos: Neste estudo foram avaliados 50 idosos (25 institucionalizados e 25 não institucionalizados) sujeitos a um inquérito, aos quais foram determinados os níveis plasmáticos de 25(OH)D e de iPTH.

Resultados: O grupo de idosos não institucionalizados apresentou valores para a 25(OH)D mais elevados, comparativamente ao grupo institucionalizado (p-value<0.05). Observou-se uma correlação negativa entre 25(OH)D e iPTH. Os indivíduos que tomavam suplementos vitamínicos de cálcio e/ou medicação indicada para o metabolismo do cálcio, apresentaram valores mais elevados de 25(OH)D (p-value<0.05) e mais baixos de iPTH (p-value<0.05). Os idosos não institucionalizados e que simultaneamente praticavam 3 ou mais atividades diárias, apresentaram valores mais elevados de 25(OH)D (p-value<0.05) e consequentemente concentrações mais baixas de iPTH (p-value<0.05), comparativamente aos institucionalizados.

Conclusões: A adoção de um estilo de vida ativo e o contacto com a natureza traz benefícios ao envelhecimento em qualidade.

Palavras-chave: Institucionalização; 25-hidroxivitamina D_3; 1,25-dihidroxivitamina D_3; Paratormona)

ABSTRACT

Introduction: The aging process is responsible for health decline and may lead to the dependence and consequent institutionalization. Bone metabolism involves serum calcium regulators, such as vitamin D and PTH.

Objetives: The following study evaluated and compared serum concentrations of 25(OH)D and iPTH in elderly people living in institutions and living in their homes (free-living), with active and independent life.

Methods: We evaluated 50 elderly (25 institutionalized and 25 not institutionalized). We made an individual questionnaire and we collected blood to measured the serum concentrations of iPTH and 25(OH)D.

Results: Not institutionalized elderly showed higher 25(OH)D serum levels, comparing with institutionalized elderly (p-value<0,05). The serum concentration of 25(OH)D was inversely correlated with iPTH. Furthermore calcium supplementation correlated with higher serum levels of 25(OH)D (p-value<0.05) and lower concentrations of iPTH (p-value<0,05). The free-living elderly who practice three or more activities per day, had higher concentrations of 25(OH)D (p-value<0.05) and lower concentrations of iPTH (p-value<0.05), compared to the institutionalized elderly. Outdoor activities showed also correlation with serum concentrations of both hormones (p-value<0.05).

Conclusion: The adoption of an active lifestyle and the contact with nature, carry profit to a better aging process.

Keywords: Institutionalization; 25-hydroxivitamin D_3; 1,25-dihydroxyvitamin D_3; Parathormone)

RESUMEN

Introducción: El proceso de envejecimiento es responsable de la disminución gradual de la salud general de las personas mayores que pueden conducir a la dependencia y la consecuente institucionalización. PTH y vitamina D son las principales hormonas responsables de la regulación de la fisiología ósea.

Objetivos: Este estudio tiene como objetivo evaluar la hormona implicada en la regulación del calcio en ancianos institucionalizados y, e los que viven en zonas rurales, con el estilo de vida independiente y activa. **Métodos:** Este estudio evaluó 50 ancianos (25 institucionalizada y 25 no institucionalizada) objeto de una investigación, que se determinaron los niveles plasmáticos de 25 (OH) D y PTH.

Resultados: El grupo de ancianos no institucionalizados mostraron valores de 25 (OH) D mayor en comparación con el grupo institucionalizado (valor de p <0.05). Hubo una correlación negativa entre la 25 (OH) D y PTH. Las personas que tomaron suplementos vitamínicos de calcio y / o medicamentos indicados para el metabolismo del calcio, tenían mayores niveles de 25 (OH) D (valor de p <0,05) y menor PTHi (valor de p <0.05). La ancianos no institucionalizados y al mismo tiempo practicaron 3 o más actividades diarias mostraron mayores niveles de 25 (OH) D (valor de p <0.05) y en consecuencia menores concentraciones de PTH (valor de p <0.05) en comparación con institucionalizada.

Conclusións: La adopción de un estilo de vida activo y el contacto con la naturaleza trae beneficios al envejecimiento de calidad.

Palabras clave: Institucionalización; 25-dihidroxivitamina D_3; 1,25-hidroxivitamina D_3; la hormona paratiroidea

INTRODUCTION

Over the last decades we have been witnessing the aging process of the population. In Portugal, as it stands all over the world, between the years of 2009 and 2014 there was a decrease of the young population and of the population in active age with an increase of the elderly. This is a result of many factors like the low birth rate, the increase of longevity and immigration (Instituto Nacional Estatistica, 2014).

The aging process conducts to physical and sensory limitations that make daily activities more difficult and conduct to dependency. Besides, the elderly suffers a progressive decline of their physical and mental health, witch creates a need for more support (Marisa & Neves, 2012). In 2014, in Portugal, the dependency index was 31 elderlies for each 100 people in active age (Instituto Nacional Estatistica , 2014).

It has been found, in the developing countries, a lot of changes on the families' role regarding the care provided to the elderly. Factors like urbanization, young migration to other cities, smaller families mean, in practice, less people available to take care of the elderly (World Health Organization, 2005). The necessity of being helped (mentally, affectively and physically) causes the elderly to live institutionalized (Castro, Camargos, Rodrigues, & Machado, 2011; Marisa & Neves, 2012; Paula, Sequeira, & Dias, 2011).

The institutionalized elderly are different from the one that is not, specially in a daily routine perspective and lifestyle. The first depends on what the people that takes care of him decides, the second only depends on himself and can change his daily program whenever he wants. Is increasingly consensual the necessity to keep people active in their environments keeping in mind the physical, social and mental equilibrium. In this way, we can even question if being institutionalized provides this necessary and healthy equilibrium between the biological conditions and his environment (Paula et al., 2011; World Health Organization, 2005). Several studies point to the idea that institutionalization creates physical inactivity and social exclusion, as well as the communication between the elderly, the exterior world and the environment. Institutionalized elderly usually find themselves restricted to the institutionalized space and the tasks that the people taking care of them make them do. This limitations origin the decline of the autonomy capacity which culminates in the increase of the dependency(Marisa & Neves, 2012; Paula et al., 2011). On the other hand, this elderly benefit of a daily support and care according to their necessities (Paula et al., 2011). The non-institutionalized-elderly lives in his comfort zone and plans his activities. He depends only on his family, friends and community to take care of his needs (Marisa & Neves, 2012; Paula et al., 2011).

With the aging process, the osseous metabolism suffers some alterations like the reduction of the mass bone and a higher risk of fracture. The mass bone is maintained through the continuous balance between the formation and destruction. The osseous metabolism, it involves the availability of several minerals (calcium and phosphide) and a series of hormones that regulate the plasmatic concentration of calcium. The parathormone (PTH) and vitamin D are the manly responsible hormones osseous physiologic regulation (Boucher, 2012; Lips, 2012; Thacher & Clarke, 2011).

Vitamin D (Calciferol) includes two steroids forms, the D_2 and D_3, both of them obtained the diet and cutaneous synthesis potentiated by the presence of UV radiation. Vitamin D plays an hormonal role and is produced from 7-dehydrocholesterol, a cholesterol precursor found in the high skin concentrations. UV radiation potentiates the formation of vitamin D_3 witch activation has two hydroxylation: In the liver is hydroxylated to 25-hydroxivitamin D_3 (25(OH)D), compound that is transported to the kidney in order to suffer a new hydroxylation and create the 1,25-dihydroxyvitamin D_3 ($1,25(OH)_2D_3$) (The most active form of vitamin D). The $1,25(OH)_2D_3$ (calcitriol) acts in the intestine to absorbed the calcium (7,8). The deficiency of vitamin D results in a decrease of the bone mineralization and in a rickets in the child and osteomalacia in the adult (Laird, Ward, McSorley, Strain, & Wallace, 2010). The hypovitaminosis D is a lack of vitamin increasingly frequent in the developed countries due to dietary errors lower sun exposure and sedentary lifestyle (Silva, Camargos, Fujii, Dias, & Soares, 2008; Thacher & Clarke, 2011). Beyond these aspects, several studies point to hypovitaminosis D even in countries with a lot of sun radiation and in studies made at the final of the summer (Lanham-new, 2008; Pérez-llamas et al., 2008; Portela et al., 2010). The plasmatic concentration of vitamin D, is interpreted according to reference values assumed for the adults, being that, plasmatic concentrations that are inferior to 20 ng/ml determine state of deficiency of the hormone; values between 20 ng/ml and 30 ng/ml, are considered insufficient; and concentrations between 30 and 100 ng/ml are sufficient when it comes to an adult (Analytics, Ce, & La, 2010). In fact, the geriatric population is more sensitive to hypovitaminosis D due to several reasons: low sun exposure, reduction of the capacity to synthesise the hypovitaminosis D, bad diet, inadequate absorption of calcium by the gastrointestinal tract, utilization of medication and the compromise of the kidneys (Santiago et al., 2012; Saraiva et al., 2007; Timpini, Pini, Tantucci, Cossi, & Grassi, 2011). Several studies point to a plus risk of hypovitaminosis D on patients that are institutionalized or hospitalized (Ebeling, 2014; Gallagher et al., 1998; Himeno et al., 2009; Kinyamu, Gallagher, Balhorn, Petranick, & Rafferty, 1997; Kinyamu, Gallagher, Rafferty, & Balhorn, 1998; Kuwabara et al., 2009; Marta & Cardoso, n.d.; Suleiman, Nelson, Li, & Moniz, 1997). The synthesis of $1,25(OH)_2D_3$ is potentiated by the PTH and inhibited by high serum levels of calcium.

The hormone of the parathyroid, PTH, is produced by the parathyroid glands. The secretion of this hormone is regulated by the plasmatic calcium concentration, in an inverse relation between the ion concentration and the hormone liberation (Ebeling, 2014).

Ribeiro, M., Figueiredo, J. & Gabriel, A. (2016). Lifestyle impact on serum level of vitamin D and PTH, in elderly. *Millenium, 2*(2), 27-36.

The connection of PTH to the receptors of the parathyroid hormone on the target tissues, begins a sequence of reactions that result in the increase of extracellular calcium. The PTH stimulates the bone reabsorption, resulting in the release of bone's calcium, as well as the reabsorption of calcium in the renal tubules and, synthesis of 1,25-dihydroxyvitamin D, that acts over the intestinal cells to increase the calcium reabsorption (Saraiva et al., 2007; Thacher & Clarke, 2011). The peptide of PTH intact (iPTH) is composed by 84 amino acids and suffers modifications in the liver, capable of produce fragments of PTH. The reference range for the iPTH was established through the dosing in samples in healthy individuals, setting up a global range of 14 to 72 pg/ml (Pth, 2007).
This study has the purpose of evaluate the hormones that are involved in the regulation of calcium in institutionalized and non-institutionalized elderly, with an independent and active lifestyle.

1. METHODS

This investigation was made having in mind an observational and analytic study.

1.1 Sample

The first group was composed by 25 institutionalized elderly, with ages between 63 and 98 (19 were female and 6 were male) not completely immobilized that were living in three different nursing homes. The second group was composed by 25 non-institutionalized elderly, with ages between 63 and 91 (15 were female and 10 were male) with an independent and active life. After we made a questionnaire, we collected blood samples in to EDTA tube. We collected the blood samples during November.

1.2 Data collection instruments and procedures

For the present study were selected two sample groups. In order to do that we used the sampling technique for convenience of the non-probabilistic type. In an initial fase, the participants were evaluated through a questionnaire about life style, autonomy and health state. The autonomy and mobility level was evaluated using the Barthel Index. This index allows the mediation of the dependency level through the sum of points obtained on each scale parameter. The punctuation obtained allows us to frame the respondent in a specific class of dependency: Totally dependent (<20points) Severely dependent (20-39 points) moderately dependent (40-59 points) lightly dependent (60-89) and independent (90-100 points).
After the realization of the questionnaires, the process of collecting blood samples was fulfilled using EDTA test tubes, posteriorly stored in ice until the moment of analytic dosing.
For the measurement of the vitamin D, we used the assay ADVIA Centaur Vitamin D Total, Siemens- Germany, that realizes the quantitative determination of the total 25(OH)vitamin D in the serum and human plasma. It is a competitive immunoassay, that uses an antibody anti-fluorescein monoclonal connected by covalent to paramagnetic particles, an antibody anti-25(OH)vitamin D monoclonal marked by an acridine ester and a vitamin analog marked with fluorescein. The quantity of vitamin D present in the sample will be inversely proportional to the amount of relative light units (RLUs) detected by the system. This assay has, as detention limits, concentrations of 25 (OH)D of 4,2 ng/ml and 150 ng/ml (Analytics et al., 2010)
For the plasmatic determination of iPTH (Intact parathyroid hormone) we used the assay ADVIA Centaur PTH intact, Siemens-Germany. It is a sandwich type immunoassay, that uses direct quimioluminometric technology, and utilizes constant quantities of two antibodies anti-PTH human. The first antibody is a polyclonal anti-PTH human of goat marked by acridine ester. The second is a polyclonal antibody ant PTH human of goat biotinylated. The solid faze contains streptavidin, a substance that allows the connection of the biotinylated antibody. The quantity of IPTH present in the sample is directly proportional to the quantity of relative units of light (RLUs) detected by de system. For this assay, the limits of detection are 2,5 pg/ml and 1900 pg/ml (Pth, 2007).

1.3 Statiscal analysis

The statistical treatment of the collected data by questionnaires and blood samples, had as support the IBM SPSS 21 Software. The statistical designs applied were: Wilcoxon-Mann-Whitney, linear correlation coefficient Pearson and Spearman Correlation of Ordinal. For the statistical inference was assumed a degree of confidence of 95%, for a random error probability less or equal to 5%

2. RESULTS

According to the collected data from the surveys and the obtained results on the 25(OH)D and iPTH dosing, we obtained the results that we are going to introduce and describe in a short way on the tables 1 and 2.

Table 1: Relationship between 25(OH)D / iPTH results, and all variables studied.

		25(OH)D (ng/ml)		iPTH (pg/ml)	
		M±SD (n)	*p*	M±SD (n)	*p*
Institutionalization	Yes	5.72±3.75 (25)	0.021	93.57±38.69 (23)	0.076
	No	7.19±3.88 (25)		74.08±30.23 (21)	
Gender	Female	6.87±4.17 (34)	0.404	82.87±38.20 (30)	0.392
	Male	5.57±2.99 (16)		87.26±31.49 (14)	
Chronic Disease					
Kidney	Yes	6.19±3.51 (11)	0.629	70.76±26.93 (10)	0.198
	No	6.53±3.98 (39)		88.24±37.54 (34)	
Bone	Yes	7.75±4.24 (4)	0.202	58.20±30.35 (3)	0.185
	No	6.35±3.84 (46)		86.18±35.83 (41)	
Skin	Yes	6.66±2.29 (3)	0.539	69.63±31.77 (3)	0.500
	No	6.44±3.94 (47)		85.34±36.29 (41)	
Thyroid	Yes	8.27±2.95 (3)	0.059	64.80±23.83 (3)	0.295
	No	6.34±3.89 (47)		85.70±36.41 (41)	
Other	Yes	6.15±3.20 (20)	0.265	82.76±33.08 (17)	0.277
	No	6.67±4.26 (30)		85.22±38.14 (27)	
Vitamin Supplements					
Calcium Metabolism	Yes	8.41±5.10 (7)	0.030	63.44±32.08 (7)	0.052
	No	6.14±3.58 (43)		88.21±35.59 (37)	
Others	Yes	6.47±3.20 (2)	0,869	70.80±29.42 (2)	0.612
	No	6.46±3.90 (48)		84.91±36.34 (42)	
Daily Activities					
Walking	Yes	6.68±3.79 (28)	0.459	72.21±26.98 (25)	0.016
	No	6.18±3.99 (22)		100.14±40.48 (19)	
Agriculture	Yes	7.33±4.03 (21)	0.033	71.42±28.56 (17)	0.073
	No	5.82±3.65 (29)		92.36±38.11 (27)	
Housework	Yes	7.53±4.24 (18)	0.110	64.08±23.28 (16)	0.003
	No	5.86±3.53 (32)		95.81±37.02 (28)	
Number of daily activities	[1-2]	6.23±3.92 (25)	0.456	96.21±39.77 (22)	0.041
	≥3	6.69±3.84 (25)		72.33±27.52 (22)	
Food					
Number of daily meals	[3-4]	6.28±3.53 (37)	0.721	85.47±36.23 (32)	0.527
	[5-6]	6.91±4.76 (13)		81.07±36.35 (12)	
Barthel Index					
Slightly dependent		4.29±0.21 (7)	0.124	120.53±56.61 (6)	0.075
Independent		6.81±4.04 (43)		78.54±28.58 (38)	

Ribeiro, M., Figueiredo, J. & Gabriel, A. (2016). Lifestyle impact on serum level of vitamin D and PTH, in elderly. *Millenium, 2*(2), 27-36.

Table 2: Relationship between 25(OH)D / iPTH results, and all variables studied according the variable "institutionalization".

		Institutionalization				
25(OH)D (ng/ml)		Yes		No		
		M±SD (n)	*p*	M±SD (n)	*p*	*p*
Vitamin Supplements						
Calcium Metabolism	Yes	4.72±0.00 (1)	0.139	9.02±5.29 (6)	0.224	0.617
	No	5.76±3.82 (24)		6.62±3.29 (19)		0.068
Others	Yes	4.20±0.00 (1)	0.579	8.73±0.00 (1)	0.474	0.317
	No	5.79±3.81 (24)		7.13±3.95 (24)		0.036
Daily Activities						
Number of daily activities	[1-2]	6.01±4.04 (21)	0.235	7.35±3.51 (4)	0.619	0.131
	≥3	4.20±0.00 (4)		7.16±4.03 (21)		0.055
Food						
Number of daily meals	[3-4]	5.90±3.97 (22)	0.823	6.87±2.82 (15)	0.753	0.030
	[5-6]	4.37±0.30 (3)		7.67±5.23 (10)		0.358
Barthel Index						
Slightly dependent		4.29±0.21 (7)	0.511	-(*)	-(*)	-(*)
Independent		6.29±4.31 (18)		7.19±3.88 (25)		0.103
iPTH (pg/ml)						
Vitamin Supplements						
Calcium metabolism	Yes	50.70±0.00 (1)	0.175	65.57±34.60 (6)	0.276	1.00
	No	95.52±38.39 (22)		77.49±28.88 (15)		0.146
Others	Yes	50.00±0.00 (1)	0.132	91.60±0.00 (1)	0.322	0.317
	No	95.55±38.39 (22)		73.21±30.74 (20)		0.047
Daily Activities						
Number of daily activities	[1-2]	92.79±41.05 (19)	0.685	117.87±24.97 (3)	0.021	0.131
	≥3	97.30±29.07 (4)		66.78±24.64 (18)		0.042
Food						
Number of daily meals	[3-4]	91.92±35.39 (20)	1.00	74.73±36.53 (12)	0.776	0.186
	[5-6]	104.60±66.06 (3)		73.22±21.17 (9)		0.782
Barthel Index						
Slightly dependent		120.53±56.61 (6)	0.208	-(*)	-(*)	-(*)
Independent		84.06±26.24 (17)		74.08±30.23 (21)		0.223

Legend: M: Average. SD: Standard Deviation. N: number of valid cases. p: p-value. Wilcoxon Mann-Whitney test for independent samples and Correlations of Pearson and Spearman.

(*) For this condition, there are zero cases

3. DISCUSSION

An introspective analysis to the results exposed showed, in first hand, a severe deficiency of vitamin D in both groups of study. In average, the concentration of 25(OH)D was 5,72 ng/ml±3,75 for the institutionalized group, and 7,19 ng/ml±3,88 for the non-institutionalized group. Attending to these results, we can deduce that in both groups, the average was substantially lower to the values considered sufficient of vitamin D for adults, because values lower than 20 ng/ml translate deficiency of this hormone. In a study realized by M. L. Pita Martin Portela et al. 2010, witch aimed to dose the 25(OH)D in institutionalized elderly of two countries with similar solar radiation index, they verified that, even in the end of the summer there were a deficit of vitamin D in both groups. This study seems to indicate that the deficiency of vitamin D is not restrict to a specific season, but transversal to all year, despite the fact that the values of vitamin D tend to be higher during the months of summer (Portela et al., 2010).

The synthesis mechanism of vitamin D tends to suffer alterations with the aging process, not only because of the lower sun exposure, but also due to the compromised capacity to create precursors of vitamin D in the skin, the reduce intake of vitamin D in the diet and, possibly, also because of the decay of the receptors of vitamin D in the duodenum. Besides, the capacity to convert the vitamin D in its active molecule ($1,25(OH)_2D$) suffers a decline, because of the renal commitment, natural in this age group. Citing a study by Saraiva et al 2007, that evaluated the prevalence of deficiency/failure of vitamin D in non-institutionalized and institutionalized elderly, 71,2% of the institutionalized individuals and 43,8% of the non-institutionalized had values of 25(OH)D lower than the recommended minimum, being that, in both groups, the woman had values of 25(OH)D lower than the men ($p<0,001$) (Santiago et al., 2012). A study realized by Gallagher et al, 1998, refers precisely differences of 2 to 3 ng/ml of 25(OH)D, between genders, (Gallagher et al., 1998) although our study didn't prove that.

In fact, the deficiency of vitamin D looks common among elderly, being that the institutionalized tend to present a sharpest deficit of vitamin D comparatively to the non-institutionalized (Kinyamu et al., 1997). The study realized by Saraiva et al 2007, found that the non-institutionalized group presented, in average, serum concentration of 25(OH)D higher comparatively to the institutionalized group (Saraiva et al., 2007).

On the other hand, for the iPTH the results were considerably high. The average values of iPTH were between 93,57 pg/ml±38,69 for the institutionalized group and 74,08 pg/ml±30,23 for the non-institutionalized individuals. Attending to this data we verified that, for the PTH hormone, there is no deficit but higher concentrations to the reference range (14-72 pg/ml). Several studies point for an increase of the plasmatic concentration of iPTH with the aging process. Gallagher et al 1998, gives focus to this increase and points, as a possible explanation, the decrease of the renal function (Gallagher et al., 1998). However, such increase is not explained only by the decrease of renal clearance, but can represent secondary hyperparathyroidism being that a result of vitamin D failure (Saraiva et al., 2007).

Beyond this aspect, it becomes important to emphasize, that in the group samples, we verified an inverse relation between the 25(OH)D and iPTH ($r= - 0,160$). So, the institutionalized group presented lower concentrations of 25(OH)D and higher concentrations of iPTH, while the non-institutionalized revealed higher concentrations of 25(OH)D and lower concentrations of iPTH. Several studies, performed on elderly, support the inverse relation between 25(OH)D and PTH (Portela et al., 2010; Saraiva et al., 2007; Silva et al., 2008). This results reflect the attempt to compensate the insufficiency of vitamin D, through the PTH. Lower concentrations of $1,25(OH)_2$ D, culminate with the decrease of calcium intestinal absorption and consequently, with the decrease of serum calcium, witch in turn, triggers the increase of PTH secretion by the parathyroid. In our study, the presence of thyroid disease, didn't show any kind of relation with the concentration of 25(OH)D, however, it seems to exist a correspondence between these two variables ($p=0,059$). In fact, an accentuated deficit of vitamin D triggers an increase of the PTH secretion. When the deficit is long, the probability of developing secondary hyperparathyroidism is high.

Attending to the vitamin supplementation, we verified that the elderly that took calcium supplements and/or indicated medication for the calcium metabolism, presented higher values of 25(OH)D ($p<0,05$) and lower concentrations of iPTH ($p=0,052$). Several studies have been developed, with the objective of understanding the pros and cons of this type of medication. According to Kuwabara et al 2009, the daily vitamin D supplementation in institutionalized individuals is crucial, having in mind that the sun exposure among these elderly is reduced (Kuwabara et al., 2009). Curiously, in our study, we verified that the non-institutionalized elderly that don't take any type of vitamin supplementation, present higher values of 25(OH)D ($p<0,05$) and lower concentrations of iPTH ($p<0,05$) comparatively to the institutionalized. Attending to these results, we can verify that the adoption of an active life style, independent and the life in the countryside seems to contribute for more balanced plasmatic concentrations of these hormones. Even so, the hypovitaminosis D is evident and should not be underrated. These data allow us to reflect about the necessity of vitamin supplementation for the calcium metabolism, even in elderly that live in the countryside and have an active life. According to the National Academy of Science, it is important to use an daily unique multivitamin that contains 400-800UI/d of ergocalciferol (10-20 µg/dia), that will provide the normal level of vitamin D,

even in institutionalized elderly (Marta & Cardoso, n.d.) The daily activities practiced by the elderly, showed to be related with the hormones that are being studied. We verified that the individuals that performed more daily activities tended to present lower concentrations of iPTH ($p<0,05$). Analyzing the results, the practice of outdoor activities seems to be related with the concentrations of 25 (OH)D and consequently iPTH, as agricultural activities and walks. The lower sun exposure is associated to a decrease of mobility and to a lower activity. Several studies point, as manly cause of the decrease of vitamin D plasmatic concentration with the aging process, the lower sun exposure (Gallagher et al., 1998). In fact, the practice of outdoor activities allows the increase of sun exposure and, consequently, an increase of cutaneous synthesis of vitamin D, needed for the calcium intestinal absorption. The consequent increase of the calcium serum levels triggers the decrease PTH synthesis. This could be the explanation for active individuals to present better results for the hormones that regulate calcium. Apart from this aspect, the practice of daily activities has been associated with an improvement of the bone density and consequently the prevention of osteoporosis. It is known that factors like the prevention of the need of vitamin D and the practice of physical exercise contributes for the bone reshuffle. However, the relation between a sedentary lifestyle and the plasmatic concentrations of the hormones that regulate calcium is not evident (Marta & Cardoso, n.d.). A study performed by Suleiman et al, 1997, that aimed to evaluate the influence of the ingestion of calcium and the physical activity in the osseous turnover in postmenopausal woman, concludes that the practice of physical activity allied to an ingestion of calcium in the diet, favored the increase of the bone mineral density ($p<0.001$) (Suleiman et al., 1997).

The elderly that realized three to four meals per day, and that were not institutionalized, tended to present better results for the vitamin D. There weren't found studies that support the relation between the number of daily meals and the concentrations of 25(OH)D and iPTH. However, the diet and, particularly, the daily ingestion of calcium and vitamin D in the diet are indispensable for the bone metabolism. Kinyamu et al, 1998 investigated in what way the calcium ingestion through dairy, could reflect the decrease of iPTH. It concludes that, in fact, the ingestion of foods rich in calcium contributed for the decrease of iPTH and prevention of secondary Hyperparathyroidism (Kinyamu et al., 1998).

CONCLUSIONS

The present study corroborates the premise that the adoption of an active life style and the contact with nature brings benefits to the aging process. It was found an elevated prevalence of hypovitaminosis on the elderly that made part of this study and particularly the institutionalized. The concentrations of 25(OH)D were substantially higher on the countryside elderly with an active and independent life. This result might be explained through the higher sun exposure of these elderly, comparatively to the institutionalized ones, whose tasks are, usually restricted to the institutional space. The PTH represented an inverse relation with the 25(OH)D expected, this is, the group with lower concentrations of 25(OH)D, presented higher concentrations of iPTH. This is a physiological behavior and intends to compensate the hypovitaminosis D, however it can be explained as well with the secondary hyperparathyroidism. It would be important to discard this condition in future studies through the ionized calcium mediation in order to, in case of hypercalcemia, we can contribute for its clarification. The PTH serum level will be higher if it is a result of some kind of hyperparathyroidism; if the hypercalcemia has a non-parathyroid origin, than the PTH will deleted. It would be advantageous to exclude the interference of the renal and liver function in these hormones concentrations, through de measurement of the serum creatinine and transaminases, respectively, excluding all the elderly that presented all these changed parameters. Beyond this conditions, it would be interesting to associate these results to the bone mechanisms, through the mediation of the bone mineral density and markers of bone reshuffle, associating them to the risk of fracture and falls prevention.

Concluding, we observe a higher prevalence of hypovitaminosis D in geriatric population, that were more sharp in the institutionalized group, but also present in the non-institutionalized group. Because of this, we consider that the incentive for sun exposure, vitamin supplementation for the calcium metabolism, food fortification and the practice of daily activities, should be taken into account, in our country as well as the implementation of food fortification politics with vitamin D, specially directed to the ones with higher risk.

ACKNOWLEDGEMENTS

This study was funded and supported by: *Labinsaúde* – integrated in the project co-funded by QREN within the *"Programa Mais Centro",* of the coordination of the center region commission and EU through European regional development fund as well as Coimbra Health School as organic unit of the Polytechnic Institute of Coimbra.

REFERENCES

Analytics, Manual de ensaios do Advia centaur - Bula Vitamin D total (2010). Siemens Medical Solutions. *25*, 1–5.

Boucher, B. J. (2012). The problems of vitamin d insufficiency in older people. *Aging and Disease*, *3*(4), 313–329.

Castro, M., Camargos, S., Rodrigues, R. N., & Machado, C. J. (2011). Idoso , família e domicílio : uma revisão narrativa sobre a decisão de morar sozinho, *28*(1), 217–230.

Ebeling, P. R. (2014). Vitamin D and bone health: Epidemiologic studies. *BoneKEy Reports*, *3*(November 2013), 511. http://doi.org/10.1038/bonekey.2014.6

Gallagher, J. C., Kinyamu, H. K., Fowler, S. E., Dawson-Hughes, B., Dalsky, G. P., & Sherman, S. S. (1998). Calciotropic hormones and bone markers in the elderly. *Journal of Bone and Mineral Research : The Official Journal of the American Society for Bone and Mineral Research*, *13*(3), 475–82. http://doi.org/10.1359/jbmr.1998.13.3.475

Himeno, M., Tsugawa, N., Kuwabara, A., Fujii, M., Kawai, N., Kato, Y., … Tanaka, K. (2009). Effect of vitamin D supplementation in the institutionalized elderly. *Journal of Bone and Mineral*

Metabolism, *27*(6), 733–7. http://doi.org/10.1007/s00774-009-0081-7

Instituto Nacional de Estatística (2014) *População- Estatísticas Demográficas 2014.* INE, Portugal (2014). Disponível em: http://www.ine.pt.

Kinyamu, H. K., Gallagher, J. C., Balhorn, K. E., Petranick, K. M., & Rafferty, K. A. (1997). Serum vitamin D metabolites and calcium absorption in normal young and elderly free-living women and in women living in nursing homes. *The American Journal of Clinical Nutrition, 65*(3).

Kinyamu, H. K., Gallagher, J. C., Rafferty, K. A., & Balhorn, K. E. (1998). Dietary calcium and vitamin D intake in elderly women : effect on serum parathyroid hormone and vitamin D metabolites. *The American Journal of Clinical Nutrition 67*(2), 342–348.

Kuwabara, A., Tsugawa, N., Tanaka, K., Fujii, M., Kawai, N., Mukae, S., Okano, T. (2009). Improvement of vitamin D status in Japanese institutionalized elderly by supplementation with 800 IU of vitamin D(3). *Journal of Nutritional Science and Vitaminology*, *55*(6), 453–8. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/20086314

Laird, E., Ward, M., McSorley, E., Strain, J. J., & Wallace, J. (2010). Vitamin D and bone health: potential mechanisms. *Nutrients*, *2*(7), 693–724. http://doi.org/10.3390/nu2070693

Lanham-new, S. A. (2008). Importance of calcium , vitamin D and vitamin K for osteoporosis prevention and treatment, (July 2007), 163–176. http://doi.org/10.1017/S0029665108007003

Lips, P. (2012). Interaction between vitamin D and calcium. *Scandinavian Journal of Clinical and Laboratory Investigation. Supplementum*, *243*(Suppl 243), 60–4. http://doi.org/10.3109/00365513.2012.681960

Marisa, H., & Neves, F. (2012). Causas e Consequências da Institucionalização de Idosos - Estudo tipo série de casos. Dissertação de Mestrado em Gerontologia. Universidade da Beira Interior - Ciências da Saúde. Disponivel em: https://ubibliorum.ubi.pt/bitstream/10400.6/1209/1/CAUSAS_CONSEQUENCIAS_INSTITUCIONALIZA%C3%87AO_IDOSOS.pdf

Marta, S., & Cardoso, R. (1998). Vitamina D em idosos (Tese de douturamento não publicada). Faculdade de Ciências da Nutrição e Alimentação da Universidades do Porto.

Paula, M., Sequeira, R., & Dias, M. O. (2011). Adaptação dos idosos institucionalizados. *Millenium*, 40: 161–184. Disponivel em: www.ipv.pt/millenium/Millenium40/12.pdf.

Pérez-llamas, F., Ph, D., López-contreras, M. J., Ph, D., Blanco, M. J., Ph, D., … Ph, D. (2008). Seemingly paradoxical seasonal influences on vitamin D status in nursing-home elderly people from a Mediterranean area, *24*, 414–420. http://doi.org/10.1016/j.nut.2008.01.006

Instituto Nacional de Estatística (2014) *População- Estatísticas Demográficas 2014.* INE, Portugal (2014). Disponível em: http://www.ine.pt.

Portela, M. L. P. M., Mónico, A., Barahona, A., Dupraz, H., Sol Gonzales-Chaves, M. M., & Zeni, S. N. (2010). Comparative 25-OH-vitamin D level in institutionalized women older than 65 years from two cities in Spain and Argentina having a similar solar radiation index. *Nutrition (Burbank, Los Angeles County, Calif.)*, *26*(3), 283–9. http://doi.org/10.1016/j.nut.2009.04.022

PTH Intacta, Manual de ensaios do Advia Centaur (2007). Bula PTH intacta (iPTH). Siemens Medical Solutions Diagnostics. 1-12.

Santiago, T., Rebelo, M., Porto, J., Silva, N., Vieira, J., & Costa, J. M. N. (2012). Hipovitaminose D em Doentes Internados num Serviço de Medicina Interna, *25*(2), 68–76.

Saraiva, G. L., Cendoroglo, M. S., Ramos, L. R., Araújo, L. M. Q., Vieira, J. G. H., Maeda, S. S., … Lazaretti-Castro, M. (2007). Prevalência da deficiência, insuficiência de vitamina D e hiperparatiroidismo secundário em idosos institucionalizados e moradores na comunidade da cidade de São Paulo, Brasil. *Arquivos Brasileiros de Endocrinologia & Metabologia*, *51*, 437–442. http://doi.org/10.1590/S0004-27302007000300012

Silva, B. C. C., Camargos, B. M., Fujii, J. B., Dias, E. P., & Soares, M. M. S. (2008). Prevalência de deficiência e insuficiência de vitamina D e sua correlação com PTH, marcadores de remodelação óssea e densidade mineral óssea, em pacientes ambulatoriais. *Arquivos Brasileiros de Endocrinologia & Metabologia*, *52*(3), 482–488. http://doi.org/10.1590/S0004-27302008000300008

Suleiman, S., Nelson, M., Li, F., & Moniz, C. (1997). Effect of calcium intake and physical activity levei on bone mass and turnover in healthy , white , postmenopausal women. *The American Journal of Clinical Nutrition*, *66*(4).

Thacher, T. D., & Clarke, B. L. (2011). Vitamin D insufficiency. *Mayo Clinic Proceedings. Mayo Clinic*, *86*(1), 50–60. http://doi.org/10.4065/mcp.2010.0567

Timpini, A., Pini, L., Tantucci, C., Cossi, S., & Grassi, V. (2011). Vitamin D and health status in elderly. *Internal and Emergency Medicine*, *6*(1), 11–21. http://doi.org/10.1007/s11739-010-0407-4

World Health Organization. (2005). Envelhecimento ativo: uma política de saúde, 60. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Envelhecimento+ativo:+uma+pol?tica+de+sa?de#0