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Nutritional status and body composition of elderly persons hospitalized in the public hospitals of Greater Casablanca, Morocco

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Abstract
Background/Objectives*:*
Senescence is associated with changes in body composition and body mass index (BMI) that are considered essential indicators in the assessment of the nutritional status of hospitalized elderly persons (HEP). The objective of this study is to describe the nutritional status and body composition of Moroccan HEP in public hospitals in the Greater Casablanca. ***Methods/Statistical analysis:*** *A total of 120 persons aged 60 years and over hospitalized in public hospitals care services. A questionnaire for the screening of sociodemographic characteristics, clinical indicators, biological, anthropometric, body composition, and finally indices of nutritional composites, namely, the Geriatric nutritional Risk Index (GNRI), and the Mini nutritional Assessment (MNA)* ***Findings:*** *The mean age and BMI were respectively 80.96 ± 6.7 and 22.5 ± 4.5. 46.7% (n = 56). Significant differences were found between the two classes of BMI (<21 kg / m² versus> 21 kg / m²) and protein intake, fat mass and C reactive Protein Negative correlations were found between BMI and age ,duration of hospitalization (r = -0.5, p <0.001) and CRP (r = -0.3, p <0.001), and positive between BMI and a set of clinical and biological parameters. .*

Keywords: *BMI, CRP, nutritional status, Morocco, Senior*

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I. Introduction

Ageing is a slow and gradual process that leads to a decrease in the functional reserves of most physiological systems, which leads to a state of vulnerability in the elderly person. To this end, senescence is associated with physiological changes, in particular, of body composition and body mass index (BMI), considered as essential indicators in the assessment of the nutritional status of older persons. In this sense, several studies report a remarkable change in body size in patients aged over 60 years (1) (2) (3).

Indeed, the ageing population are affected by the malnutrition that has become a public health problem, since its prevalence reaches 80% in institutions and hospitals both in the care of the suite and in long-term geriatric care. However, rates of this prevalence vary depending on the population studied and the diagnostic tools that are not homogeneous (4) (5).Furthermore, malnutrition (caused by low protein-energy) is the main cause of the decrease in mass and muscular strength among the hospitalized elderly persons (HEP), it also has a significant impact on the functional capabilities, in this case, a decrease in chewing capacity, the perception of flavors, as well as the efficacy of the immune and metabolic system, in particular, by causing an inflammatory syndrome and a decrease in the rate of circulatory proteins. Studies have indicated that denutrition increases the risk of mortality (RR x 4), Morbidity (RR x 5), and infection (RR x 2.5) in HEP (6) (7) (8).

Systematic screening and the rapidity of nutritional interventions enable the improvement of the functional state of the HEP, accelerate the healing process, and reduce the incidence of mortality and morbidity, including the reduction of hospital care costs (9). In the light of these, only few studies in Morocco in this subject, so we wanted to conduct a study to assess the nutritional status of elderly people hospitalized in the public hospitals of the city of Casablanca

II. Materials and Methods

This is a cross-sectional epidemiological survey of the nutritional status of HEP in the healthcare services of public hospitals in the city of Casablanca, conducted from March 2015 to December 2016.

Subjects: We included 120 subjects, men and women, aged 60 and over in a random sample. These patients were selected from the various hospital services in the Greater Casablanca region. These elderly patients have been admitted to the hospital and do not come from other medical facilities whose duration of hospitalization is greater than or equal to ten days.

The exclusion criteria were: elderly patients with pathologies that interfere with body composition, such as edema, burns, peritoneal dialysis, hemodialysis, rehydration perfusion, major cardiopulmonary resuscitation, wearing a pacemaker, and intake of diuretics (n = 76). Informed consent was obtained from all subjects participating in the study, informed of its purpose and course of action in accordance with the deceleration of Helsinki in 1964.

Data collection: a single investigator in the hospitalization chamber conducted individual interviews. Each interview lasted from 45 to 60 minutes. The survey included a face-to-face questionnaire, tested and standardized by a pre-test with a subsample, to collect all the data from the study. The questionnaire examined the sociodemographic characteristics of the patient, including age, sex, marital status, level of education, and the environment of residence, and then, on clinical and biological indicators, on hospital parameters, such as, duration and reason for hospitalization, medication, motor skills, feeding, the existence of problems of chewing and swallowing , and the biological balance, in this case, albumin, C reactive protein (CRP), serum iron, serum ferritin, total cholesterol. Then, on anthropometric indicators and those of body composition namely the weight, the size, BMI, lean mass, fat mass, total cell water, intracellular water and extracellular water, and nutrient composite indices, including the Geriatric nutritional Risk Index (GNRI) and the Mini nutritional Assessment (MNA). Finally, a food balance for each subject of the study.

Statistical Analysis: The Gaussian variables were presented by the mean ± standard deviation (SD), whereas the non-Gaussian variables were presented by the median and the interquartile interval [QRI]. Qualitative variables were presented by the Absolute (n) and relative (%) frequency. The Chi 2 test was used for association between qualitative variables, whereas, the student and Fisher T-Test was used to compare the BMI between the quantitative variables. The relationship between the BMI and the continuous variables was evaluated with the correlation test of Spearman. A downward linear regression was performed to identify the factors associated with BMI. Qualitative and quantitative variables, of which p value was less than 0.05 during the various analysis, were included in this model. SPSS software 20 was used. The results were statistically significant when P value was less than 0.05.

III. Results

3-1 Description of the Samples :

Our study examined a sample of 120 PA patients with an average age of 80.96 ± 6, 7. 29.0% (n = 56) of the subjects showed a BMI of less than 21 kg/m² (BMI < 21/m²) versus 53.3% (n = 64) with BMI greater than or equal to 21 kg/m² (BMI ≥ 21/m²). In addition, 85.8% (n = 103) of the subjects came from the home, while 14.2% (n = 17) came from the social centres. Moreover, 44.0% (n = 85) of the patients were from the urban environment. All the characteristics of the subjects of the study were presented in Table 1.

Tableau 1: General characteristics of elderly patients hospitalized in the study

	N total	***Characteristics***
Socio-demographic characteristics		
Marital status	120	
Married		41 (34.2)
Not Married		79 (65.8)
Parity	120	6.0 [4.0-7.0]
Clinical and biological indicators		
Reasons for hospitalization	120	
C1		33(27.2)
C2		53(44.2)
C3		34(28.3)
Duration of hospitalization	120	26.0 [11.2-45.0]
Problems with chewing and / or swallowing	120	

Yes		81(67.5)
No		39(32.5)
Biology report	120	
Albumin (g/l)		32.1±3.5
CRP (mg/l)		33.4 [17.4-64.2]
Ferritin(µg/l)		275.2±37.0
Serum Iron(mg/l)		0.7±0.2
Cholesterol levels (g/l)		1.7±0.2
Anthropometric indicators	120	
Weight (kg)		57.4±15.3
Size (cm)		157.0±16.8
BMI (kg/m²)		22.5±4.5
body composition (BIA) (%)	120	
lean mass		35.4±6.9
Fat mass		64.5±6.9
Intracellular water		28.5±4.0
Extracellular water		23.9±2.0
Total cellular water		52.3±5.6
Nutritional composite indexes	120	
MNA		17.9±4.2
GNRI		89.3±14.1
Food balance	120	
Energy (Kcal/J)		1091.6±387.6
Protein (g/J)		0.8±0.2
Liquid Intake (ml/J)		766.9±318.8

BMI : Body Mass Index ; **GNRI :** Geriatric Nutritional Risk Index ; **MNA :** Mini Nutritional Assessment; **CRP :** C Réactive Protéine; **C1 :** Isolated acute pathology; **C2 :** Acute Pathology with Cascades; **C3 :** poly-pathology; **BIA :** bioelectrical impedance analysis

3-2 Distribution of BMI based on clinical, biological, anthropometric and nutritional composite Indices:
The student and Fisher T test revealed statically significant differences between the two classes of BMI and a set of quantitative variables, including weight, protein intake, fat mass, and lean mass (Table 2).

Tableau 2: Distribution of BMI based on clinical, biological, anthropometric and nutritional composite

	BMI<21 Kg/m²	***BMI≥21 Kg/m²***	***P value***
Age	85.2 ±5.3	77.2± 5.5	0.15
Duration of hospitalization	35.0[24.2-70.0]	20.5[11.0-30.0]	0.02*
Weight (kg)	47.0 ±6.1	66.5 ±15.1	<0.01
Size (cm)	153.0± 21.3	160.8 ±9.4	<0.01
MNA	15.1 ±3.4	20.4± 3.3	0.69
GNRI	79.6± 10.3	97.7 ±11.2	0.43
Energy (kcal/J)	832.4 ±224.6	1318.5± 357.8	0.14
Protein (g/J)	0.7± 0.1	1.0 ± 0.1	<0.001
Liquid Intake (ml/J)	614.6± 200.0	900.2± 344.1	0.02
Fat mass (%)	36.7± 5.2	34.3± 8.0	<0.001
lean mass (%)	63.2± 5.2	65.6± 8.0	<0.001
Intracellular (%)water	27.7± 3.8	29.2± 4.1	0.2
Extracellular (%)water	23.7± 2.3	24.1 ±1.7	0.12
Total cellular (%)water	51.1± 6.1	53.4± 4.9	0.5
Albumin (g/l)	30.3± 2.7	33.6± 3.4	0.01
CRP (mg/l)	56.6[24.5-71.8]	28.0[17.4-50.4]	<0.001*
Ferritin (µ/l)	285.4± 44.5	266.3± 26.1	0.01
Serum Iron (mg/l)	0.6± 0.1	0.78± 0.1	0.15
Cholesterol levels (g/l)	1.6± 0.1	1.8± 0.2	0.08

GNRI : Geriatric Nutritional Risk Index ; **MNA :** Mini Nutritional Assessment; **CRP :** C Réactive Protéine, * Médiane [IQR]

The Chi 2 test emphasized that the two classes of BMI were deferred according to the reason for hospitalization ($p < 0.001$), number of medications ($p < 0.001$), self-medication ($P = 0.2$), Motor skills ($p < 0.001$), feeding

method ($p < 0.001$), dental problem ($p = 0.005$), problem of chewing and swallowing ($p = 0.001$), difficulty of perception of gout ($p < 0.001$) , diet followed ($P = 0.3$) and number of meals ($p < 0.001$).

3-3 Correlation between BMI and clinical, biological, anthropometric and nutritional composite Indices:
The correlation of Spearman showed that BMI was consistently negatively correlated with age ($r = -0.7$, $p < 0.001$), duration of hospitalization ($r = -0.5$, $p < 0.001$), and CRP ($r = -0.3$, ($p < 0.001$) while it was consistently positively correlated with weight ($r = 0.8$, $p < 0.001$), size ($r = 0.3$, $p < 0.001$), MNA ($r = 0.7$, $p < 0.001$), GNRI ($r = 0.9$, $p < 0.001$), energy ($R = 0.7$, ($p < 0.001$), protein ($r = 0.6$, $p < 0.001$), fluid inputs ($r = 0.5$, $p < 0.001$), Total body water ($r = 0.2$ $p < 0.008$) and albumin ($r = 0.6$, $p < 0.001$).

3-4 Factors associated with BMI
The variables whose p value was less than 0.05 in the univariate analysis were included in the downward linear regression model. The results indicated that GNRI, energy, intracellular water, albumin, and cholesterol levels could be considered as factors associated with BMI in our study (Table3)

Tableau 3: Factors Associated with BMI

	A	***Beta***	***P value***	***IC 95%***
GNRI	0.76	0.23	<0.001	[0.04 ;0.11]
Energy	0.002	0.14	0.006	[0.001 ;0.003]
Intracellular water	-0.16	-0.14	<0.001	[-0.23 ;-0.09]
Albumin	-0.31	-0.24	<0.001	[-0.43 ;-0.18]
Cholesterol levels	2.21	0.12	0.01	[0.89 ;3.5]

GNRI: Geriatric Nutritional Risk Index

IV. Discussion & Conclusion

The objective of the study is to evaluate the nutritional status of HEP in the care services of the public hospitals of the city of Casablanca. The results of our survey revealed a BMI of 22 Kg/m² for the entire population studied. The vast majority of these patients exhibited an addiction of motor skills, an imbalance in the different compartments of the body composition, a difficulty of chewing, swallowing disorders, perception of taste as well as a need for assistance in feeding. In addition, more than half of these subjects were found to be dietary and less than three meals per day, which reflected the amount of daily ingestats (21). Similarly, these patients presented a concentration of lowered albumin, a decreased MNA score and an increased CRP. The inflammatory state of the subjects contributed to a difficulty of interpretation of the martial balance (22), all these parameters were associated with a poor nutritional condition (23). All of our observations have shown that BMI alone does not help to diagnose a state of malnutrition, given the lack of specificity, it is the responsibility of judging the presence of this malnutrition by associating the BMI with the MNA score and serum albumin as described by the HAS (Haute Autorité de Santé) report (9).

Subjects whose BMI is strictly less than 21Kg/m² were considered to be undernourished, the results of our study show that the prevalence of malnutrition is 29.0% (n = 56). The latter is part of the range of malnutrition that has been reported by the scientific literature (30 to 70%) (9). It was reported that this protein-energetic denutrition has been associated with a hypercatabolisme situation that increases the risk of co-morbidity and mortality, as shown by a study conducted in 82 elderly people in hospital (24). However, the undernourished subjects of our study presented a lower energy and protein intake, a non-fatty mass diminished to the advantage of fat mass and a higher CRP rate compared to subjects whose BMI ≥ 21Kg/m². This may relate, among other things, to the state of malnutrition, inactivity and chronic inflammation experienced by these subjects (25) (26) (27) (28). As such, three studies support our results (2) (3) (29).

Our results have shown that there is a negative correlation between BMI and the duration of hospitalization. In this sense, the authors indicated that a longer duration of hospitalization was correlated with a low BMI with a proven risk of mortality and co-morbidity (30) (31).
In addition, our observations showed positive correlatives between BMI and MNA, fluid inputs, and total body water. In this regard, studies have shown the same results as ours (32) (33) (34). Thus, these observations come to consolidate our constables.

However, our results indicated that GNRI, energy, intracellular water, albumin, and cholesterol levels were considered factors associated with BMI in our study. A group of authors came to the same conclusion as our own, while others did not enter into such constations (11) (35) (36). The differences between our results and those of the other authors can relate to the population studied and to the procedure of the criteria for inclusion of subjects during the study.

Other studies have reported that the BMI has been associated with energy and cholesterol levels (26)

(37) (39). This association can be explained by the fact that the presence of a hypercatabolisme induces an increase in energy requirements and affects the BMI and indirectly on the cholesterol level in the elderly hospitalized.

In the same sense, some investigations show that the BMI was associated, on the one hand, with the body composition, in particular, the intracellular water, and on the other hand, the serum concentration of the biological markers, in this case, albumin (34) (38) (39). A large number of studies go along with the results of our investigation. This association may refer to the decrease in weight in frail elderly people induces a loss of intracellular water and an increase in extracellular water. This water imbalance affects body composition. In addition, it was pointed out that a decrease in BMI leads to a decrease in serum albumin concentration and the risk of increased mortality in HEP (39).

It is incumbent upon us to note that our study has met certain limits which reside essentially in its transversal nature, a relatively small workforce and the possibility that some patients may have had mild, non-visible over hydration, which may have resulted in overestimation of the lean mass and, thus, underestimation of the prevalence of malnutrition. However, the forces of our investigation remain in the fact that this is the first epidemiological study conducted on the nutritional status of the elderly hospitalized in the city of Casablanca, having regard to a set of biological, clinical, anthropometric and nutritional characteristics of the subjects and in the use of the measurement technique by the BIA.

At the end of this study, we highlighted the state of malnutrition in HEP (29.0%), this malnutrition was accompanied by an inflammatory syndrome and a disturbance of the body composition. Our study was also able to highlight the association between BMI and GNRI, energy, intracellular water, albumin and cholesterol levels. Thus, a multi-disciplinary and early management of the admission of hospitalized elderly patients seems to be appropriate for a good hospital evolution of the elderly Moroccan patients. Longitudinal studies should be started to consolidate our findings.

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