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Original article

Evaluation of water balance in a population of older adults. A case control study

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SUMMARY

Older adults are at risk for dehydration and its' potentially life-threatening consequences. Unrecognized dehydration can complicate chronic medical problems and increase morbidity. The objective of the study was to estimate water balance, intake and loss in elderly people living in Greece using the Water Balance Questionnaire (WBQ). WBQ was administered in winter to 108 independents (65–81yrs) (Group A), 94 independents (82–92yrs) (Group B) and 51 hospitalized (65–92yrs) (Group C). A database from previous study of 335 adults (18–65yrs) (Control Group) used for comparison. Mean estimates of water balance, intake and loss were, respectively, for Group A −749 ± 1386 mL/day, 2571 ± 739 mL/day and 3320 ± 1216 mL/day, for Group B −38 ± 933 mL/day, 2571 ± 739 mL/day and 3320 ± 1216 mL/day, for Group C 64 ± 1399 mL/day, 2586 ± 1071 mL/day and 2522 ± 1048 mL/day and for Control Group −253 ± 1495 mL/day, 2912 ± 1025 mL/day and 3492 ± 2099 mL/day. Significant differences were detected in water balance, intake and loss ($p < 0.01$). Water balance and water intake in Group A was the lowest. For Groups A, B, C and Control, contribution of solid foods to water intake was 36%, 29%, 32%, 25%, of drinking water was 32%, 48%, 45%, 47%, of beverages was 32%, 23%, 23% and 28% respectively. Significant differences observed in the contribution of drinking water and beverages ($p < 0.01$). Group A had lower water balance and water intake. Groups B and C had lower water intake from beverages.

1. Introduction

The population of older adults, i.e. people over the age of 65 years is a vulnerable group. Dehydration is a common problem, affecting not only the hospitalized ones but also the free living and the ones living in long term facilities [1]. It can also cause a significant increase in morbidity and mortality amongst them, as it is often connected to increased risk of infections, mainly of the urinary tract, which can significantly elevate the need for hospitalization and treatment [2].

If dehydration in older adults remains unrecognized and untreated, it can worsen the course of chronic diseases and raise mortality risk. For people aged between 80 and 90 yrs, the likelihood of hospitalization for the treatment of dehydration is 6 fold higher compared to the ones from 65 to 69 years and a percentage equal to 18% may pass away during hospitalization [3].

According to the European Food Safety Authority (EFSA) the recommendations regarding hydration in the older adults are not different for the younger ones. According to those recommendations, elderly men need approximately 2.5 L of fluids/day and women 2 L of fluids/day. This amount is corresponding to the total fluid intake and includes, apart from drinking water, the water content of food items, beverages, coffee, tea, fruit juices, etc [4]. Previous recommendations from the US National Research Council proposed an intake of 30 mL/kg body weight for people over the age of 65 yrs, or 1 mL of fluids per 1 Kcal of energy intake [5]. The Dutch Nutrition Board, after evaluating the needs of free living older adults in Europe who were born between 1913 and 1918 concluded that the necessary level of fluid intake is 1700 mL/day [6]. On the other hand, the Apports Nutritionnels Conseille of France recommends an intake of at least 1500 mL of fluids/day, an amount that should be increased according to the lever of physical

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activity and/or the temperature of the environment [7]. The US Institute of Medicine suggests for the older adults the same fluid intake as for the younger ones, based on studies on adults. More specifically, it suggests that intake 3.7 L/day for men and 2.7 L/day for women over the age of 70 yrs [8]. Finally, in Greece, the recent nutritional guidelines for the older adults by the ministry of Health, published in 2014 included the recommendation of the intake of approximately 8–10 glasses of fluids (2–2.5 L) per day, of which at least 6–8 glasses (1.5–2 L) should be water, with the addition that the total needs of fluids depend on the environmental temperature, the physical activity and the co morbidities that the older adults may have to confront [9].

The consumption of water and fluids in general is regulated by the sensation of thirst. Thirst is a complicated biological mechanism that allows our body to feel the fluids' shortage. But at the time that thirst is present our body is usually already dehydrated. According to research data, the sensation of thirst is decreasing with aging [10,11]. Therefore older adults are in greater risk of dehydration as their body loses the ability to identify fluid shortage and trigger the sensation of thirst [8,12,13]. Therefore, if older adults consume fluids ad libitum, following their sensation of thirst, it is possible that they will not cover efficiently their hydration needs and they will not be able to avoid dehydration. Moreover, as cognitive decline and dependency is usual in greater ages, older adults may not communicate sufficiently their need for hydration, or may not be provided with sufficient fluids, in order to avoid the frequency urination, especially in the dependent ones.

The aim of the present study was to evaluate the fluid balance, the intake and losses, in 250 elderly volunteers, grouped according their age, their way of living and their physical performance in three groups, i.e. elderly living alone independently (with age 65–80), old elderly (with age >81 yrs) living independently and hospitalized elderly (with age >65 yrs).

2. Materials and methods

Two hundred fifty three older adult patients (133 male, 120 female) were consecutively enrolled on voluntarily basis in the study. All patients were over the age of 65 years (mean age 77.0 ± 7.4 years) and they were recruited from October 2012 until February 2013 in Athens. Exclusion criteria for the study were the presence of infections of the urinary tract, chronic kidney disease (CKD), diabetes mellitus and patients who had received advice for the limitation of their fluid intake for medical reasons. All volunteers after being informed about the purpose of the study signed and informed consent form. The study was approved by the Medical Research Ethics Committee of the Laikon General Hospital.

The participants were divided in three groups, Group A with 108 independents aged 65–81 yrs (54 males), Group B with 94 independents aged 82–92 yrs (45 males) and Group C with 51 hospitalized in the Laikon General Hospital of Athens aged 65–92yrs (34 males). In addition, a database from previous study with common methodology, area and season, of 335 adults (Control Group) aged 18–65 yrs (167 males) was used in order to compare the results of the study with the results from younger adults [14]. All participants completed the validated Water balance Questionnaire (WBQ) described elsewhere [15].

Group C was also screened for malnutrition with the Mini Nutritional Assessment questionnaire [16]. MNA was originally designed in order to provide a quick evaluation of nutritional risk in elderly patients and identify those who would benefit from a nutritional intervention [16] and it is considered the best available choice amongst screening tools for that population [17]. MNA consists of four parts, namely anthropometry [Body Mass Index (BMI), Mid Arm Circumference (MAC), and weight loss)], general evaluation (with information regarding way of living, drugs, physical and cognitive performance), nutritional assessment (nutritional intake, possible problems affecting nutritional intake) and self evaluation of nutritional intake and health condition in general. The score collected ranges up to 30. A score less than 17 is indicative for malnutrition, from 17 to 23.5 the patient is at risk of malnutrition and finally for a score above 24 the patients is considered at good nutritional status.

The same group was also evaluated according to the Katz Index of Independence in Activities of Daily Living (ADL) [18]. The Katz Index of independence in ALD is one of the most commonly used tool in order to assess functional independency [19–21], which is also indicative of a range of dysfunctions caused from various pathological conditions. It is the most appropriate tool to assess the functional ability of the patients to perform actions of everyday living independently [18,22,23], including questions regarding the ability to bath, dress, use the toilet, and eat without help.

In the same group (Group C) blood and urine samples were collected for further analysis of their hydration status. More specifically, urine specific gravity, color and pH and were measured, and from blood samples hematocrit, hemoglobin, electrolyte (Sodium and Potassium) concentration, Urea and creatinine were also measured. The volunteers were advised to avoid food items that could alter the color of their urine and report any significant health problem after their inclusion in the study.

2.1. Statistical analysis

Continuous variables were expressed as mean values ± standard deviation (mean ± SD), while categorical variables as absolute and relative frequencies. P–P plots and histograms were used to assess normality. One way Anova tests were used to determine differences between genders and between the groups. Multiple comparisons were conducted with z-test and Bonferroni corrections. All reported P-values are based on two-sided tests and compared to a significance level of 5%. Statistical analysis was performed using SPSS for Windows, version 18.0 (SPSS Inc, Chicago, IL).

3. Results

In the sample of the 253 volunteers, the mean BMI was 26.6 ± 4.4 kg/m^2, mean age 77.0 ± 7.4 yrs and mean yrs of education were 9.4 ± 5 yrs. Sixty five per cent of the volunteers were married, 28% widowed, 5% single and 2% divorced. Eighty nine percent of the volunteers were pensioners, 6% had no children and only 0.04% was receiving regularly dietary advice from a dietitian.

The results of the analyses of the urine and blood samples of Group C, (n = 51) which was the hospitalized group, mean age was 76.5 ± 7, urine specific gravity was 1012.4 ± 4.5, urine pH 6.1 ± 0.8, hematocrit 35.7 ± 13.1, hemoglobin 11.8 ± 5.1 g/dl, urine sodium 139.7 ± 4 mmol/L, urine potassium 4.2 ± 0.6 mmol/L, urea 55.9 ± 47.6 mg/dl and creatinine 1.1 ± 0.6 mg/dl. Score from ADL Katz was 0 (0, 3) and MNA score 20.5 (15, 24.5).

The baseline characteristics of the population measured according to their age and gender is presented in Table 1.

The water balance from the evaluation of fluid intake and fluid losses by the WBQ is presented in detail in Table 2a. For the independents aged 65–81 yrs (Group A) the mean of water balance was −749 ± 1386 mL/day, their fluid intake was 2571 ± 739 mL/day and water losses 3320 ± 1216 mL/day. For the independents aged >81 yrs old (group B) the mean of water balance was −38 ± 933 mL/day, their fluid intake was 2571 ± 739 mL/day and their fluid losses 3320 ± 1216 mL/day, while in Group C water balance was positive and equal to 64 ± 1399 mL/day, fluid intake was found to be 2586 ± 1071 mL/day and fluid losses 2522 ± 1048 mL/day. Control

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