Dehydration in older people institutionalised in nursing homes: prevalence, associated factors and approach

Olga Masot Ariño

Universitat de Lleida

TESI DOCTORAL

Dehydration in older people institutionalised in nursing homes: prevalence, associated factors and approach

Olga Masot Ariño

Memòria presentada per optar al grau de Doctor per la Universitat de Lleida
Programa de Doctorat en Salut

Director/a
Dra. Mª Teresa Botigué Satorra

Tutor/a
Dra. Mª Teresa Botigué Satorra

2018

La doctoranda ha gaudit d'un "Ajut per a personal predoctoral de la UdL en formació. Programa de promoció de la recerca – Àrees deficitàries – de la convocatòria 2014", durant els cursos acadèmics 2015/2016, 2016/2017 i 2017/2018 per tal de realitzar la present tesi doctoral.

El projecte en el qual s'emmarca la tesi doctoral va estar finançat a través del "Ajut pont per a projectes d'investigació. Any 2017" de la Universitat de Lleida.

L'estada internacional de 3 mesos a la Maastricht University, amb la corresponent menció internacional, s'ha pogut dur a terme gràcies als "Ajuts per estades en altres centres per fer tasques de recerca. Any 2017-2018", convocada per la Universitat de Lleida.

Aquesta tesi ha rebut un ajut de l'Institut de Llengües de la Universitat de Lleida per a la correcció lingüística (convocatòria de 2018), per a la revisió dels apartats en anglès no publicats anteriorment.

"STOP THE ROT, KEEP MOVING", that was the banner headline of a newspaper article, with the subheading: "Scientists all over the world are seeking the root causes of the problems of ageing and their solution". Cor, scientists right on time, aren't you. For us it's far too late. But come on over, there's plenty of research material staggering about in here.

The secret diary of Hendrick Groen, 83 ¼ years old

Hendrik Groen

AGRAÏMENTS

A qui sempre m'ha acompanyat, durant tota la vida o encara que fos un sol segon, perquè si he arribat fins aquí ha sigut gràcies a tots vosaltres.

Primer de tot i molt especialment, m'agradaria dedicar unes línies a la meva directora de tesi, la Teresa. Què dir? Cap de les dos som gaire d'adornar les nostres paraules, però no puc deixar passar l'ocasió per agrair-t'ho tot. "En aquest sentit," tot és TOT. I la veritat és que no hagués arribat fins aquest moment sense tu. Sense la teva confiança ni qualitat. Per a mi ets un referent d'esforç, entrega i sacrifici. M'has ensenyat que sempre les coses es poden fer millor i que no ens hem de rendir mai per aconseguir tot allò que ens proposem. Gràcies per haver-me donat l'oportunitat de conèixer el món científic i docent i per haver confiat amb mi. La teva passió per fer les coses ben fetes ha sigut la meva força.

En segon lloc, m'agradaria agrair la participació en l'estudi dels residents de la Residència i Centre de Dia Lleida-Balàfia. I, també, voldria reconèixer la implicació de tots els seus professionals, i en especial, la de la Jèssica. Gràcies per tot!

Als del dia a dia: Ana, Carmen, Elena, Eva, Luisa, Maria, Mariona, Miguel Àngel, Ramon i Pilar, gràcies per haver confiat en mi, per fer el dia a dia més amè, per les xerrades i els savis consells, per ensenyar-me tot el que sé sobre docència i investigació, i per haver-me fet sentir sempre una més.

A tu, Josep Enric. La meva llar. Ets l'home dels meus somnis, qui em cuida i vetlla perquè sigui feliç. Qui em recull quan em trenco i m'aixeca per a què continuï lluitant. Gràcies per estimar-me tan i ser com ets. T'estimo i sempre t'estimaré.

A Cal Pepe el Jardí. Papa i Mama gràcies per inculcar-me la cultura del treball, per guiar-me en tot moment i per educar-me. Al Roger. Per mi ets un gran exemple

d’humilitat, lleialtat i treball. Sempre has tingut clar què t’agradava fer i què no. Espero que tinguis molta sort en tots els teus projectes. Ets molt valent, germà. T’estimo. Als padrins Antonio i Joan, a la padrina Dolores i als tiets Ramon i Antonio. Vau ser la llavor per a què infermeria fos la meva passió. Cuidar de vosaltres va ser un bonic regal.

A Cal Torrero, per ser la meva segona casa, per ser més que uns tiets i més que una cosina. Al Kenneth i a la petita Mònica. Sempre hi sou presents.

A Cal Ferrer, la meva casa adoptiva. Des del minut u m’heu rebut amb els braços oberts i m’heu fet sentir com una filla més. Us estimo.

Finalment, als amics, que hi són sempre: als d’Aspa, als de La Caparrella, a les meves nenes de la carrera... i, en especial, a la Judit.

INDEX

TABLES

Chapter 1. Theoretical framework

Chapter 3. Methodology

Chapter 4. Results

Paper I

Paper II

Paper III

Paper IV

FIGURES

Chapter 1. Theoretical framework

Chapter 3. Methodology

Chapter 4. Results

Paper I

Paper III

Paper IV

EQUATION

LIST OF ABBREVIATIONS

ABVD: Actividades básicas de la vida diaria

ADH: Anti-diuretic hormone

BIA: Bioelectrical impedance analysis

BUN: blood urea nitrogen

CR: serum creatinine

MNA: Mini Nutritional Assessment

Na^+: serum sodium

NOS: The Newcastle-Ottawa Scales

SBP: Systolic blood pressure

TBW: Total body water

U: serum urea

UPP: úlceras por presión

US: the United States

USG: Urine specific gravity

V-VST: Volume-Viscosity Swallow Test

VGI: Valoración geriátrica integral

RESUM

Títol: La deshidratació en persones grans institucionalitzades en residències geriàtriques: prevalença, factors associats i abordatge.

Objectiu: 1) Identificar els factors de risc associats a la deshidratació a nivell internacional; 2) determinar la prevalença i els factors associats a la deshidratació en les persones grans institucionalitzades en una residència de Lleida; 3) establir la prevalença de la baixa ingesta hídrica en les persones grans institucionalitzades a Lleida i analitzar els factors que s'hi associen; i 4) examinar les intervencions existents a nivell internacional per l'abordatge de la deshidratació i la millora de la ingesta de líquids.

Metodologia: En primer lloc, es va realitzar una *scoping review* sobre els factors de la deshidratació, seguint la metodologia d'Arksey i O'Malley (2005), per tal de definir les variables susceptibles d'estudi. Seguidament, es va dur a terme un estudi descriptiu i transversal en una residència de Lleida. La mostra va ser el total de residents, tots ells majors de 65 anys. Les dades recollides van ser la deshidratació (BUN/Cr < 21) i variables sociodemogràfiques, clíniques, funcionals i mentals. Posteriorment, es va realitzar una altra *scoping review*, seguint la mateixa metodologia, per conèixer quines intervencions s'havien dut a terme per tal d'abordar-la.

Resultats: La prevalença de deshidratació va ser del 75,5% (IC 95% 65,5 – 85,5) en el total dels 96 residents. Es van associar de manera independent el ser dona (OR = 9,37; IC 95% 2,15 – 40,87), tenir una ingesta hídrica < 1.500 ml (OR = 2,16; IC 95% 1,38 – 8,51), el risc d'úlceres per pressió (UPP) (OR = 1,68; IC 95% 1,35 – 6,93) i la disfàgia (OR = 4,53; IC 95% 2,31 – 15,56). Per altra banda i donada la relació entre la deshidratació i la baixa ingesta hídrica, es van analitzar els factors associats a aquesta última. Com a resultats, el 34% dels residents ingeria < 1.500 ml/dia, però el 94,3% no bevia segons els seus estàndards recomanats. A més, es van trobar factors coincidents amb la deshidratació, el risc d'UPP i la disfàgia. Quant a les intervencions per abordar-los, es va veure que les invasives (seroteràpia intravenosa i subcutània) milloraven la clínica de la deshidratació, però produïen reaccions locals. Mentre que les no invasives (assistència individualitzada,

estimulació per beure més i oferir una varietat de begudes) augmentaven la ingesta i milloraven els paràmetres analítics de deshidratació.

Conclusions: És important ressaltar la magnitud del problema de la deshidratació, present en 3 de cada 4 residents, i un dels seus factors associats, la baixa ingesta hídrica, sent un terç d'ells els que no bevien suficientment. Els resultats obtinguts ajuden a identificar i comprendre els seus factors en la gent gran institucionalitzada. Per tant, serveixen de base per a desenvolupar futures estratègies per al seu abordatge, donat que no s'ha trobat evidència en el nostre territori.

Paraules clau: deshidratació; baixa ingesta hídrica; factors associats; intervenció; gent gran; residència.

RESUMEN

Título: La deshidratación en personas mayores institucionalizadas en residencias geriátricas: prevalencia, factores asociados y abordaje.

Objetivo: 1) Identificar los factores de riesgo asociados a la deshidratación a nivel internacional; 2) determinar la prevalencia y los factores asociados a la deshidratación en las personas mayores institucionalizadas en una residencia de Lleida; 3) establecer la prevalencia de la baja ingesta hídrica en las personas mayores institucionalizadas en Lleida y analizar los factores que se asocian; y 4) examinar las intervenciones existentes a nivel internacional para el abordaje de la deshidratación y la mejora de la ingesta de líquidos.

Metodología: En primer lugar, se realizó una *scoping review* sobre los factores de la deshidratación, siguiendo la metodología de Arksey y O'Malley (2005), para definir las variables susceptibles de estudio. Seguidamente, se realizó un estudio descriptivo y transversal en una residencia de Lleida. La muestra fue el total de residentes, todos ellos mayores de 65 años. Los datos recogidos fueron la deshidratación (BUN/Cr <21) y variables sociodemográficas, clínicas, funcionales y mentales. Posteriormente, se realizó otra *scoping review*, siguiendo la misma metodología, para conocer qué intervenciones se habían llevado a cabo para abordarla.

Resultados: La prevalencia de deshidratación fue del 75,5% (IC 95% 65,5 – 85,5) en el total de los 96 residentes. Se asociaron de manera independiente el ser mujer (OR = 9,37; IC 95% 2,15 – 40,87), tener una ingesta hídrica < 1.500 ml (OR = 2,16; IC 95% 1,38 – 8,51), el riesgo de UPP (OR = 1,68; IC 95% 1,35 – 6,93) y la disfagia (OR = 4,53; IC 95% 2,31 – 15,56). Por otra parte y dada la relación entre la deshidratación y la baja ingesta hídrica, se analizaron los factores asociados a esta última. Como resultados, el 34% de los residentes ingería < 1.500 ml/día, pero el 94,3% no bebía según sus estándares recomendados. Además, se encontraron factores coincidentes con la deshidratación, el riesgo de UPP y la disfagia. En cuanto a las intervenciones para abordarlos, se vio que las invasivas (sueroterapia intravenosa y subcutánea) mejoraban la clínica de la

deshidratación, pero producían reacciones locales. Mientras que las no invasivas (asistencia individualizada, estimulación para beber más y ofrecer una variedad de bebidas) aumentaban la ingesta y mejoraban los parámetros analíticos de deshidratación.

Conclusiones: Es importante resaltar la magnitud del problema de la deshidratación, presente en 3 de cada 4 residentes, y uno de sus factores asociados, la baja ingesta hídrica, siendo un tercio de ellos los que no bebían suficientemente. Los resultados obtenidos ayudan a identificar y comprender sus factores en las personas mayores institucionalizadas. Por lo tanto, sirven de base para desarrollar futuras estrategias para su abordaje, dado que no se ha encontrado evidencia en nuestro territorio.

Palabras clave: deshidratación; baja ingesta hídrica; factores asociados; intervención; personas mayores; residencia.

ABSTRACT

Title: Dehydration in older people institutionalised in nursing homes: prevalence, associated factors and approaching.

Objective: 1) Identify risk factors associated with dehydration on an international level; 2) determine the prevalence and the factors associated with dehydration among older people institutionalised in a nursing home in Lleida; 3) establish the prevalence of low fluid intake in institutionalised older people in Lleida and to analyse the factors associated with this; and 4) determine the different model of care to treat dehydration and to improve the fluid intake.

Methodology: Firstly, a scoping review was performed on the dehydration factors, following the methodology of Arksey and O'Malley (2005), in order to define variables selected to study. Subsequently, a cross-sectional pilot study was carried out at a nursing home in Lleida. The sample was the total of residents, all of them over 65 years old. The data collected were dehydration marker (BUN/Cr < 21) and sociodemographic, clinical, functional and mental variables. Afterwards, another scoping review was carried out, following the same methodology as the first, to identify what interventions had been carried out to address it.

Results: The prevalence of dehydration was 75.5% (IC 95% 65.5 – 85.5) in the total of 96 residents. Female (OR = 9.37; 95% CI 2.15 – 40.87), had a fluid intake < 1500 mL (OR = 2.16; 95% CI 1.38 – 8.51), the risk of pressure ulcers (OR = 1.68; 95% CI 1.35 – 6.93) and dysphagia (OR = 4.53; 95% CI 2.31 – 15.56) were associated with dehydration independently. On the other hand and given the relationship between dehydration and low fluid intake, the factors associated with the latter were analysed. As a result, 34% of residents were in < 1500 mL/day, but 94.3% did not drink according to their recommended standards. In addition, factors that coincided with dehydration, the risk of pressure ulcers and dysphagia were found. Regarding interventions to address them, it was found that invasive methods (intravenous and subcutaneous serotherapy) improved the dehydration clinic, but produced local reactions. Meanwhile, non-invasive

interventions (individualised assistance, stimulation to drink more and offer a variety of drinks) increased intake and improved the analytical parameters of dehydration.

Conclusions: It is important to emphasize the magnitude of the problem of dehydration, present in 3 out of 4 residents, and one of its associated factors, low fluid intake, with one third of them who did not drink sufficiently. The results obtained help to identify and understand its factors in institutionalised older people. Therefore, they serve as a basis to develop future strategies to approach this problem, since there has been no prior evidence in our territory.

Key words: dehydration; low fluid intake; associated factors; intervention; older people; nursing home.

CHAPTER 1

Theoretical framework

Chapter 1. Theoretical framework

1. Dehydration in older people

Water is the most important component of the human body, representing more than 50% of the total mass (1). This water is essential for health due to the amount of physiological mechanisms involved (2). Therefore, when some disorder of water and electrolytes occurs, dehydration can appear (3,4). The American Medical Association warns that there is no absolute definition of dehydration, and that its signs and symptoms may be vague, deceptive, or even absent in older adults (3). Nevertheless, the term dehydration might signify different fluid and electrolyte problems, like sodium (Na^+), osmolality concentration and fluid volume depletion (5).

In these senses, the European Food Safety Authority (6) defines dehydration as “the process of losing body water and leads eventually to hypohydration (the condition of body water deficit)”. Besides, the Dehydration Council (7) adds that “this can be due mainly to a water deficit (hypernatremia) or loss of salts and water deficit (hyponatremia)". Even so, dehydration is an imbalance in the body’s level of water or Na^+ that occurs when a person does not take in the amount of fluid needed to replenish what the body is losing. This imbalance causes a deficit in the fluids and electrolytes that are essential for brain and body functions (8).

Dehydration can be classified according to its condition, being able to be acute or chronic. Acute dehydration is a loss of water and Na^+, often caused by acute processes such as vomiting, diarrhoea, blood loss, among others (9). This kind of dehydration may be experienced by ill people of all ages and is closely related to Na^+ blood levels. In this sense, acute dehydration can be classified in reference to the ratio of fluid to electrolyte loss.

The first type is isotonic dehydration or euvolemia, in which there is a balance between the loss of water and Na^+. In this case, no osmotic water shift from the intracellular fluid to the extracellular fluid is produced. The main causes of isotonic

dehydration are osmotic diuresis of glucose, inadequate fluid or salt intake, or gastrointestinal fluid losses such as vomiting and diarrhoea (7,10,11).

Secondly, hypotonic, hyponatremia or hypovolemia derives from the lower serum Na^+ concentration or from intravascular water shifts to the extravascular space. These situations increase intravascular volume depletion (12). Its main causes are diuretics therapy, sweating, blood loss, chronic salt wasting or water replacement without salt replacement (7,11,12).

The third type is hypertonic dehydration, also called hypernatremia or hypervolemia. It may originate for two different reasons. Firstly, as a consequence of fluid deficit, which is the most common in older people (13). This is because an excessive water loss leads to raised Na^+ levels, which result in hypernatremia in the extracellular fluid compartment and draw water from the intracellular fluid. Its main causes are associated with low fluid intake, diarrhoea, or as a result of aged, renal tubular disease, infection, hot weather or resistance to vasopressin action. Secondly, hypernatremia can be a consequence of Na^+ excess, which is rare but possible. This occurs either due to the excessive administration of intravenous solutions with high Na^+ concentrations or with high levels of Na^+ by oral intake (7,10,12).

On the other hand, when elders do not adequately replenish fluids, chronic dehydration or underhydration can appear. This is a preclinical state of early dehydration of longer duration, where the body has long lived with the alteration of the water balance. Besides, it can start in the absence of acute illness (9,14) and it is the most common cause of fluid and electrolyte imbalance in older people living in nursing homes (2).

2. Pathophysiology of dehydration in older people

Water is essential for the correct operations of biochemical processes, brain and body functions. These functions include the maintenance of circulation, the lymphatic system, body temperature, transport and removal of metabolic waste products,

facilitating digestion, acting as a lubricant, and flushing out the urinary tract, eyes and other crucial organs. In addition, the correct procedure of all these mechanisms is essential to prevent illness and maintain a high level of cognition and energy (15–17).

The body is able to regulate its hydration levels in order to compensate for any alteration (18). This process has the name of regulating the water balance, for which two elements are in charge: thirst (leading to increased fluid intake) and arginine vasopressin (also called anti-diuretic hormone (ADH)) (figure 1). In order to stimulate thirst, there must be a series of factors such as salivation, digestive processes, evaporation of the skin and lungs and urination that cause this sensation. In these cases, the plasma decreases and thus increases the level of concentration of the solute in the interstitial fluid. Then, through osmotic pressure, the fluid of the intracellular compartment moves to the extracellular. As a result, it leads to intracellular dehydration, which by means of the osmoreceptors located in the anterior ventricle anteroventral wall area gives the order to the hypothalamus to produce stimulation of thirst (19). On the other hand, to stop the loss of water, ADH stimulates the medulla within the kidney to produce more highly concentrated urine (20). However, these processes can disrupt the ageing process (21,22).

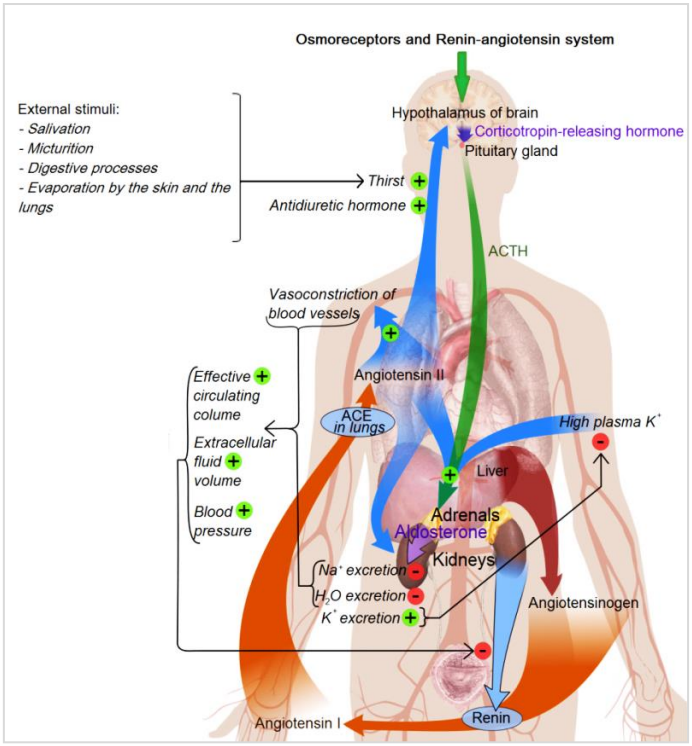

Figure 1. Physiology of the water balance
(Adapted from Mikael Häggström)

In this way, the ability to feel thirsty and the kidney function fall with age; consequently, the ability to concentrate urine and retain fluid decreases. This theory is tested by Davies et al. (22), who compared the response of the mechanisms regulating the water balance in rehydration between a control group consisting of young adults and another group made up of elders. The results showed that men aged over 70 years had lower resting ADH levels than men aged less than 40 years. In the same way, dehydration vasopressin levels rose faster in the older men ($p = 0.02$). Relating to thirst, although infusion loading caused significant falls in thirst ($p < 0.001$), there was no variation with age. Nevertheless, the perception of thirst during the osmotic loading experiment was recorded differently by the two age groups ($p < 0.0001$). The authors state that the ambiguous thirst results may be due to the fact that this is a complex and subjective mechanism, which requires subtle experimental approaches to unravel its intricacies.

Therefore, the alteration of the physiological process to maintain a correct regulation in the water balance in older people can lead to a great incidence of dehydration.

3. Prevalence of dehydration in older people

Dehydration experienced by older people is a problem present in a large part of this group and constitutes a silent epidemic. Depending on the level of care where the person is living, the prevalence of dehydration will be different. In the community, it will be around 20% (23–27), while in hospitals it can range from 2% to 48% (5,9,28–35). In nursing homes, it can reach up to 50% (36).

Given the magnitude of the problem, it is very important to know where the level of care with more risk of suffering dehydration is. The study by Wolff et al. (37) concluded that residents admitted to nursing homes have 10 times more risk of suffering from hyperatremia than when they are in their homes. Besides, other authors (32,38) add that more than half of the admissions for dehydration to hospitals come from nursing homes. In view of the above, it is necessary to know more about the prevalence of dehydration in these institutions.

Table 1 thus shows a summary of studies on dehydration in nursing homes in different countries. From the bibliography consulted, the highest prevalence was that obtained by Ellershaw et al. (36), in which half of the participants had dehydration. In the same vein is the study by Holben et al. (39), whose prevalence was 46.28%. In a Belgian study (40), the prevalence of dehydration in nursing homes was 38.60% and in another study carried out in the Netherlands (41), the prevalence was 35.20%. In the most current study, conducted in the United Kingdom, the prevalence calculated with osmolality was 28% (42). This result is similar to other studies conducted in the same country (43), or in France (44) or the United States (US) (14). In other recent studies, Wu et al. (45) obtained a prevalence of 17% through the calculation of blood urea nitrogen and serum creatinine ratio (BUN/Cr) and Wolf et al. (37) a prevalence of 12% through serum Na^{+}.

Table 1. Prevalence of dehydration in older people living in nursing homes

Author(s)	Study location	Year	n	Age	Method of diagnosing dehydration	Prevalence (%)
Hooper et al. (42)	UK	2016	188	> 65	Mild dehydration: serum osmolality 295–300 mOsm/kg	20
					Severe dehydration: serum osmolality >300 mOsm/kg	28
Wolff et al. (37)	UK	2015	21610	≥ 65	Na+ ≥145 mmol/L	12
Siervo et al. (43)	UK	2014	186	≥ 65	Mild dehydration: serum osmolality 295–300 mOsm/kg	27
					Severe dehydration: serum osmolality >300 mOsm/kg	19
An Vandervoort et al. (40)	Belgium	2013	198	N/A	N/A	38.6
Wu et al. (45)	China	2011	111	MD 74.9	BUN/Cr ≥ 20	17
Koopmans et al. (41)	The Netherlands	2007	890	N/A	ICHPPC	35.20
Mentes (46)	US	2006	35	MD 82	Hospitalisation for dehydration, on-site administration of intravenous fluids or a BUN/Cr ≥ 25:1	31
Culp et al. (47)	US	2004	313	≥ 65	BUN/Cr ≥ 21:1	With delirium: 43.5 Without: 30.3
Jensdóttir et al. (48)	Iceland	2003	2033	N/A	MDS	1.2
	US		756207			1.4
	Canada		31808			0.8
Léger et al. (44)	France	2002	308	> 70	Physician diagnosis	24
Holben et al. (39)	US	1999	121	≥ 65	MDS Plus	46.28

n: number of residents; %: percentage of residents; BUN/Cr: blood urea nitrogen and serum creatinine; ICHPPC: The International Classification of Health Problems in Primary Care; MD: Median age; Na^+: sodium; MDS: Minimum Data Set; N/A: Data not available

Table 1 (continued)

Author(s)	Study location	Year	n	Age	Method of diagnosing dehydration	Prevalence (%)
Mentes et al. (49)	US	1999	2318	> 70	MDS	With acute confusion: 12 Without: 3.7
Ellershaw et al. (36)	UK	1995	84	MD 73	Serum osmolality was >295 mOsmoL/kg; Na^+ >148 mmol/L; Cr was > 130 umol/L; U > 12 mmol/L	50
Collin et al. (14)	US	1994	88	MD 85	24-hour fluid balance < 1500mL	23.86

n: number of residents; %: percentage of residents; U: serum urea; Cr: serum creatinine; MD: Median age; Na^+: sodium

On the other hand, studies that related dehydration to mental conditions concluded that the prevalence of dehydration in residents with delirium was 43.50%, decreasing to 30% when they did not present this mental problem (47). This theory was supported by the study by Mentes et al. (49), which indicated that the difference between prevalence in acute confusion can even be tripled.

4. Factors associated with dehydration in nursing homes

There are certain factors that can be associated with dehydration in older people institutionalised in nursing homes. These can be classified according to geriatric assessment (50) used to evaluate the different clinical, functional, mental and social components of the health status of geriatric patients.

4.1. Clinical component

The factors related to the clinical component are classified according to whether they refer to a clinical pathology, a sign or symptom, a pharmacological treatment or a sub-class denominated “others”.

Related to pathologies, dehydration is associated with: acute or chronic infections (39,51–54), renal (42,52) and cardiovascular diseases (45,52). Moreover, exhibiting more than four chronic conditions (52), suffering from a cardiovascular accident (52), diabetes (42) and having a history of dehydration (55) are also identified as risk factors. Thus, the risk of dehydration is compounded when older people experience the acute and chronic diseases that are associated with increasing age.

On the other hand, the clinical signs and symptoms interacting with dehydration are: fever (51), mouth problems (51), thirst (42), sunken eyes (39), pressure ulcers (56,57), lack of pain management (58), constipation (59) and reduced muscle volume (60). Furthermore, dysphagia is also a risk factor of dehydration (55,58,61), a common disorder in the geriatric population living in nursing homes (62–64).

Several other clinical factors, such as being at the end of their life (41,51,53), having been in contact with a health centre in the previous two months (42) and carrying some form of catheter or drainage (53) are risk factors of dehydration. This is maybe because these situations are often accompanied by pathologies that compromise the correct water and electrolyte balance.

With reference to pharmacological treatments, taking more than four different types of medication (52,54) is a risk factor of dehydration. Besides, taking medication for diabetes (42), laxatives (52), diuretics, angiotensin converting enzyme inhibitors or non-steroidal antinflammatory drugs can increase the risk of dehydration (65). Furthermore, the risk of dehydration can be exacerbated by the use of laxatives (52,66) and diuretics (46,65), which are frequently consumed by older people. Consequently, this sort of drugs favours the excretion of fluid by sweating, stool or urine.

To complete the clinical factors that are associated with dehydration, the influence of intake on dehydration should be explained. It has been seen that the inadequate intake of nutrients (55) and fluids (39,54,58) is highly correlated with dehydration. The body is hydrated through the ingestion of foods and fluids, and when this is

compromised, a series of metabolic decompensations that result in dehydration appear (1).

4.2. Functional component

With age, changes to the functional state occur (67). Some authors show that functional impairment or being highly dependent is closely related to not having proper hydration, because it is compromised (58,59,68). Therefore, the risk factors connected to the residents' functional impairment are: self-feeding difficulties (52,53,68), speech problems (68), being bedridden (52) and requiring help with mobility (52). Added to these, LaPlante et al. (69) demonstrate that individuals who need help with two or more ADLs, who have unmet needs, have significantly greater probability of adverse consequences like dehydration.

4.3. Mental component

As far as the mental component is concerned, there are some factors associated with dehydration: not wanting to drink as a self-imposed restriction (46), aggressiveness (44), agitation (44), delirium (47), acute confusion (49,70) and disorientation (49). Even so, the factor that is most associated with the mental component is cognitive impairment (15,37,40,42,58,71,72). Given that, those with dementia may forget to drink, as daily routines are lost and social contact diminishes, which is associated with low fluid intake (42). The relationship between mental component and dehydration results from the alteration of cognitive functions, aggravated by the aging process and acute illnesses such as infections.

4.4. Social component

At a socio-demographic level, the key factors identified are age (≥85 years old) (37,45,52,53) and being female (42,45,52,53). On the one hand, age is related to the chronification and worsening of the baseline health status of the elderly and, on the other hand, this age group has higher female prevalence.

As for sociocultural issues, the main risk factor of dehydration is institutionalisation (37) and all that goes with this, since the situation in nursing homes is really complex. They are chronically plagued by inadequate staff numbers and high staff turnover (73). Some examples of these issues, which affect the hydration state, are requiring skilled care (52), an inadequate number of knowledgeable staff, lack of supervision of certified nursing assistants by professional staff and also lack of attention to individual beverage preferences (58). In the same way, many nursing homes have inadequate staff numbers in the summer, because of holidays (10). Other important social factors are the lack of social support and the inability to speak the language of the country (58,68). All of them are barriers to free access to liquids to ingest.

In relation to environmental factors, winter is a dehydration factor (52), because with the cold a vasoconstrictor response occurs in the body, which causes an increase in urine and, consequently, loss of fluid (74). Furthermore, thirst at this time of year is less noticeable compared to hot weather, which makes them drink less (75). On the other hand, another relevant factor is heat waves (10,76).

After visualizing the many factors that may influence dehydration, it is really necessary to establish how it can be detected in an early state and which methods exist for this. Otherwise, several consequences might arise.

5. Evaluation of the dehydration state in older people

Various analytical tests and signs and symptoms are considered that can help to detect dehydration in the elderly (77). Since there is no gold standard (78), it is necessary to clarify which indicators of dehydration exist in this group, such as blood and urinary tests, physical signs and symptoms, and checklists to evaluate dehydration in older people.

5.1. Blood and urinary tests

Regarding blood tests, the detection of dehydration is performed through the analysis of Na^+ serum, blood nitrogen/creatinine ratio, serum osmolarity and urine test. Detailed below are the characteristics of these blood components.

5.1.1. Serum sodium

Na^+ is the positive ion found mainly outside the cells in the extracellular fluids of the human body. The Na^+ concentration in the blood is the result between the entry of the same through diet and its exit through the filtrate of the kidney or also lost in the faeces. Moreover, the appearance of dehydration in older people is related to the reduction of ADH regulation capacity (79). Na^+ disorders are diagnosed by findings from laboratory studies (11) and, according to these results, dehydration may be classified as hyponatremia or hypernatremia.

In older people, hyponatremia is a common electrolyte disorder defined as a serum Na^+ level of < 135 mmol/L (12,80). On the other hand, a single cut-point of hypernatremia for the elderly is not defined. Some authors (79,81) accept that hypernatremia occurs when serum Na^+ concentration is > 145 mmol/L. Others state that symptoms may often be present until Na^+ levels exceed 160 mmol/L (81). Furthermore, Shah et al., in a review of the literature, conclude that the range for hypernatremia could vary from 140 – 150 mmol/L (82).

5.1.2. Plasma blood urea nitrogen: creatinine ratio

High or low values of BUN and Cr are pointers of different pathologies. It will only be an indicator of dehydration when an increase in BUN occurs and Cr is normal (> 15:1). However, other authors have used other cut-points. For instance, Wu et al. (45) and Bennett et al. (9) use the value ≥ 20:1; Culp et al. (47), ≥ 21:1 and Mentes (46) use ≥ 25:1. On the other hand, when urea (U) and nitrogen are proportionally elevated, this indicates kidney disease. Moreover, in contrast, a decreased BUN and a normal Cr is an

indicator of liver disease, low protein intake and/or overhydration. Finally, when BUN values are normal and that of Cr decreases, these are indicators of muscle-wasting disease (for example: cachexia, sarcopenia) (66).

5.1.3. Serum osmolarity

The concentration of osmotically active particles of blood serum can be expressed in terms of osmolarity (molal units per litre of solution, mmol/L) or in terms of osmolality (expressed in terms of milliosmoles of solute per kilogram of serum water, mOsm/Kg) (83).

In reference to osmolarity, there are many equations to calculate this. Some studies identify up to 35 different formulas (84,85). The one that is considered the best in the elderly is the one developed by Khajuria and Krahn (86) (equation 1), because it was able to predict measured serum osmolality in frail older people with and without diabetes, poor renal function, dehydration and with impaired health, cognitive and functional status (43,84).

$$\text{Serum osmolarity}^{*} = [1.86 \times (Na+ + K+) + 1.15 \times \text{glucose} + \text{urea} + 14]$$

* where all components were measured in mmol/L

Equation 1. Khajuria and Krahn serum osmolarity formula

The following are the cut-points to interpret the results of the formula: normal values are 275 to ≤ 295 mmoL/L, while 295 to 300 mmol/L indicates impending dehydration, and > 300 mmoL/L is recognised as current dehydration (43,84,85).

5.1.4. Urine tests

Another way to evaluate dehydration is through urine. One of the mechanisms used is urine output, which consists of excreting and collecting urine for 24 hours. It is considered abnormal if the total output is less than 800 mL (61,87). However, it is difficult for older people to maintain an intact renal function in order to filter an

adequate volume (0.5 mL/kg/hr for male and 0.4 mL/kg/hr for female) (87). In the same way, other factors that can influence urine output are the presence of urinary incontinence and having taken diuretics drugs (88). Thus, all of these can make the urine output an imprecise method to indicate dehydration.

On the other hand, urine specific gravity (USG) or urine density is another method to detect dehydration in the elderly. It is a laboratory test that shows the concentration of all the chemical particles in the urine. In other words, this is the ratio of the density of some standard material, such as water or air. It is understood that high concentrations of this urinary parameter are an indicator of low water intake (55,89). In older people, the normal values of USG are 1010 – 1030 mmol/L (90–93). It is thus important to remark that some studies reinforce its effectiveness. Armstrong et al. (93,94) concluded that this urine parameter is able to detect chronic underhydration if USG is ≥ 1025 mmol/L. Another example is the study by Mentes and Wang (54), which determined that participants with higher levels of USG (> 1020) versus lower (< 1020) had more risk of suffering from dehydration ($p = 0.028$).

5.2. Physical signs and symptoms

The physical signs and symptoms of dehydration that can help to identify dehydration in older people in an early state are related to changes in body weight, bioelectrical impedance analysis, blood pressure, pulse, colour of urine and skin and mucosa moisture or turgor.

5.2.1. Change in body weight

Total body weight is a term that is used to describe the body mass of an organism. It is the sum of body fluid, fat, muscle, organs and bone (95). As can be seen in figure 2, the body's extra fluid part decreases with age. Furthermore, this can quickly be affected in older people by low fluid intake or blood losses. Thus, a substantial change in body weight will relate most directly to fluid status. For this reason, it may be helpful to detect changes in body weight on diagnosing hydration problems (96). The European

Food Safety Authority (6) explained that a reduction of ≥4% of body weight within 7 days may be considered to be a clear sign of dehydration.

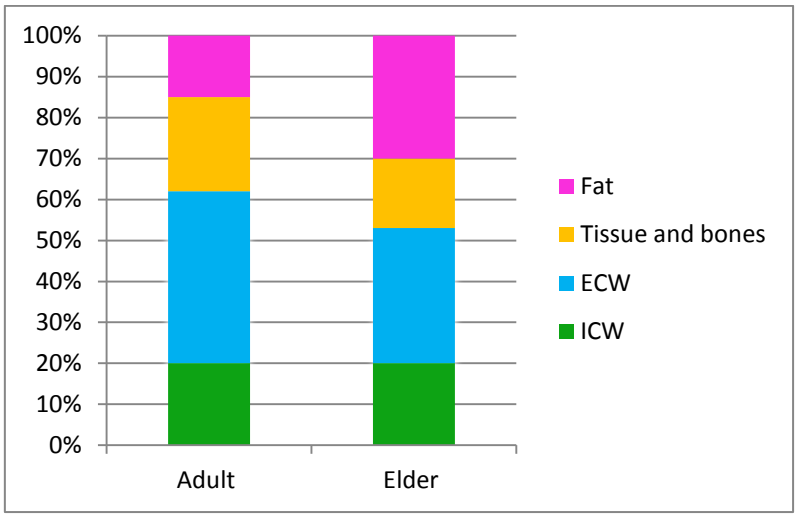

Figure 2. Body mass components in adult and elder people
ECW: extracellular water; ICW: intracellular water

Nevertheless, Cheuvront et al. (96) stressed the need to exclude other reasons for the loss of weight (such as oedema or diarrhoea) before determining that dehydration is caused by a low intake of water. Furthermore, this indicator will not be effective in the case of chronic dehydration. In addition, Vivanti et al. (97) concluded that weight can also fluctuate in well-hydrated older people.

5.2.2. Bioelectrical impedance analysis

Bioelectrical impedance analysis (BIA) is a simple, non-invasive and rapid measure of total body water (TBW), extracellular and intracellular water. The procedure consists of the patient being positioned, lying flat with limbs abducted 30° from the midsagittal plane. Four electrodes were attached in predetermined positions on the opposite side of the body (distal ends of the third metacarpal and of the second metatarsal bone, between the styloid process of the radius and ulna and between the two malleoli of the ankle) (98).

Using age-sex specific calculations, BIA has been validated for use in older patients at a resistance of 50 kHz with a standard error of 1–4% (table 2) (98,99). In the same way, the measurements of TBW can determine hyponatremia in acutely ill older patients (100). However, other studies suggested that TBW is not a sufficiently accurate method to detect changes in hydration status (101). Kyle et al. (102) concluded that the results of BIA must be interpreted with caution, because of the necessity of understanding the mechanisms for the changes observed in acute illness, altered fat/lean mass ratios, extreme heights and body shape abnormalities. Furthermore, in the study by Olde Rikkert et al. (60), no single measure of TBW, extracellular or intracellular water, was correlated with hydration status in older people. Even so, responsiveness of serial measurements to rehydration changes in fluid balance was good. For this reason, these authors recommended its use to monitor fluid balance in geriatric patients, especially when daily weighing is difficult, but not for dehydration diagnosis. Another inconvenience of using BIA to detect dehydration is that this method might not be advisable with persons who had an implanted device such as a pacemaker or a cochlear implant (103).

Table 2. Hydration state according to changes in TBW and serum Na^+
(Adapted from Cumming et al.)

	Change in serum Na+	
	Increased	**Decreased**
Increased TBW (> 50 kHz)	Hypotonic dehydration	Hypertonic dehydration
Constant TBW (50 kHz)	Isotonic balance	
Decreased TBW (< 50 kHz)	Hypertonic dehydration	Hypotonic dehydration

5.2.3. Blood pressure

A decrease in blood pressure by position change is an indicator of hypovolemia. According to Vivanti et al. (5,104), a drop of 20 mmHg in systolic blood pressure values in two minutes changing the body's position was a possible clinical assessment parameter associated with dehydration (sensitivity 69%, 95% CI 59 – 79%, specificity 56, 95% CI 46 – 66%). Nevertheless, in the study by Chassagne et al. (105), orthostatic blood pressure was not associated with hypernatremia. In the same way, Thomas et al. (35) compared postural hypotension with BUN/Cr ratio and concluded that only 18% of

patients with postural hypotension had a ratio > 20, suggesting that postural hypotension was not related to intravascular volume status.

5.2.4. Pulse

In reference to the pulse, Chassagne et al. (105) found out that hypernatremia was associated with tachycardia (> 100 bpm) ($p = 0.001$), although older people may not present tachycardia due to prescription of cardiac medications (67).

However, sudden changes in pulse (> 30 bpm) would be a sign of a large loss of blood, although institutionalised older people are not used to having this situation. The cause usually arises from diarrhoea, vomiting or decreased fluid intake in these residents (106).

5.2.5. Colour of urine

The colour of urine has a high relation to the specific density of urine. Thus, when a person does not ingest a sufficient quantity of liquids, there is an increase in the specific gravity of the urine, with the immediate result of a darkening of the colour. Thus, the colour of urine usually reacts immediately to small changes in hydration status (92). According to Mentes et al. (55,107), urine colour and urine-specific gravity may be better able to detect chronic underhydration in older people. Although it is known that these measures can also be affected by kidney function, the study has shown that residents with moderate to good renal function can concentrate their urine, as evidenced by a significant correlation between urine colour and specific gravity. Following this theory, Armstrong et al. (93,94) developed a colour chart through which the state of dehydration could be assessed based on the colour of the urine (figure 3).

Score	Description
1	Over-hydrated
2	Hydrated
3	Hydrated
4	Impeding dehydration
5	Current dehydrated
6	Current dehydrated
7	Severe dehydration
8	Severe dehydration

Figure 3. Urine colour chart

5.2.6. Skin and mucosa moisture and turgor

The measurement of axillary moisture could help assess dehydration. Dehydration could be discarded when the axillary moisture ≥ 50%, while an axillary moisture of < 30% can denote dehydration (108). One of the few research studies that exist about this is the study by Eaton et al. (109). It explains that the presence of a dry axilla supports the diagnosis of dehydration (OR; 2.8; 95% CI, 1.4 – 5.4). However, if it was compared to biochemical (dehydrated subjects had a serum U:Cr ratio (mmol/l:µmol/l) above 1:10 and plasma osmolality above 295 mmol/Kg), axillary moisture had a sensitivity of 50% and a positive predictive value of 45%. The specificity was 82%, and the negative predictive value was 84%.

On the other hand, skin turgor is closely related to dehydration. As can be seen in table 3, in the study by Chassagne et al. (105), subclavicular, sternum, forearm and thigh abnormal skin turgor were significantly associated with hypernatremia ($p < 0.001$). In the same study, dry oral mucosa was also associated with this type of dehydration. Vivanti et al. (104) realised that the sign most frequently related with dehydration was having a dry tongue (OR; 2.9; 95% CI, 1.2 – 7.0).

Table 3. Sensitivity and specificity of skin and mucosa turgor in older residents with hypernatremia

	Sensitivity (%)	Specificity (%)	OR	95% CI
Subclavicular	73.3	79.0	10.52	(6.67 – 16.6)
Sternum	50.3	19.0	3.93	(2.56 – 6.01)
Forearm	68.3	67.8	4.54	(2.96 – 6.92)
Thigh	51.7	88.2	7.97	(4.96 – 12.81)
Oral mucosa dry	49.0	87.8	6.07	(3.76 – 9.82)

5.3. Checklists to evaluate dehydration in older people

Based on the analytical tests, signs and symptoms that can help to detect dehydration, some authors have tried to create a checklist or screening tools in order to identify dehydration in the elderly. However, none of them has a steady score based on how many factors the scale of detecting dehydration in the elderly is capable of identifying.

Zembrzuski (16) developed a comprehensive nursing assessment checklist to identify residents at high risk of decreased fluid intake in nursing homes. The scale has a total of 60 items, divided into 4 modules (appendix 1):

I. Symptoms of dehydration warranting immediate medical and nursing interventions (17 items).
II. Factors associated with hydration problems (10 items).
III. Problems increasing vulnerability to suffer from dehydration: medical conditions (8 items), dietary restrictions (4 items), medications (3 items), medical history (6 items), immediate return from hospitalisation or a visit to a specialist physician (6 items).
IV. Laboratory reports (6 items).

According to the authors, the higher the number of factors or their severity, the greater the risk of diminished hydration.

On the other hand, Mentes (110) created the Dehydration Risk Appraisal Checklist, which included items concerning health conditions, medications, fluid intake behaviours, and laboratory abnormalities. The instrument uses a dichotomous,

present/absent format. In 2011, Mentes and Wang (55) reviewed it based on the frequency distribution of those items on the checklist and the theoretical soundness. During the process, they reduced the checklist from 42 to 17 items, among which laboratory abnormalities stand out. According to the authors, the presence of a higher number of items implied a higher risk (appendix 2).

The last checklist found is the Geriatric Dehydration Screening Tool, which is created by Vivanti et al. (104) and which is composed of 13 items (four physical signs of dehydration, seven questions about thirst sensation, pain and mobility and two about drinking habits). The parameters were identified through the literature, interviews and focus groups. This screening tool was developed in a geriatric and rehabilitation unit, but it was also validated in community-dwelling and institutionalised older people (111) (appendix 3).

Finally, and according to Weinberg and Minaker (3), it should be stressed that "the classical physical signs of dehydration may be absent or misleading in an older patient", because of physiological aged changes and the effects of medications, acute and chronic illnesses (112,113). In the same way, the kidney function changes with age and may mean that urinary markers of dehydration could be less useful in older people (17). However, it is necessary to detect it to avoid the appearance of the harmful consequences that it can cause.

6. Consequences of dehydration

First of all, it should be mentioned that a few studies have looked at the consequences in nursing homes, most of them are being focused on the hospital where people have other unbalance pathologies. Taking this into account, the consequences related to dehydration in the elderly are as follows.

Dehydration becomes a physiologic unbalancing act in which older people have more risk of suffering from acute health problems. These acute problems can be falls (114), fractures (115), acute confusion and delirium (114,116), pressure ulcers (115),

constipation (114), and urinary infections (114–116). Moreover, older people who have dehydration are at risk of undergoing acute coronary events (1.6% vs 0.7%; OR, 1.16; 95% CI, 1.03 – 1.32), pneumonia (3.4% vs 1.5%; OR, 1.23; 95% CI, 1.13 – 1.34) and thromboembolism (1.8% vs 0.9%; OR, 1.28; 95% CI, 1.14 – 1.42) (117). For all of these, dehydration is associated with increased risk of disability at four years (OR 2.1, 95% CI: 1.2 – 3.6) (118).

This physiologic unbalancing also increases the risk of repeated hospitalisations (119). In this sense, dehydration is listed as one of the 20 most common diagnoses reported by the US Agency for Healthcare Research and Quality (120). In addition, this agency reported that more than 300,000 admissions for dehydration were older people.

Otherwise, and related to mortality, Warren et al. (33) found that approximately 50% of older people hospitalised for acute and chronic dehydration died within 1 year of admission. Besides, mortality may be seven times higher than for patients who are not dehydrated (34,121).

As for nursing homes, Studdert et al. (122) reported that dehydration is the third cause of negligence (OR 1.18; IC 95% 1.05 – 1.32; p = 0.005), which means that chronic medical conditions might be exacerbated (33,34), such as imbalance of diabetes (123), heart disease (124) and drug toxicity (125), kidney stones or renal failure (9,126).

In view of all of this, dehydration in older people is extremely costly, but there is no research on nursing homes (116,127). However, if we focus on hospitalisation, a recent review of economic burden (128) indicated that dehydration can increase the costs by 7% to 8.5%, especially among those with moderate to severe hyponatremia. Moreover, studies carried out in the US (33,58) estimated that the annual cost of care for dehydrated older people was more than $1 billion. In this respect, Kim (129) affirmed that the cost of approximately 518,000 hospitalisations in the US was around $5.5 billion per year. Nevertheless, a more recent study in the same country (130) concluded that the average total hospital charge is $7,442 in hospitalised older patients with a principal diagnosis of dehydration.

References

1. Armstrong-Esther CA, Browne KD, Armstrong-Esther DC, Sander L. The institutionalized elderly: dry to the bone! Int J Nurs Stud. 1996;33(6):619–28.
2. Kositzke JA. A question of balance: dehydration in the elderly. J Gerontol Nurs. 1990;16(5):4–11.
3. Weinberg AD, Minaker KL. Dehydration. Evaluation in management in older adults. Council on Scientific Affairs American Medical Association. JAMA. 1995;274(19):1552–6.
4. Lavizzo-Mourey RJ. Dehydration in the elderly: a short review. J Natl Med Assoc. 1987;79(10):1033–8.
5. Vivanti A, Harvey K, Ash S, Battistutta D. Clinical assessment of dehydration in older people admitted to hospital: What are the strongest indicators? Arch Gerontol Geriatr. 2008;47(3):340–55.
6. European Food Safety Authority (EFSA). Scientific opinion on dietary reference values for water. EFSA J. 2010;8(3):1459.
7. Thomas DR, Cote TR, Lawhorne L, Levenson SA, Rubenstein LZ, Smith DA, et al. Understanding clinical dehydration and its treatment. J Am Med Dir Assoc. 2008;9(5):292–301.
8. Faes MC, Spigt MG, Olde Rikkert MG. Dehydration in Geriatrics. Geriatr Aging. 2007;10(9):590–6.
9. Bennett JA, Thomas V, Riegel B. Unrecognized chronic dehydration in older adults: examining prevalence rate and risk factors. J Gerontol Nurs. 2004;30(11):22–8.
10. Schols JM, De Groot CP, van der Cammen TJ, Olde Rikkert MG. Preventing and treating dehydration in the elderly during periods of illness and warm weather. J Nutr Health Aging. 2009;13(2):150–7.
11. Braun MM, Barstow CH, Pyzocha NJ. Diagnosis and management of sodium disorders: hyponatremia and hypernatremia. Am Fam Physician. 2015;91(5):299–307.
12. Adrogué HJ, Madias NE. Hyponatremia. N Engl J Med. 2000;342(21):1581–9.
13. Koch CA, Fulop T. Clinical aspects of changes in water and sodium homeostasis

in the elderly. Rev Endocr Metab Disord. 2017;18(1):49–66.

14. Colling JC, Owen TR, McCreedy MR. Urine volumes and voiding patterns among incontinent nursing home residents. Residents at highest risk for dehydration are often the most difficult to track. Geriatr Nurs (Minneap). 1994;15(4):188–92.
15. Wilson MM, Morley JE. Impaired cognitive function and mental performance in mild dehydration. Eur J Clin Nutr. 2003;57(Suppl 2):S24-9.
16. Zembrzuski CD. A three-dimensional approach to hydration of elders: administration, clinical staff, and in-service education. Geriatr Nurs (Minneap). 1997;18(1):20–6.
17. Hooper L, Buun D, Jimoh FO, Fairweather-Tait SJ. Water-loss dehydration and aging. Mech Ageing Dev. 2014;136–137(7):50–8.
18. Gilmour J, Penny S. Hydration & ageing. New Zeal Nurs journal. 1991;84(10):15–7.
19. Grossman SP. Thirst and sodium appetite: physiological basis. San Diego, CA: Academic Press, Inc.; 1990.
20. Tortora GJ, Derrickson B. Principles of anatomy and physiology. 13[a]. Buenos Aires: Editorial Médica Panamericana; 2013.
21. Sheehy CM, Perry PA, Cromwell SL. Dehydration: biological considerations, age-related changes, and risk factors in older adults. Biol Res Nurs. 1999;1(1):30–7.
22. Davies I, O'Neill PA, McLean KA, Catania J, Bennett D. Age-associated alterations in thirst and arginine vasopressin in response to a water or sodium load. Age Ageing. 1995;24(2):151–9.
23. Stookey JD. High prevalence of plasma hypertonicity among community-dwelling older adults: results from NHANES III. J Am Diet Assoc. 2005;105(8):1231–9.
24. Stookey JD, Pieper CF, Cohen HJ. Is the prevalence of dehydration among community-dwelling older adults really low? Informing current debate over the fluid recommendation for adults aged 70+years. Public Health Nutr. 2005;8(8):1275–85.
25. Kenkmann A, Price GM, Bolton J, Hooper L. Health, wellbeing and nutritional status of older people living in UK care homes: an exploratory evaluation of changes in food and drink provision. BMC Geriatr. 2010;10:28.

26. Buffa R, Floris G, Lodde M, Cotza M, Marini E. Nutritional status in the healthy longeval population from Sardinia (Italy). J Nutr Health Aging. 2010;14(2):97–102.
27. Miller DK, Perry HM, Morley JE. Associations among the Mini Nutritional Assessment instrument, dehydration, and functional status among older African Americans in St. Louis, Mo., USA. Nestle Nutr Workshop Ser Clin Perform Programme. 1999;1:79–86.
28. El-Sharkawy AM, Sahota O, Maughan RJ, Lobo DN. Hydration in the older hospital patient - is it a problem? Age Ageing. 2014;43:33–5.
29. El-Sharkawy AM, Watson P, Neal KR, Ljungqvist O, Maughan RJ, Sahota O, et al. Hydration and outcome in older patients admitted to hospital (The HOOP prospective cohort study). Age Ageing. 2015;44(6):943–7.
30. Chen CC, Dai YT, Yen CJ, Huang GH, Wang C. Shared risk factors for distinct geriatric syndromes in older Taiwanese inpatients. Nurs Res. 2010;59(5):340–7.
31. Murray J, Doeltgen S, Miller M, Scholten I. A descriptive study of the fluid intake, hydration, and health status of rehabilitation inpatients without dysphagia following stroke. J Nurt Gertontol Geriatr. 2015 Jan;34(3):292–304.
32. Bataille S, Baralla C, Torro D, Buffat C, Berland Y, Alazia M, et al. Undercorrection of hypernatremia is frequent and associated with mortality. BMC Nephrol. 2014;15:37.
33. Warren JL, Bacon WE, Harris T, McBean AM, Foley DJ, Phillips C. The burden and outcomes associated with dehydration among US elderly, 1991. Am J Public Health. 1994;84(8):1265–9.
34. Snyder NA, Feigal DW, Arieff AI. Hypernatremia in elderly patients. A heterogeneous, morbid, and iatrogenic entity. Ann Intern Med. 1987;107(3):309–19.
35. Thomas DR, Tariq SH, Makhdomm S, Haddad R, Moinuddin A. Physician misdiagnosis of dehydration in older adults. J Am Med Dir Assoc. 2003;4(5):251–4.
36. Ellershaw JE, Sutcliffe JM, Saunders CM. Dehydration and the dying patient. J Pain Symptom Manage. 1995;10(3):192–7.
37. Wolff A, Stuckler D, McKee M. Are patients admitted to hospitals from care

homes dehydrated? A retrospective analysis of hypernatraemia and in-hospital mortality. J R Soc Med. 2015;108(7):259–65.

38. Himmelstein DU, Jones AA, Woolhandler S. Hypernatremic dehydration in nursing home patients: an indicator of neglect. J Am Geriatr Soc. 1983;31(8):466–71.

39. Holben DH, Hassell JT, Williams JL, Helle B. Fluid intake compared with established standards and symptoms of dehydration among elderly residents of a long-term-care facility. J Am Diet Assoc. 1999;99(11):1447–50.

40. An Vandervoort MA, Van den Block L, van der Steen JT, Volicer L, Vander Stichele R, Houttekier D, et al. Nursing home residents dying with dementia in Flanders, Belgium: a nationwide postmortem study on clinical characteristics and quality of dying. J Am Med Dir Assoc. 2013;14(7):485–92.

41. Koopmans R, van der Sterren K, van der Steen J. The 'natural' endpoint of dementia: death from cachexia or dehydration following palliative care? Int J Geriatr Psychiatry. 2007;22(4):350–5.

42. Hooper L, Bunn DK, Downing A, Jimoh FO, Groves J, Free C, et al. Which frail older people are dehydrated? The UK DRIE study. J Gerontol A Biol Sci Med Sci. 2016;71(10):1341–7.

43. Siervo M, Bunn D, Prado CM, Hooper L. Accuracy of prediction equations for serum osmolarity in frail older people with and without diabetes. Am J Clin Nutr. 2014;100(3):867–76.

44. Léger JM, Moulias R, Robert P, Vellas B, Chapuy PH, Monfort JC, et al. Agitation and aggressiveness among the elderly population living in nursing or retirement homes in France. Int Psychogeriatrics. 2002;14(4):405–16.

45. Wu SJ, Wang HH, Yeh SH, Wang YH, Yang YM. Hydration status of nursing home residents in Taiwan: a cross-sectional study. J Adv Nurs. 2011;67(3):583–90.

46. Mentes JC. A typology of oral hydration problems exhibited by frail nursing home residents. J Gerontol Nurs. 2006;32(1):13-9-1.

47. Culp KR, Wakefield B, Dyck MJ, Cacchione PZ, DeCrane S, Decker S. Bioelectrical impedance analysis and other hydration parameters as risk factors for delirium in rural nursing home residents. J Gerontol A Biol Sci Med Sci. 2004;59(8):813–7.

48. Jensdóttir AB, Rantz M, Hjaltadóttir I, Gudmundsdòttir H, Rook M, Grando V.

International comparison of quality indicators in United States, Icelandic and Canadian nursing facilities. Int Nurs Rev. 2003;50(2):79–84.

49. Mentes J, Culp K, Maas M, Rantz M. Acute confusion indicators: risk factors and prevalence using MDS data. Res Nurs Health. 1999;22(2):95–105.
50. Stuck AE, Siu AL, Wieland GD, Adams J, Rubenstein LZ. Comprehensive geriatric assessment: a meta-analysis of controlled trials. Lancet. 1993;342(8878):1032–6.
51. Dyck MJ. Nursing staffing and resident outcomes in nursing homes: weight loss and dehydration. J Nurs Care Qual. 2007;22(1):59–65.
52. Lavizzo-Mourey R, Johnson J, Stolley P. Risk factors for dehydration among elderly nursing home residents. J Am Geriatr Soc. 1988;36(3):213–8.
53. Mukamel DB. Risk-adjusted outcome measures and quality of care in nursing homes. Med Care. 1997;35(4):367–85.
54. Chidester JC, Spangler AA. Fluid intake in the institutionalized elderly. J Am Diet Assoc. 1997;97(1):23–30.
55. Mentes JC, Wang J. Measuring risk for dehydration in nursing home residents: evaluation of the dehydration risk appraisal checklist. Res Gerontol Nurs. 2011;4(2):148–56.
56. Spector WD, Fortinsky RH. Pressure ulcer prevalence in Ohio nursing homes: Clinical and facility correlates. J Aging Health. 1998;10(1):62–80.
57. Pressure ulcers. Two major concerns: involuntary weight loss and dehydration. Health Care Food Nutr Focus [Internet]. 2002 Sep [cited 2017 Jan 10];19(1):11–2. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12233228
58. Kayser-Jones J, Schell ES, Porter C, Barbaccia JC, Shaw H. Factors contributing to dehydration in nursing homes: inadequate staffing and lack of professional supervision. J Am Geriatr Soc. 1999;47(10):1187–94.
59. Spangler AA, Chidester JC. Age, dependency and other factors influencing fluid intake by long term care residents. J Nutr Elder. 1999;18(2):21–35.
60. Olde Rikkert MG, Deurenberg P, Jansen RW, van't Hof MA, Hoefnagels WH. Validation of multi-frequency bioelectrical impedance analysis in detecting changes in fluid balance of geriatric patients. J Am Geriatr Soc. 1997 Nov;45(11):1345–51.

61. Leibovitz A, Baumoehl Y, Lubart E, Yaina A, Platinovitz N, Segal R. Dehydration among long-term care elderly patients with oropharyngeal dysphagia. Gerontology. 2007;53(4):179–83.
62. Satyanarayana DA, Kulkarni PK, Shivakumar HG. Gels and jellies as a dosage form for dysphagia patients: a review. Curr Drug ther. 2011;6(2):79–86.
63. Cichero J, Clavé P. Stepping stones to living well with dysphagia. Nestle Nutr Work Ser. 2012;72:1664–2147.
64. Bratlund CV, O'Donoghue CR, Rocchiccioli JT. Dehydration and dysphagia: Challenges in the older adult. J Med Speech Lang Pathol. 2010;18(3):1–10.
65. Dimant J. Delivery of nutrition and hydration care in nursing homes: assessment and interventions to prevent and treat dehydration, malnutrition, and weight loss. J Am Med Dir Assoc. 2001;2(4):175–82.
66. American Medical Directors Association (AMDA). Dehydration and fluid maintenance in the long-term care setting. Clinical Practice Guideline. Columbia, MD: AMDA; 2009.
67. Wotton K, Crannitch K, Munt R. Prevalence, risk factors and strategies to prevent dehydration in older adults. Contemp Nurse. 2008;31(1):44–56.
68. Gaspar PM. Water intake of nursing home residents. J Gerontol Nurs. 1999;25(4):23–9.
69. LaPlante MP, Kaye HS, Kang T, Harrington C. Unmet need for personal assistance services: estimating the shortfall in hours of help and adverse consequences. J Gerontol B Psychol Sci Soc Sci. 2004;59(2):S98–108.
70. Cacchione PZ, Culp K, Laing J, Tripp-Reimer T. Clinical profile of acute confusion in the long-term care setting. Clin Nurs Res. 2003;12(2):145–58.
71. Bourdel-Marchasson I, Proux S, Dehail P, Muller F, Richard-Harston S, Traissac T, et al. One-year incidence of hyperosmolar states and prognosis in a geriatric acute care unit. Gerontology. 2004;50(3):171–6.
72. Easterling CS, Robbins E. Dementia and dysphagia. Geriatr Nurs (Minneap). 2008;29(4):275–85.
73. Harrington C, Kovner C, Mezey M, Kayser-Jones J, Burger S, Mohler M, et al. Experts recommend minimum nurse staffing standards for nursing facilities in the United States. Gerontologist. 2000;40(1):5–16.

74. Sawka MN, Young AJ. Physical exercise in hot and cold climates. In: Garrett WE, Kirkendall DT, editors. Exercise and Sport Science. Philadelphia, PA: Lippincott Williams & Wilkins; 2000. p. 385–400.
75. Kenefick RW, Hazzard MP, Mahood NV, Castellani JW. Thirst sensations and AVP responses at rest and during exercise-cold exposure. Med Sci Sports Exerc. 2004;36(9):1528–34.
76. Olde Rikkert MG, Melis RJ, Claassen JA. Heat waves and dehydration in the elderly: recognising the early warning signs can save lives. BMJ. 2009;339:b2663.
77. Goldberg LR, Heiss CJ, Parsons SD, Foley AS, Mefferd AS, Hollinger D, et al. Hydration in older adults: The contribution of bioelectrical impedance analysis. Int J Speech Lang Pathol. 2014;16(3):273–281.
78. Armstrong LE. Assessing hydration status: the elusive gold standard. J Am Coll Nutr. 2007 Oct;26(5 Suppl):575S–584S.
79. Alzahrani A, Sinnert R, Gernsheimer J. Acute kidney injury, sodium disorders, and hypercalcemia in the aging kidney: diagnostic and therapeutic management strategies in emergency medicine. Clin Geriatr Med. 2013;29(1):275–319.
80. Cumming K, Hoyle GE, Hutchison JD, Soiza RL. Prevalence, incidence and etiology of hyponatremia in elderly patients with fragility fractures. PLoS One. 2014;9(2):e88272.
81. Adrogué HJ, Madias NE. Hypernatremia. N Engl J Med. 2000;342(20):1493–9.
82. Shah MK, Workeneh B, Taffet GE. Hypernatremia in the geriatric population. Clin Interv Aging. 2014;9:1987–92.
83. US National Library of Medicine. Osmolar concentration [Internet]. 1970 [cited 2017 Oct 25]. Available from: https://www.ncbi.nlm.nih.gov/mesh?term=osmolality
84. Hooper L, Abdelhamid A, Ali A, Bunn DK, Jennings A, John WG, et al. Diagnostic accuracy of calculated serum osmolarity to predict dehydration in older people: adding value to pathology laboratory reports. BMJ Open. 2015;5(10):e008846.
85. Fazekas AS, Funk G-C, Klobassa DS, Rüther H, Ziegler I, Zander R, et al. Evaluation of 36 formulas for calculating plasma osmolality. Intensive Care Med. 2013;39(2):302–8.

86. Khajuria A, Krahn J. Osmolality revisited - deriving and validating the best formula for calculated osmolality. Clin Biochem. 2005;38(6):514–9.
87. Metheny NM. Fluid and electrolyte balance: Nursing considerations. 5th ed. Jones & Bartlett Learning, editor. Sudbury, MA: Kevin Sullivan; 2012.
88. Whelan K. Inadequate fluid intakes in dysphagic acute stroke. Clin Nutr. 2001;20(5):423–8.
89. Hodgkinson B, Evans D, Wood J. Maintaining oral hydration in older adults: a systematic review. Int J Nurs Pr. 2003;9(3):19–28.
90. Bossingham MJ, Carnell NS, Campbell WW. Water balance, hydration status, and fat-free mass hydration in younger and older adults. Am J Clin Nutr. 2005;81(6):1342–50.
91. Culp K, Mentes J, Wakefield B. Hydration and acute confusion in long-term care residents. West J Nurs Res. 2003;25(3):251–66; discussion 267–73.
92. Rowat A, Smith L, Graham C, Lyle D, Horsburgh D, Dennis M. A pilot study to assess if urine specific gravity and urine colour charts are useful indicators of dehydration in acute stroke patients. J Adv Nurs. 2011;67(9):1976–83.
93. Armstrong LE, Maresh CM, Castellani JW, Bergeron MF, Kenefick RW, LaGasse KE, et al. Urinary indices of hydration status. Int J Sport Nutr. 1994;4(3):265–79.
94. Armstrong LE, Soto JA, Hacker FT, Casa DJ, Kavouras SA, Maresh CM. Urinary indices during dehydration, exercise, and rehydration. Int J Sport Nutr. 1998;8(4):345–55.
95. García Peris P, Bretón Lesmes I. Composición corporal. In: Sociedad Española de Nutrición Parenteral y Enteral (SENPE) y Sociedad Española de Geriatría y Gerontología (SEGG), editor. Valoración nutricional en el anciano. Galénitas-. Madrid; 2016. p. 97–123.
96. Cheuvront SN, Ely BR, Kenefick RW, Sawka MN. Biological variation and diagnostic accuracy of dehydration assessment markers. Am J Clin Nutr. 2010;92(3):565–73.
97. Vivanti A, Yu L, Palmer M, Dakin L, Sun J, Campbell K. Short-term body weight fluctuations in older well-hydrated hospitalised patients. J Hum Nutr Diet. 2013;26(5):429–35.
98. Bussolotto M, Ceccon A, Sergi G, Giantin V, Benincà P, Enzi G. Assessment of

Body Composition in Elderly: Accuracy of Bioelectrical Impedance Analysis. Gerontology. 1999;45(1):39–43.

99. Tengvall M, Ellegård L, Malmros V, Bosaeus N, Lissner L, Bosaeus I. Body composition in the elderly: Reference values and bioelectrical impedance spectroscopy to predict total body skeletal muscle mass. Clin Nutr. 2009;28(1):52–8.

100. Hoyle GE, Chua M, Soiza RL. Volaemic assessment of the elderly hyponatraemic patient: reliability of clinical assessment and validation of bioelectrical impedance analysis. QJM. 2011;104(1):35–9.

101. Kafri MW, Myint PK, Doherty D, Wilson AH, Potter JF, Hooper L. The diagnostic accuracy of multi-frequency bioelectrical impedance analysis in diagnosing dehydration after stroke. Med Sci Monit. 2013;19:548–70.

102. Kyle UG, Bosaeus I, De Lorenzo AD, Deurenberg P, Elia M, Gómez JM, et al. Bioelectrical impedance analysis-part II: utilization in clinical practice. Clin Nutr . 2004;23(6):1430–53.

103. Shanholtzer BA, Patterson SM. Use of bioelectrical impedance in hydration status assessment: reliability of a new tool in psychophysiology research. Int J Psychophysiol. 2003;49(3):217–26.

104. Vivanti A, Harvey K, Ash S. Developing a quick and practical screen to improve the identification of poor hydration in geriatric and rehabilitative care. Arch Gerontol Geriatr. 2010;50(2):156–64.

105. Chassagne P, Druesne L, Capet C, Ménard JF, Bercoff E. Clinical presentation of hypernatremia in elderly patients: a case control study. J Am Geriatr Soc. 2006;54(8):1225–30.

106. McGee S, Abernethy WB, Simel DL. The rational clinical examination. Is this patient hypovolemic? JAMA. 1999;281(11):1022–9.

107. Mentes JC, Wakefield B, Culp K. Use of a urine color chart to monitor hydration status in nursing home residents. Biol Res Nurs. 2006;7(3):197–203.

108. Kinoshita K, Hattori K, Ota Y, Kanai T, Shimizu M, Kobayashi H, et al. The measurement of axillary moisture for the assessment of dehydration among older patients: a pilot study. Exp Gerontol. 2013;48(2):255–8.

109. Eaton D, Bannister P, Mulley GP, Connolly MJ. Axillary sweating in clinical

assessment of dehydration in ill elderly patients. BMJ. British Medical Journal Publishing Group; 1994;308(6939):1271.

110. Mentes JC, Iowa-Veterans Affairs Nursing Research Consortium. Hydration management protocol. J Gerontol Nurs. 2000;26(10):6–15.
111. Rodrigues S, Silva J, Severo M, Inácio C, Padrão P, Lopes C, et al. Validation analysis of a geriatric dehydration screening tool in community-dwelling and institutionalized elderly people. Int J Environ Res Public Health. 2015;12(3):2700–17.
112. Robinson BE, Weber H. Dehydration despite drinking: beyond the BUN/Creatinine ratio. J Am Med Dir Assoc. 2004;5(Suppl. 2):S68–71.
113. Feinsod FM, Levenson SA, Rapp K, Rapp MP, Beechinor E, Liebmann L. Dehydration in frail, older residents in long-term care facilities. J Am Med Dir Assoc. 2004;5(2 Suppl):S36-41.
114. Palevsky PM, Bhagrath R, Greenberg A. Hypernatremia in hospitalized patients. Ann Intern Med. 1996;124(2):197–203.
115. Rolland Y, Kim MJ, Gammack JK, Wilson MM, Thomas DR, Morley JE. Office management of weight loss in older persons. Am J Med. 2006;119(2):1019–26.
116. Mentes JC, Culp K. Reducing hydration-linked events in nursing home residents. Clin Nurs Res. 2003;12(3):210–25; discussion 226–8.
117. Leung AA, McAlister FA, Finlayson SRG, Bates DW. Preoperative hypernatremia predicts increased perioperative morbidity and mortality. Am J Med. 2013;126(10):877–86.
118. Stookey JD, Purser JL, Pieper CF, Cohen HJ. Plasma hypertonicity: another marker of frailty? J Am Geriatr Soc. 2004;52(8):1313–20.
119. Gordon JA, An LC, Hayward RA, Williams BC. Initial emergency department diagnosis and return visits: risk versus perception. Ann Emerg Med. 1998;32(5):569–73.
120. Stranges E, Stocks C. Potentially preventable hospitalizations for acute and chronic conditions, 2008 [Internet]. Healthcare cost and utilization project. Agency for Healthcare Research and Quality. 2010 [cited 2018 Apr 26]. Available from: https://www.hcup-us.ahrq.gov/reports/statbriefs/sb99.pdf
121. Porock D, Oliver DP, Zweig S, Rantz M, Mehr D, Madsen R, et al. Predicting death

in the nursing home: development and validation of the 6-month Minimum Data Set mortality risk index. J Gerontol A Biol Sci Med Sci. 2005;60(4):491–8.

122. Studdert DM, Spittal MJ, Mello MM, O'Malley AJ, Stevenson DG. Relationship between quality of care and negligence litigation in nursing homes. N Engl J Med. 2011;364(13):1243–50.
123. Wachtel TJ, Tetu-Mouradjian LM, Goldman DL, Ellis SE, O'Sullivan PS. Hyperosmolarity and acidosis in diabetes mellitus: a three-year experience in Rhode Island. J Gen Intern Med. 1991;6(6):495–502.
124. Chan J, Knutsen SF, Blix GG, Lee JW, Fraser GE. Water, other fluids, and fatal coronary heart disease: the Adventist Health Study. Am J Epidemiol. 2002;155(9):827–33.
125. Chernoff R. Thirst and fluid requirements. Nutr Rev. 1994;52(8 Pt 2):S3-5.
126. Jovanovich A, Berl T. Chronic kidney disease: Mortality and serum sodium in CKD—yet another U-shaped curve. Nat Rev Nephrol. 2012;8(5):261–3.
127. Salahudeen AK, Doshi SM, Shah P. The frequency, cost, and clinical outcomes of hypernatremia in patients hospitalized to a comprehensive cancer center. Support Care Cancer. 2013;21(7):1871–8.
128. Frangeskou M, Lopez-Valcarcel B, Serra-Majem L. Dehydration in the elderly: a review focused on economic burden. J Nutr Health Aging. 2015;19(6):619–27.
129. Kim S. Preventable hospitalizations of dehydration: implications of inadequate primary health care in the United States. Ann Epidemiol. 2007;17(9):736.
130. Xiao H, Barber J, Campbell ES. Economic burden of dehydration among hospitalized elderly patients. Am J Health Syst Pharm. 2004;61(23):2534–40.

CHAPTER 2

Objectives

Chapter 2. Objectives

In view of the above, and considering that no research has been found in our territorial context, it is necessary to investigate in this area. For these reasons, the aim of this thesis was to detect and analyse the problem of dehydration in institutionalised older people living in nursing homes, in order to identify the best practices to improve this situation.

In this sense and in order to achieve this, the following objectives were considered to:

1. Identify and assess the risk factors associated with dehydration in older people living in nursing homes on an international level (paper I).

2. Estimate the prevalence of dehydration and identify the factors associated with it in older people living in an assisted nursing home in Lleida (paper II).

3. Establish the prevalence of low fluid intake in institutionalised older residents in Lleida and to analyse the factors associated with this (paper III).

4. Identify and evaluate the interventions carried out for the management of dehydration and low fluid intake in older people living in nursing homes on an international level (paper IV).

CHAPTER 3

Methodology

Chapter 3. Methodology

1. Methodology to address objectives 1 and 4

In order to achieve objectives 1 and 4, a scoping review was carried out. First of all, it is necessary to mention that scoping reviews are sometimes confused with systematic reviews. For this reason, it is important to clarify the differences between them (table 1) (1,2).

Table 1. Comparison between the characteristics of scoping and systematic reviews

Characteristics	Systematic Review	Scoping Review
Research question	Focused research question with narrow parameters	Research question(s) often broad
Inclusion and exclusion criteria	Inclusion/exclusion usually defined at outset	Inclusion/exclusion can be developed *post hoc*
Quality assessment	Quality filters often applied	Quality not an initial priority
Data analysis	Detailed data extraction	May or may not involve data extraction
Results synthesis	Quantitative synthesis often performed	Synthesis more qualitative, and typically not quantitative
Risk of bias assessment	Formally assesses the quality of studies and generates a conclusion relating to the focused research question	Used to identify parameters and gaps in a body of literature

A scoping review is a technique for 'mapping' relevant literature in a field of interest, which provides a medium level of evidence (figure 1) (3). This involves making a synthesis and analysis of a wide range of research and non-research related material in order to provide greater conceptual clarity about a specific topic or field of evidence. Scoping reviews are also considered useful in policy-directed nursing research (4,5).

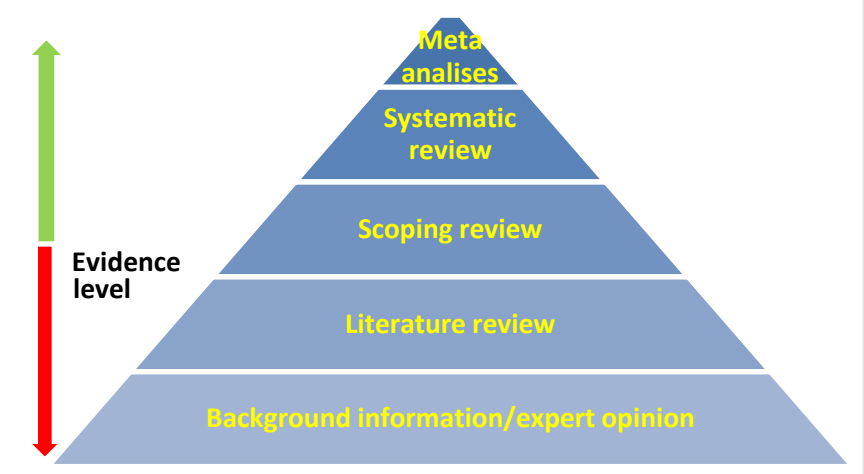

Figure 1. Evidence level

Following the methodology of Arksey and O'Malley (3), the framework used in the two scoping reviews developed in this thesis was divided into 5 stages.

1.1. Stage 1: identifying the research question

First of all, a research question has to be designed before starting the scoping. This question addresses the way in which the search strategy has to be organised. In order to address objectives 1 and 4 the questions cited in table 2 were designed.

Table 2. Research questions from scoping reviews

Objectives of the thesis	Research question
1	What are the risk factors associated with dehydration in older people living in nursing homes?
4	What interventions are carried out for the management of dehydration and low fluid intake in people over 65 institutionalised in nursing homes?

1.2. Stage 2: identifying relevant studies

In stage 2, the relevant studies were identified by two different researchers. In this sense, the relevant information about this process (time span, electronic databases, key words and inclusion and exclusion criteria) is set forth in table 3.

Table 3. Information used to identify the relevant studies for objectives 1 and 4

Information	Objective 1	Objective 4
Time span	October 2016 and January 2017	November 2016 and February 2017 Later, updated: until March 2018
Electronic databases	PubMed; Scopus and CINAHL	PubMed; Scopus and CINAHL, grey literature and the bibliography derived from scientific articles
Key words	dehydration" and "hydration"; "hypernatremia"; "osmolar concentration"; "thirst"; "drinking*"; "fluid intake"; "risk factor"; "aged"; "nursing home" and "long-term care"	dehydration" and "hydration", "fluid intake", "hypernatremia", "water loss", "thirst", "drink*", "fluid therapy", "rehydration solutions", "promoting fluid intake", "*thickened", "beverages", "aged", "nursing home" and "long-term care"
Inclusion criteria	○ Observational studies ○ Evaluated dehydration ○ People aged ≥ 65 years old ○ Institutionalised in a nursing home ○ No limits were put on either the language or the date of the research.	○ Interventional and observational studies ○ Studies examined an association between the intervention, or modifiable exposure, and hydration status and/or fluid intake ○ People aged ≥ 65 years old ○ Institutionalised in a nursing home ○ No limits were put on either the language or the date of the research.
Exclusion criteria	○ Studies conducted at other levels of care ○ Studies focused only on fluid intake	Studies conducted at other levels of care

1.3. Stage 3: study selection

For the purpose of developing stage 3 and focusing on the inclusion criteria, study selection was carried out. Due to the rules of the two journal's where papers I and IV were published, the methods of selection of the studies had to differ. On the one hand, Davis et al. (5) was used in paper I and, on the other hand, PRISMA (6) was executed in paper IV. Basically, the variation between them is procured in the presentation diagram of the results, not in the selection methodology.

Both methods consist of two phases. In step 1, the searches from each database were imported into Mendeley version 1.17.8 (https://www.mendeley.com) and the full

dataset was checked for duplication. The titles and abstracts were then screened for eligibility. Finally, in step 2, potentially relevant papers were screened based on their full text content. Two researchers selected a number of studies independently. When there was any disconformity, a consensus was reached with the help of the whole team of researchers.

1.4. Stage 4: charting the data

In the scoping review called "Risk factors associated with dehydration in older people living in nursing homes: Scoping review", which is related to objective 1, the 16 papers finally included were then subjected to data charting. The information was independently reviewed by two researchers. In cases of uncertainty, the final decision was taken in meetings and based on a consensus of a further three researchers. The data charting took into consideration information relating to: author(s); year of publication; study location; study population(s); methodology; method of diagnosis; and dehydration risk factors.

The scoping review called "How to improve hydration and water intake in institutionalised older people? A scoping review" was developed in order to assess objective 4, including 11 papers for review. The entire selection and analysis process was carried out independently by two researchers and in case of ambiguity or uncertainty, the final decision was also made by consensus in meetings in which all the researchers participated. In this case, the information included was: author/s, year of publication, country, design, population and duration of the study, description of the intervention or observation and results found.

In reference to the quality of the studies, although it is known that it is not a priority to evaluate this in the scoping reviews (table 1) (3), the authors considered that it was essential to know the risk of bias of the papers finally included in both scoping reviews, in order to verify their results. In paper I, the risk of bias was evaluated using the Newcastle-Ottawa Scales (NOS) adapted for cross-sectional, cohort and case-control studies (7). In paper IV, this risk was examined through the Cochrane Handbook for

Systematic Reviews of Interventions (8) for intervention studies and the NOS (7) for observational studies. These evaluations were carried out by the whole evaluation team.

1.5. Stage 5: collating, summarising and reporting the results

In the last stage, the results were classified in two different ways. In paper I, the risk factors of dehydration were classified in line with the geriatric assessment (9) used to evaluate the different clinical, functional, mental and social components of the health status of geriatric patients. On the other hand, the results of paper IV were classified according to the nature of the interventions, whether they were invasive or non-invasive.

2. Methodology to address objectives 2 and 3

2.1. Study design

The research project, on which this thesis was based, was a prospective, cross-sectional study carried out on a sample of adults more than 65 years old institutionalised in an assisted nursing home in Lleida.

2.2. Population and sample of the study

The subjects of the study were the institutionalised people in an assisted nursing home. The field study was carried out in the *Residència i centre de dia Lleida-Balàfia* located in the city of Lleida. This nursing home is one of the two current centres, out of a total of 16 in the city of Lleida, in which all the places are public. It has a total capacity of 96 beds. No specific exclusion criteria existed in the selection of residents. In this case, the management company is *Gestió de Serveis Sanitaris*.

2.3. Variables and measuring instruments

For this thesis, only some variables were used from the project in which it is defined. Their selection is based on the results of the scoping review about risk factors of dehydration (paper I) and from the literature.

2.3.1. Variables and measuring instruments to address objective 2

The variables and measuring instruments used to address objective 2 were related to sociodemographic characteristics and health, functional and mental status. The dependent variable was dehydration, which was defined by the analytical parameter BUN/Cr < 21 (10).

With respect to the rest of the variables, the sociodemographic characteristics selected for this study were:

- Age: date of birth and expressed in years.
- Sex: male and female.

The health status variables selected were related to clinical, functional and mental conditions. In relation to clinical variables, those selected were:

- Low fluid intake: if daily average was < 1500 mL. It was collected for 24 hours per day, over a period of one week. All the liquids that they ingested were considered, these being: water, juice, milk, coffee latte and gelatine.
- Urinary infections: those registered over the previous year were recorded in electronic patient files and retrospectively analysed. According to McGeer's criteria (11), urinary tract infections were diagnosed based on microbiologic urine analysis and accompanied by documented signs and symptoms, such as a change from the baseline clinical situation.
- Renal disease: evidence of medical diagnosis of renal disease.
- Cardiovascular disease: evidence of medical diagnosis of cardiovascular disease.

- Cardiovascular accident: evidence of medical diagnosis of cardiovascular accident.
- Diabetes: evidence of medical diagnosis of diabetes.
- Presence of > 4 chronic diseases: evidence of medical diagnosis of more than 4 chronic diseases.
- Presence of sunken eyes: evidence that the resident has sunken eyes.
- Risk of suffering pressure ulcers: this was evaluated by the Braden Scale (12,13). The scale includes six items that contribute to the appearance of ulcers: sensory perception, moisture, activity, mobility, nutrition and friction and shear. Each category is rated on a scale from 1 to 4, excluding the "friction and shear" category which is rated on a 1-3 scale. The scores can range between 6 and 23. In the final score, ≤ 12 points is considered to have a high risk; 13-14, a moderate risk; ≤ 15-16 if < 75 years old or ≤ 15-18 if > 75 years old, to have a low risk; and the rest of points are without risk.
- Dysphagia: assessed using the Volume-Viscosity Swallow Test (V-VST) (14). In order to detect dysphagia, the subject has to be placed in a sitting position, monitoring their oxygen saturation. Boluses of 5, 10 and 20 mL are administered, with nectar, liquid and pudding viscosities. On each occasion, a record is taken of signs of compromised safety (changes in voice quality, cough and/or a decrease in oxygen saturation < 3%) or signs of compromised effectiveness (impaired labial seal, oral or pharyngeal residue, and/or piecemeal deglutition). It is determined that the test is positive when any clinical sign of impaired safety or efficacy of swallow appears.
- Laxatives: it was considered that they were taking laxatives if these were prescribed habitually.
- Taking more than 4 drugs: as usual.

On the other hand, their functional state was recorded using the Barthel Index (15,16). This is an ordinal scale used to measure performance in activities of daily living and the main aim is to establish the degree of independence from any help, whether physical or verbal. It addresses 10 conditions: presence or absence of faecal and urinary incontinence and help needed with grooming, toilet use, feeding, transfers, walking,

dressing, climbing stairs and bathing. Each item provides a different score, meaning that the total sum: < 20 points indicates totally dependent; 21-60: severe dependence; 61-90: moderate dependence; 91-99: low dependence and 100, independence.

Finally, the variables related to mental condition included in this study were:

- Cognitive impairment: evaluated using the Mini-Mental State Examination (MMSE) (17–19). MMSE is used extensively to measure cognitive impairment, to screen for dementia and also to estimate the severity and progression of the cognitive impairment. MMSE evaluates seven spheres: orientation to time and to place, registration, attention and calculation, recall, language, repetition and complex commands. There are two versions: a 30-point and a 35-point questionnaire. In this study, the version used was 30 points, as it is the most developed at the international level. In geriatric patients, scores above 23 indicate that there is no cognitive impairment.
- Aggressiveness: it was evaluated through the item “G” of the Quality Of Life in Late-Stage Dementia (QUALID) Scale (he/she was irritable or aggressive over the past week: becomes angry, cursed, pushed or attempted to hurt others) (20,21).
- Agitation: it was evaluated through the item 5 “agitation” of the Cornell scale for depression in dementia, valued over the past week. According to this scale, it was considered agitation whether the residents presented restlessness, hand wringing or hair pulling (22,23).
- Delirium: it was evaluated through the item 19 “delirium” of the Cornell scale for depression in dementia, valued over the past week. According to this scale, it was considered agitation whether the residents presented mood-congruent delusions like delusions of poverty, illness, or loss (22,23).
- Confusion: it was evaluated through the item “mental state” of the Downton fall risk index (24,25).

2.3.2. Variables and measuring instruments to address objective 3

The dependent variable used to address objective 3 was fluid intake, which is described in the previous section.

Furthermore, as well as the variables of paper II, the sociodemographic characteristics selected were age and sex. Along with this, health status was monitored with urinary infections, risk of suffering pressure ulcers (Braden Scale) and functional (Barthel Index) and cognitive state (MMSE).

On the other hand, low fluid intake is closely related to an alteration in the nutritional condition (26–28). For this reason, this condition was analysed in greater depth in the study with the variables:

- Nutritional status: measured using the Mini Nutritional Assessment (MNA) (29,30). It consists of 18 items and the sum of its total score is maximum 30. Its categorisation is as follows: over 24 points indicates normal nutritional status; from 17 to 23.5, at risk of malnutrition, and less than 17, malnourished.
- Clinical signs of impaired safety of swallow: assessed using the V-VST (14).
- Clinical signs of impaired efficacy of swallow: assessed using the V-VST (14).
- Dysphagia to liquid viscosity: if the resident has some difficulty of swallowing with liquid viscosity. This was assessed with V-VST (14).
- Diet texture: if the resident feeds through texture modified diet or with a normal texture.

Besides, the dehydration was assessed with the analytical parameter BUN:Cr. The literature identifies this as most useful to detect some alteration in the hydration status. It was considered an alteration of the hydration status if the BUN/Cr > 21 was (10).

2.4. Data collection

The staff that collected the data was trained by the project team through regular meetings. These were held in order to unify the different tasks, to guarantee the internal consistency of the results and to minimise the systematic errors.

Before the data collection, a pilot test of the questionnaire was carried out. It is recommended that this be 10-15% of the total sample; therefore, there were 10-15 interviews to assess the understanding of all the indicators, whether the order of the questions was the most appropriate and whether they were clear and precise. Afterwards, the relevant mistakes were corrected.

As the data were collected, they were transferred to a specific computerised database to process them. Once the information was recorded, a series of controls was carried out to debug the possible errors in the data.

2.5. Statistical analysis

Firstly, a description of the sociodemographic characteristics, the health status and the anthropometric and biochemical measures of the population studied was carried out. The descriptive analysis of the sample was carried out by measures of central tendency and of dispersion or measures of distribution of frequencies, based on the nature of the variables.

In both cases, the database used was reviewed by means of a study of extreme frequencies and an analysis of inconsistencies. In addition, all the statistical calculations were undertaken with the SPSS software version 24.

2.5.1. Statistical analysis to address objective 2

In order to identify the factors that are associated with dehydration, bivariate analyses were carried out. The statistical analyses that were used, depending on the nature of

the variables, were chi-square or t-student. Afterwards, those that obtained a level of statistical significance < 0.25 were incorporated into the logistic regression, in accordance with the recommendations of Hosmer and Lemeshow (31), to know which of them were associated independently with dehydration. In these models, the level of significance accepted was $p < 0.05$.

2.5.2. Statistical analysis to address objective 3

To study and evaluate the association between fluid intake and the different factors, the Pearson's rank-order correlation for the quantitative variables and the t-test for the different categories were performed. In all these analyses, the level of meaning accepted was $p < 0.05$.

2.6. Ethical considerations

Prior to beginning the study, the *Residència i Centre de Dia per a Gent Gran Lleida-Balàfia* gave authorisation to carry out the project in their facilities (appendix 4). Furthermore, the University Hospital Arnau de Vilanova Clinical Research Ethics Committee of Lleida reported favourably on the project application (appendix 5).

Before starting the interview, the resident or his/her relative (if the resident had a score < 2 on the Global Deterioration Scale) was informed about the nature of the study and their rights through oral information and an information sheet (appendix 6). Subsequently, they gave their consent to participate by signing the informed consent (appendix 7). On the other hand, the data protection of the participants was guaranteed by means of encoding. Each resident had an identification code and only the coordinator of the project knew the relation between the personal data and the identification code.

References

1. Brien SE, Lorenzetti DL, Lewis S, Kennedy J, Ghali WA. Overview of a formal scoping review on health system report cards. Implement Sci. 2010;5(1):2.
2. Armstrong R, Hall BJ, Doyle J, Waters E. Cochrane Update: 'Scoping the scope' of a cochrane review. J Public Health (Bangkok). 2011;33(1):147–50.
3. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19–32.
4. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. Implement Sci. 2010;5:69.
5. Davis K, Drey N, Gould D. What are scoping studies? A review of the nursing literature. Int J Nurs Stud. 2009;46(10):1386–400.
6. Urrútia G, Bonfill X. PRISMA declaration: A proposal to improve the publication of systematic reviews and meta-analyses. Med Clin (Barc). 2010;135(11):507–11.
7. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses [Internet]. 2007 [cited 2017 Mar 30]. Available from: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp
8. Higgins JPT, Green S, (editors). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [Internet]. The Cochrane Collaboration. 2011 [cited 2018 Mar 14]. Available from: http://handbook.cochrane.org.
9. Stuck AE, Siu AL, Wieland GD, Adams J, Rubenstein LZ. Comprehensive geriatric assessment: a meta-analysis of controlled trials. Lancet. 1993;342(8878):1032–6.
10. Culp KR, Wakefield B, Dyck MJ, Cacchione PZ, DeCrane S, Decker S. Bioelectrical impedance analysis and other hydration parameters as risk factors for delirium in rural nursing home residents. J Gerontol A Biol Sci Med Sci. 2004;59(8):813–7.
11. McGeer A, Campbell B, Emori TG, Hierholzer WJ, Jackson MM, Nicolle LE, et al. Definitions of infection for surveillance in long-term care facilities. Am J Infect Control. 1991;19(1):1–7.
12. Bergstrom N, Braden BJ, Laguzza A, Holman V. The Braden Scale for predicting

pressure sore risk. Nurs Res. 1987;36(4):205–10.

13. Bernal MC, Curcio CL, Chacón AJ, Gómez JF, Botero AM. Validez y fiabilidad de la escala de Braden para predecir riesgo de úlceras por presión en ancianos. Rev Esp Geriatr Gerontol. 2001;36(5):281–6.
14. Clavé P, Arreola V, Romea M, Medina L, Palomera E, Serra-Prat M. Accuracy of the volume–viscosity swallow test for clinical screening of oropharyngeal dysphagia and aspiration. Clin Nutr. 2008;27(6):806–15.
15. Mahoney F l, Barthel DW. Functional evaluation: the Barthel Index. Md State Med J. 1965;14:61–5.
16. Shah S, Vanclay F, Cooper B. Improving the sensitivity of the Barthel Index for stroke rehabilitation. J Clin Epidemiol. 1989;42(8):703–9.
17. Folstein MF, Folstein SE, McHugh PR. Mini-Mental state: a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12(3):189–98.
18. Lobo A, Esquerra J, Gomez Burgada F, Sala JM, Seva A. El Mini-Exámen Cognoscitivo: un test sencillo y práctico para detectar alteraciones intelectuales en pacientes médicos. Actas Luso Esp Neurol Psiquiatr. 1979;7(3):189–202.
19. Escribano-Aparicio M V, Pérez-Dively M, García-García FJ, Pérez-Martín A, Romero L, Ferrer G, et al. Validación del MMSE de Folstein en una población española de bajo nivel educativo. Rev Esp Geriatr Gerontol. 1999;34(6):319–26.
20. Weiner MF, Martin-Cook K, Svetlik DA, Saine K, Foster B, Fontaine CS. The quality of life in late-stage dementia (QUALID) scale. J Am Med Dir Assoc. 2000;1(3):114–6.
21. Lucas-Carrasco R, Gómez-Benito J, Rejas J, Brod M. The Spanish version of the dementia quality of life questionnaire: A validation study. Aging Ment Health. 2011;15(4):482–9.
22. Alexopoulos GS, Abrams RC, Young RC, Shamoian CA, Alexopoulus GS, Abrams RC, et al. Cornell Scale for Depression in Dementia. Biol Psychiatry. 1988;23(3):271–84.
23. Pujol J, Azpiazu P, Salamero M, Cuevas R. Sintomatología depresiva en la demencia. Escala de Cornell: validación de la versión en castellano. Rev Neurol. 2001;33(4):397–8.

24. Downton JH. Falls in the elderly. In: Brockklehurst's Textbook of Geriatric Medicine and Gerontology. 4 ed. Churchill Livinsgstone; 1992. p. 318–23.
25. Aranda-Gallardo M, Enriquez de Luna-Rodriguez M, Vazquez-Blanco MJ, Canca-Sanchez JC, Moya-Suarez AB, Morales-Asencio JM. Diagnostic validity of the STRATIFY and Downton instruments for evaluating the risk of falls by hospitalised acute-care patients: a multicentre longitudinal study. BMC Health Serv Res. 2017;17(1):277.
26. Nell D, Neville S, Bellew R, O'Leary C, Beck KL. Factors affecting optimal nutrition and hydration for people living in specialised dementia care units: A qualitative study of staff caregivers' perceptions. Australas J Ageing. 2016;35(4):E1–6.
27. Bernoth MA, Dietsch E, Davies C. 'Two dead frankfurts and a blob of sauce': the serendipity of receiving nutrition and hydration in Australian residential aged care. Collegian. 2014;21(3):171–7.
28. Kenkmann A, Price GM, Bolton J, Hooper L. Health, wellbeing and nutritional status of older people living in UK care homes: an exploratory evaluation of changes in food and drink provision. BMC Geriatr. 2010;10:28.
29. Guigoz Y, Vellas B, Garry PJ. Mini Nutritional Assessment: A practical assessment tool for grading the nutritional state of elderly patients. Facts Res Gerontol. 1997;4(Suppl 2):15–59.
30. Salvá A, Bolibar I, Muñoz M, Sacristán V. Un nuevo instrumento para la valoración nutricional en geriatria: El Mini Nutritional Assessment (MNA). Rev Gerontol. 1996;6:319–28.
31. Hosmer DW, Lemeshow S. Applied logistic regression. 2n ed. New York: John Wiley & Sons; 2000.

CHAPTER 4

Results

Chapter 4. Results

1. Paper I: Risk factors associated with dehydration in older people living in nursing homes: Scoping review

Status: published

Authors (in signing order): Masot O*, Lavedán A, Nuin C, Escobar-Bravo MA, Miranda J, Botigué T*	
Title: Risk factors associated with dehydration in older people living in nursing homes: Scoping review	
Journal (title, volume, start and end page): International Journal of Nursing Studies, 82, 90 - 8	
Year: 2018	*Key (A: article, R: review)*: R
Impact factor: 3.755	*Quartile and area:* 1Q (1/116), Nursing
Citations received: 0	*DOI*: 10.1016/j.ijnurstu.2018.03.020

*Corresponding authors

Title: Risk factors associated with dehydration in older people living in nursing homes: Scoping Review

ABSTRACT:

Background: Dehydration in the older people is a prevalent problem that is often associated with physiological changes, physical limitations and environmental conditions.

Objectives: The scoping review was carried out to identify risk factors associated with dehydration in older people living in nursing homes.

Design: The revised scoping methodology framework of Arksey and O'Malley, 2005 was applied. Study selection was carried out in accordance with Davis et al., 2009 and focused on the inclusion criteria (people over 65 years old and living in nursing homes). Risk factors were classified using the geriatric assessment.

Data sources: An electronic database search was performed in PubMed, Scopus and CINAHL. The literature search was carried out between October 2016 and January 2017.

Review methods: Thematic reporting was performed and study findings were validated through interdisciplinary meetings of experts. The quality of the papers consulted was also evaluated using the Newcastle-Ottawa Scale adapted for cross-sectional, cohort and case-control studies.

Results: In all, 16 papers were analysed, all of which were observational studies. The risk of bias ranged from very low (n = 1), to medium (n = 13) and high (n = 2). The risk factors were classified in line with the different components of the geriatric assessment. In the socio-demographic characteristics age and gender were identified. In the clinical component, infections, renal and cardiovascular diseases and end-of-life situations were the most common factors highlighted in the papers analysed. With reference to the functional component, its limitation was associated with dehydration, while for factors of mental origin, it was related to dementia and behavioural disorders. Finally, the factors relating to the social component were institutionalisation, requiring a skilled level of care and it being winter.

Conclusions: The most commonly repeated factors highlighted in the review were age, gender, infections, end of life and dementia, with it being important to highlight the large number of factors in the clinical component. Even so, the great majority of the factors were unmodifiable conditions associated typically associated with the physiology of ageing.

KEYWORDS: Dehydration; Nursing Homes; Older People; Risk factors.

WHAT IS ALREADY KNOWN ABOUT THE TOPIC?

- Dehydration is a complex health problem involving a variety of clinical, physical, mental and social factors.
- Dehydration is a subject that has not been very widely researched amongst institutionalised older people.
- There is no gold standard for the correct diagnosis of dehydration in the elderly.

WHAT THIS PAPER ADDS

- It identifies and clarifies the factors associated with dehydration in institutionalised older people living in nursing homes.
- It opens the way to carrying out more far-reaching research into the interaction between the factors considered and their relative importance in the incidence of dehydration.
- It reveals the factors that are associated with dehydration and allows us to recognise the risk at an earlier stage and paves the way for designing screening tools in the future.

1. INTRODUCTION

Water is the largest single component of the human body, making up over 50% of total body mass (Armstrong-Esther et al., 1996). The Dehydration Council (Thomas et al., 2008) defines dehydration as “a complex condition resulting in a reduction in total body water. This could be primarily due to a water deficit (water loss dehydration or

hypernatremia) or to both a salt and water deficit (salt loss dehydration or hyponatremia)". Dehydration is a common condition among older people (Bourdel-Marchasson et al., 2004) and hypernatremia is the most common type (Thomas et al., 2008).

Studies report high levels of dehydration in older people who live in nursing homes. Its prevalence probably ranges from 12% to 50% (An Vandervoort et al., 2013; Ellershaw et al., 1995; Hooper et al., 2016; Léger et al., 2002; Mentes, 2006; Wolff et al., 2015; Wu et al., 2011). To be more specific, in a study by the DRIE, carried out in the UK ('DRIE – Dehydration Recognition in our Elders', n.d.), the prevalence of dehydration was found to be 20%. However, another study carried out by Mentes (Mentes, 2006), in the USA, observed a level of around 30%.

The elderly have a high risk of dehydration for a number of socio-demographic and clinical reasons and also as a result of limitations imposed by their functional and cognitive state (Schols et al., 2009). These factors tend to be further exacerbated by chronic illnesses and the physiological changes caused by the ageing process (Godfrey et al., 2012).

The real incidence of dehydration is unknown and probably underestimated because the lack of standardised methods and the variety of ways for determining whether an individual is dehydrated or not (Vivanti et al., 2008). In nursing homes, many residents may be mildly dehydrated in the absence of acute illness, but this could go unnoticed until this dehydration becomes more severe (Bennett, 2000). Dehydration can be diagnosed by evaluating physical or cellular changes (Vivanti et al., 2010). Although using analytical parameters is optimal, it is invasive, time-consuming and expensive (Mentes and Wang, 2011). For these reasons, some authors consider diagnoses based on physical conditions to be more appropriate for older people (Vivanti et al., 2010).

Due to the high incidence of dehydration in nursing homes, its consequences and the lack of a gold standard for detecting it, it is considered essential for caregivers to know the risk factors associated with dehydration. For this reason, the aim of this scoping

review is to identify and clarify the risk factors associated with dehydration in older people living in nursing homes.

2. MATERIALS AND METHODS

A scoping review is a technique for 'mapping' relevant literature in a field of interest (Arksey and O'Malley, 2005). Scoping involves making a synthesis and analysis of a wide range of research- and non-research-related material in order to provide greater conceptual clarity about a specific topic or field of evidence. Scoping reviews are also considered useful in policy-directed nursing research (Davis et al., 2009).

In the present case, the scoping review framework adopted was based on the methodological model of Arksey and O'Malley (Arksey and O'Malley, 2005) with contributions from Davis et al. (Davis et al., 2009) and was divided into five stages.

2.1. Stage 1: identifying the research question

The research question addressed the way in which the search strategy was to be organised: "What are the risk factors associated with dehydration in older people living in nursing homes?"

2.2. Stage 2: identifying relevant studies

Relevant studies were identified by searching recent literature published between October 2016 and January 2017. The whole research team selected the key words, established the research strategies and defined the inclusion and exclusion criteria for the articles. OM and TB worked together to search in the PubMed, Scopus and CINAHL databases for the following terms: "dehydration" and "hydration", "hypernatremia", "osmolar concentration", "thirst", "drinking*", "fluid intake", "risk factor", "aged", "nursing home" and "long-term care".

No limits were put on either the language or the date of the research because few research projects have been carried out in this area. The criteria followed for the inclusion of papers were mainly observational studies (cross-sectional, cohort and case-control) that evaluated dehydration in institutionalised older people living in nursing homes. On the other hand, studies carried out at other care levels or that only focused on fluid intake (without considering dehydration) were excluded.

2.3. Stage 3: study selection

Focusing on the inclusion criteria, study selection was carried out in accordance with Davis et al. (Davis et al., 2009), who stressed the need to include all relevant documentation relating to any sign, symptom or aspect of the problem being investigated. At the same time, they recommended excluding works that contain commentaries or conclusions that cannot be drawn from the results and/or tables presented as part of the study. In potential cases of controversy as to eligibility for inclusion, any final decision should be left to third party arbitration.

Thus, in step 1, the searches from each database were imported into the Mendeley version 1.17.8 (https://www.mendeley.com) and the full dataset was checked for duplication. The titles and abstracts were then screened for eligibility. Finally, in step 2, potentially relevant papers were screened based on their full text content. OM and TB each selected a number of studies independently. When there was any disconformity, a consensus was reached with the help of three other researchers (JM, CN and AL).

2.4. Stage 4: charting the data

The 16 papers finally included in the scoping were then subjected to data charting. The information was independently reviewed by two researchers (OM and TB). In cases of uncertainty, the final decision was taken in meetings and based on a consensus of three more researchers (JM, CN and AL). The data charting took into consideration information relating to: the author(s); year of publication; study location; study

population(s); methodology; method of diagnosing dehydration; and dehydration risk factors.

Once the final articles had been selected, we proceeded to evaluate their quality using NOS adapted for cross-sectional, cohort and case-control studies (Wells et al., 2007). This evaluation was carried out by the whole evaluation team.

2.5. Stage 5: collating, summarising and reporting the results

The risk factors identified in the papers reviewed were classified in line with the geriatric assessment (Stuck et al., 1993) used to evaluate the different clinical, functional, mental and social components of the health status of geriatric patients.

3. RESULTS

3.1. Identification and selection of relevant papers

The total number of papers obtained from the initial database search was 763. After eliminating duplications (n = 492) and excluding 166 papers by quickly reviewing their titles and abstracts, the number of potentially relevant papers was reduced to 105. In step 1, we analysed the relevance of each of the abstracts, eliminating a further 38 in the process. Then, in step 2, we examined the full text of the 67 remaining papers. Finally, 16 papers were chosen for the review (Fig.1).

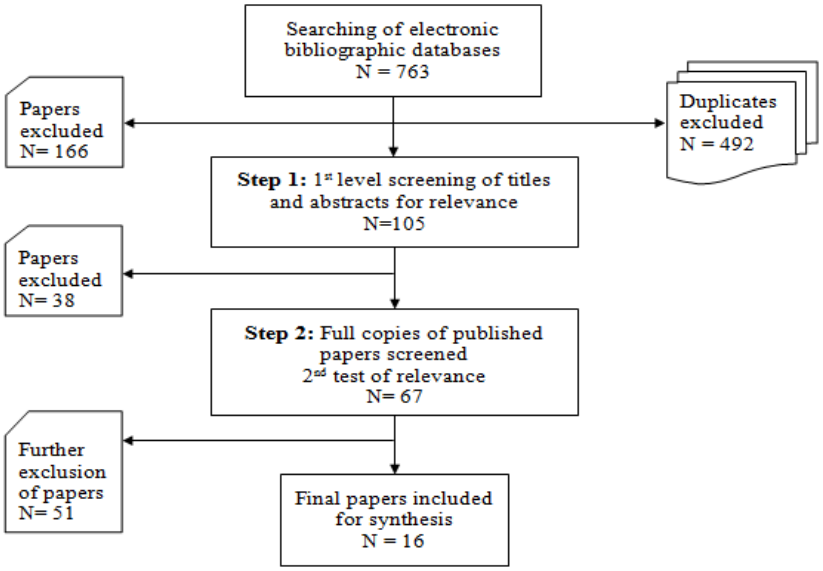

Fig.1. Overall flow of scoping review search and selection adapted from Davis et al. (Davis et al., 2009)

3.2. Characteristics of included studies

The 16 studies selected were based on work carried out in six different countries: nine in the USA, three in the UK, and one each in France, China, Belgium and The Netherlands. Given the lack of reported research in this area, we did not place any limit on the dates when the studies had been carried out. As a result, five of the papers analysed related to studies conducted before 2000, with the majority of these having taken place in the USA (n = 4). All of the papers included in the final review were observational studies. In line with the study design, we considered 11 cross-sectional studies, four cohort studies and one case-control. The other characteristics of the chosen studies are summarised in Table 1.

Table 1. Overview of the 16 selected studies

Author(s), year of publication	Study location	Study populations	Methodology	Method of diagnosing dehydration	Dehydration risk factors
Mentes (2006)	Los Angeles, USA	n = 35 residents 2 nursing homes	Prospective, cross-sectional design	A hospitalisation for dehydration, on-site administration of intravenous fluids or a BUN/Cr ≥ 25:1	- Residents would not drink - Dehydration was not as prevalent in people who could not drink as a result of cognitive or physically impairment
Léger et al. (2002)	France	n = 308 residents 66 nursing homes	Cross-sectional study	Physician diagnosis	Aggressive and/or agitated behaviour
Wolff et al. (2015)	UK	n = 21,610 residents	Retrospective, cross-sectional design	Na+ ≥145 mmol/L	- Age, dementia and institutionalisation - No association with male gender
Culp et al. (2004)	USA	n = 313 residents	Cohort study	BUN/Cr ≥ 21:1	Delirium
Cacchione et al. (2003)	USA	n = 74 residents	Prospective, cross-sectional design	Na+	Acute confusion
Ellershaw et al. (1995)	London, UK	n = 84 residents with advanced cancer	Cohort study	- Serum osmolality >295 mOsmoL/kg - Na+ >148 mmol/L - Creatinine > 130 umol/L - Urea > 12 mmol/L	- Risk factors: None - No association with: thirst or dry mouth
Holben et al. (1999)	Ohio, USA	n = 121 residents	Prospective, cross-sectional design	MDS+	Chronic infections, sunken eyes and insufficient fluid intake
Wu et al. (2011)	Taiwan, China	n = 111 residents	Cross-sectional study	BUN/Cr ≥ 20	Age, female gender and cardiovascular disease
Mentes and Wang (2011)	Iowa and Los Angeles, USA	n = 133 residents	Cross-sectional study	Urine-specific gravity >1.020	- Difficulty swallowing and history of dehydration - No association with: urinary incontinence, diuretics, needing assistance with drinking or ability to drink independently, but forgetful

BUN/Cr: blood urea nitrogen and serum creatinine; Na+: sodium; MDS: Minimum Data Set; N/A: Data not available

Table 1 (Continued)

Author(s), year of publication	Study location	Study populations	Methodology	Method of diagnosing dehydration	Dehydration risk factors
An Vandervoort et al. (2013)	Flanders, Belgium	n = 198 residents	Retrospective cross-sectional study. This was a post-mortem study	N/A	Dementia
Dyck (2007)	USA	n = 363,895 residents 2951 nursing homes	Cross-sectional secondary analysis	MDS	- End-of-life, infection, fever and oral problems - No association with: staffing or facility characteristics
Spector and Fortinsky (1998)	Ohio, USA	n = 15121 residents 843 nursing homes	Cross-sectional study	MDS+	Pressure ulcers
Lavizzo-Mourey et al. (1988)	Philadelphia, USA	n = 264 residents	Case-control study	Na+ > 150 mg/dL or BUN/Cr > 25	Age, female gender, > 4 chronic diseases, > 4 drugs, winter, bedridden, skilled care level and laxative drugs
				Na+ > 150 mg/dL and BUN/Cr > 25	Age, female gender, > 4 chronic diseases, > 4 drugs, winter, requires assistance with feeding and mobility, bedridden, cardiovascular disease, infections, renal disease, laxative drugs and CVA
					No association with: required tube feeding, diuretics, neuroleptics or sedative drugs
Mukamel (1997)	USA	n = 289,101 residents with dehydration	Cross-sectional study	Medical diagnosis	Age, female gender, urinary tract infection, catheter, end of life and self-feeding difficulties
Koopmans et al. (2007)	Nijmegen, The Netherlands	n = 890 residents with dementia	Cohort study	Codification of death according to the ICHPPC	End of life

BUN/Cr: blood urea nitrogen and serum creatinine; Na+: sodium; MDS: Minimum Data Set; N/A: Data not available; CVA: Cardiovascular accident; ICHPPC: The International Classification of Health Problems in Primary Care

Table 1 (Continued)

Author(s), year of publication	Study location	Study populations	Methodology	Method of diagnosing dehydration	Dehydration risk factors
Hooper et al. (2016)	UK	n = 188 residents	Cohort study	Mild dehydration: serum osmolality 295–300 mOsm/kg	Female gender, renal disease and diabetes
				Severe dehydration: serum osmolality >300 mOsm/kg	Renal disease, dementia, use of any diabetic medication and contact with health care in the past 2 months
					No association with thirst

3.3. Risk of Bias, Validity and Methodological Quality

The quality of the papers was measured using the NOS adapted for cross-sectional, cohort and case-control studies (Wells et al., 2007). The total scores on this scale can range from 0 to 10. In this case, the total score for the papers analysed ranged from 3 to 8 (Table 2). There was only one paper that with a total score of 8 (Wolff et al., 2015), with a very low risk of bias, which would supposedly indicate a high level of quality. In contrast, there were thirteen papers of average quality: eight with a score of 6 (An Vandervoort et al., 2013; Cacchione et al., 2003; Hooper et al., 2016; Koopmans et al., 2007; Lavizzo-Mourey et al., 1988; Mentes and Wang, 2011; Spector and Fortinsky, 1998; Wu et al., 2011) and five with scores of 5 (Culp et al., 2004; Ellershaw et al., 1995; Léger et al., 2002; Mentes, 2006; Mukamel, 1997). With respect to low quality papers, only two obtained scores indicating a high-risk of bias (scores of 3 and 4) (Dyck, 2007; Holben et al., 1999).

Table 2. Risk of Bias for observational studies

Study details	Type of study	Sample size[1]	Case definition adequate[3]	Ascertainment of exposure[1,2,3]	Represen-tativeness of cases[1, 3] or exposed cohort[2]	Selection of controls[3] or Non-exposed cohort[2]	Outcome not present at start of study[2] or Definition of controls[3]	Compara-bility[1, 2,3]	Same methods used to ascertain cases and controls[3]	Non response rate[1, 3] or Adequacy of follow-up[2]	Assessment of the outcome[1, 2]	Follow-up long enough for outcomes to occur[2]	Statistical test[1]	Number of points obtained
Mentes (2006)	Cross-sectional	0	n/a	2	0	n/a	n/a	1	n/a	0	2	n/a	0	5
Léger et al. (2002)	Cross-sectional	0	n/a	2	1	n/a	n/a	0	n/a	0	1	n/a	1	5
Wolff et al. (2015)	Cross-sectional	1	n/a	2	1	n/a	n/a	0	n/a	1	2	n/a	1	8
Culp et al. (2004)	Cohort	n/a	n/a	1	1	0	0	1	n/a	1	1	0	n/a	5
Cacchione et al. (2003)	Cross-sectional	1	n/a	1	1	n/a	n/a	0	n/a	0	2	n/a	1	6
Ellershaw et al. (1995)	Cohort	n/a	n/a	1	0	1	0	1	n/a	1	1	0	n/a	5
Holben et al. (1999)	Cross-sectional	0	n/a	1	0	n/a	n/a	0	n/a	0	2	n/a	1	4
Wu et al. (2011)	Cross-sectional	1	n/a	2	0	n/a	n/a	0	n/a	0	2	n/a	1	6
Mentes and Wang (2011)	Cross-sectional	0	n/a	2	1	n/a	n/a	0	n/a	0	2	n/a	1	6
An Vandervoort et al. (2013)	Cross-sectional	0	n/a	0	1	n/a	n/a	1	n/a	1	2	n/a	1	6
Dyck (2007)	Cross-sectional	0	n/a	1	1	n/a	n/a	0	n/a	0	0	n/a	1	3

Table 2 (Continued)

Study details	Type of study	Sample size[1]	Case definition adequate[3]	Ascertainment of exposure[1,2,3]	Represen-tativeness of cases[1, 3] or exposed cohort[2]	Selection of controls[3] or Non-exposed cohort[2]	Outcome not present at start of study[2] or Definition of controls[3]	Compara-bility[1, 2,3]	Same methods used to ascertain cases and controls[3]	Non response rate[1, 3] or Adequacy of follow-up[2]	Assessment of the outcome[1, 2]	Follow-up long enough for outcomes to occur[2]	Statistical test[1]	Number of points obtained
Spector and Fortinsky (1998)	Cross-sectional	0	n/a	1	1	n/a	n/a	1	n/a	0	2	n/a	1	6
Lavizzo-Mourey et al. (1988)	Case-control	n/a	1	1	1	0	0	1	1	1	n/a	n/a	n/a	6
Mukamel, (1997)	Cross-sectional	1	n/a	1	1	n/a	n/a	0	n/a	0	1	n/a	1	5
Koopmans et al., (2007)	Cohort	n/a	n/a	1	0	1	0	1	n/a	1	1	1	n/a	6
Mukamel (1997)	Cohort	n/a	n/a	1	1	1	0	1	n/a	0	1	1	n/a	6

0 indicates high risk of bias, 1 or 2 indicates low risk of bias; n/a indicates that the study is not being judged on this criterion; [1]Applicable to cross-sectional studies only; [2]Applicable to cohort studies only; [3]Applicable to case-control studies only

3.4. Findings: Risk factors of dehydration

Table 3 shows the factors that that were identified as determinants of dehydration and the frequency with which they appeared in the selected papers in association with the components of geriatric assessment (Stuck et al., 1993): socio-demographic characteristics and clinical, functional, mental and social components.

Firstly, with respect to socio-demographic level, the key factors identified were age (≥85 years old) (Lavizzo-Mourey et al., 1988; Mukamel, 1997; Wolff et al., 2015; Wu et al., 2011) and being female (Hooper et al., 2016; Lavizzo-Mourey et al., 1988; Mukamel, 1997; Wu et al., 2011).

Secondly, the factors related to the clinical component were classified according to whether they referred to a clinical pathology, a sign or symptom, a pharmacological treatment or a sub-class denominated "others". The pathologies associated with dehydration were: exhibiting more than four chronic conditions (Lavizzo-Mourey et al., 1988); having suffered a cardiovascular accident (Lavizzo-Mourey et al., 1988), diabetes (Hooper et al., 2016) and having a history of dehydration (Mentes and Wang, 2011). Acute or chronic infections (Dyck, 2007; Holben et al., 1999; Lavizzo-Mourey et al., 1988; Mukamel, 1997), renal (Hooper et al., 2016; Lavizzo-Mourey et al., 1988) and cardiovascular diseases (Lavizzo-Mourey et al., 1988; Wu et al., 2011) were also identified, with these being the pathologies that were most frequently related to dehydration in the papers that were analysed. The clinical signs and symptoms which interacted with dehydration were: fever (Dyck, 2007), having mouth problems (Dyck, 2007), sunken eyes (Holben et al., 1999), pressure ulcers (Spector and Fortinsky, 1998) and having difficulty swallowing (Mentes and Wang, 2011). The type of pharmacological treatment associated with dehydration was: taking more than four different types of medication (Lavizzo-Mourey et al., 1988), taking medication for diabetes (Hooper et al., 2016) and taking laxatives (Lavizzo-Mourey et al., 1988). Finally, we found several other clinical factors, such as being at the end of their life (Dyck, 2007; Koopmans et al., 2007; Mukamel, 1997), having been in contact with a health centre in the previous two months (Hooper et al., 2016), having some form of

catheter or drainage (Mukamel, 1997) and having an insufficient fluid intake (Holben et al., 1999).

Thirdly, with respect to the second component of the geriatric assessment (Stuck et al., 1993), the risk factors related to the residents' functional state were: self-feeding difficulties (Lavizzo-Mourey et al., 1988; Mukamel, 1997), being bedridden (Lavizzo-Mourey et al., 1988) and requiring help with mobility (Lavizzo-Mourey et al., 1988). There were six factors associated with the mental component: dementia (An Vandervoort et al., 2013; Hooper et al., 2016; Wolff et al., 2015), not wanting to drink as a self-imposed restriction (Mentes, 2006), aggressiveness (Léger et al., 2002), agitation (Léger et al., 2002), delirium (Culp et al., 2004) and acute confusion (Cacchione et al., 2003). Finally, it is also necessary to underline the fact that the factors related to the social component were institutionalisation (Wolff et al., 2015), requiring skilled care and it being winter (Lavizzo-Mourey et al., 1988).

Table 3. Risk factors for dehydration

Socio-demographic characteristics		Clinical																			Functional			Mental						Social		
		Pathologies							Signs and symptoms					Treatment			Others																
Age	Female gender	Infections	Renal disease	Cardiovascular disease	> 4 chronic disease	CVA	Diabetes	History of dehydration	Fever	Oral Problems	Sunken eyes	Pressure ulcers	Difficulty swallowing	> 4 drugs	Antidiabetic	Laxatives	End of life	Contact with health care in past 2 months	Catheter	Insufficient fluid intake	Difficulties with self-feeding	Being bedridden	Requiring assistance with mobility	Dementia	Unwillingness to drink	Aggressiveness	Agitation	Delirium	Acute confusion	Institutionalisation	Requiring skilled care	Winter
+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+		+	+	+		+	+		+	+	+	+	+	+	+
+	+	+	+	+													+				+			+								
+	+	+															+							+								
+	+	+																														

CVA: Cardiovascular accident

3.5. Findings: No Risk factors of dehydration

Based on the classification of components in the geriatric assessment (Stuck et al., 1993), Table 4 shows the factors that the papers analysed did not associate with dehydration and the frequency with which they occurred. At the socio-demographic level, it was found that male gender (Wolff et al., 2015) was not associated with dehydration.

On the other hand, within the clinical component, related to pathologies, urinary incontinence was not a factor in dehydration (Mentes and Wang, 2011). Signs and symptoms were not associated with thirst (Ellershaw et al., 1995; Hooper et al., 2016) or having a dry mouth (Ellershaw et al., 1995) either. With reference to pharmacological treatments, no associations were found with diuretics (Lavizzo-Mourey et al., 1988; Mentes and Wang, 2011), neuroleptic treatments or sedatives (Lavizzo-Mourey et al., 1988). Finally, required tube feeding (Lavizzo-Mourey et al., 1988) was not related to dehydration either.

As far as the functional component is concerned, needing help to drink (Mentes and Wang, 2011) and not being able to do so (Mentes, 2006) were not factors in dehydration. With respect to the mental component, forgetting to drink (Mentes and Wang, 2011) was not a factor either. We must finally highlight the fact that the social component was not associated with the working hours of health care workers or the characteristics of the nursing home (Dyck, 2007) either.

Table 4. Not factors of dehydration

Socio-demographic characteristics	Clinical							Functional		Mental	Social	
	Pathologies	Signs and symptoms		Treatment			Others					
Male gender	Urinary incontinence	Thirst	Dry mouth	Diuretics	Neuroleptics	Sedatives	Required tube feeding	Need assistance with drinking	Inability to drink	Forgetting to drink	Staffing	Facility characteristics
+	+	+ +	+	+ +	÷	+	+	+	+	+	+	+

4. DISCUSSION

4.1. Summary of evidence /substantial findings

This scoping review analysed the content of 16 papers that studied the risk factors associated with dehydration in institutionalised older people living in nursing homes. No limitation was placed on the year in which the studies were published on account of the limited amount of research that has been carried out in this area. This explains why the years of the studies range from 1988 to 2016. Given the fact that dehydration is considered one of the great geriatric syndromes, we classified the risk factors based using the geriatric assessment, which made it possible to evaluate the patients from a holistic perspective (Stuck et al., 1993).

4.1.1. Socio-demographic characteristics

The socio-demographic factors that were associated with dehydration were age and being female. In the ageing process, a reduction in muscle mass and increase in fat mass takes place that produces a reduction in total body water content. It is also known that this metabolic process predominantly occurs in women, as they naturally have a smaller proportion of muscle mass than men (Tannen et al., 2011). This explains why Wolf et al. (Wolff et al., 2015) did not identify being a man as a risk factor for suffering dehydration.

4.1.2. Clinical component

The pathologies identified as factors in dehydration were those related to the loss of fluids or restrictions or difficulties relating to their intake. To be more specific, infections cause insensible water loss that could result in hypertonic dehydration (Dyck, 2007; Thomas et al., 2008). As a result, pneumonia and other infectious disorders, such as infections of the urinary tract or sepsis of unknown origin, have been associated with a high risk of dehydration. Loss of liquids can be conditioned by other processes, as well, such as fever and pressure ulcers, which are other factors that were identified in this review. We also identified diabetes as a risk factor because when blood sugar levels are higher than they should be for prolonged periods, the

kidneys will try to eliminate part of the excess glucose, expelling it in the form of urine. Furthermore, the fact that some other medical conditions, such as renal and cardiovascular diseases, have also been associated with dehydration could be the result of water restrictions to which the patients suffering from them have been subjected (Hunt et al., 2009). Finally, and related to difficulties ingesting liquids, we found that residents who had difficulty swallowing were four times more likely to suffer dehydration than those who could swallow normally (Mentes and Wang, 2011). This, in itself, could also have been a side-effect of a stroke, which was another of the pathologies identified by this review as a risk factor. This means that the number of chronic conditions was also a risk factor for dehydration (Johnson et al., 2015), as revealed by the results.

In contrast, urinary incontinence was not a risk factor for dehydration according to the logistic regression made in the study by Mentes and Wang (Mentes and Wang, 2011), although an association was found in their previous bivariate analysis. However, as the authors themselves point out, this result could have been influenced by a confusion variable, because it has been shown that it is possible for a functionally dependent patient who needs help going to the toilet to be deprived of water, and therefore show signs of dehydration, without suffering any type of cognitive alteration (Armstrong-Esther et al., 1996).

With reference to signs and symptoms, the perception of thirst is reduced by the ageing process (Davies et al., 1995) and this can influence the level of hydration. Even so, this did not appear as a risk factor in the current review. This may have been due to the fact that the studies represented here were subject to a series of methodological limitations that could have conditioned the results obtained. For example, in the study by Hooper et al. (Hooper et al., 2016), 74% of the sample presented some degree of cognitive impairment that could have adversely affected their ability to sense thirst. This association was not contemplated in the study that Ellershaw et al. (Ellershaw et al., 1995) carried out with end-of-life stage patients either, which could explain why these patients received continuous artificial hydration. This would also explain why the same study found no association with the presence of dry mouth. In other cases, the

end-of-life stage is one of the conditions that has been most commonly identified, as it is characterised by a low intake of water and nutrients, a general feeling of weakness, and respiratory and/or circulatory problems: conditions that all favour dehydration (Brandt et al., 2005).

Finally, certain pharmaceutical products were associated with dehydration. Laxatives are an example of this; on the one hand they are associated with dehydration because of their relation to constipation (Spangler and Chidester, 1998); on the other, their consumption causes an increase in the elimination of liquids from the body (Hajat et al., 2010).

4.1.3. Functional component

The results of the scoping review showed that residents experiencing difficulty feeding themselves, those that were bedridden and those requiring help with mobility were all associated with dehydration. These could, however, be grouped together and referred to as “functionally limited” because all three items are evaluated by the functional assessment scales of basic activities involved in daily life. Following this logic, and in line with the British Nutrition Foundation, the risk factors found in relation to this component should be regarded as consequences of the progressive physiological ageing of geriatric patients. On the other hand, requiring help with drinking was not classified as a risk factor for dehydration. Although this was not identified as such by the logistic regression carried out in the study, it was by the bivariate analysis (Mentes and Wang, 2011).

4.1.4. Mental component

The needs to eat and drink were compromised by both the clinical and physical evolutions of residents suffering from dementia (Reed et al., 2005). To be more precise, An Vandervoort (An Vandervoort et al., 2013) concluded that there was a correlation between the degree of dementia and dehydration, with those exhibiting more advanced stages of dementia being more dehydrated. It must also be remembered that dementia implies a deterioration of memory, intellect and behaviour. As a result, behaviour-related problems, such as aggressiveness, agitation,

delirium and acute confusion were identified as risk factors for dehydration. In contrast, taking pharmaceutical products to address altered behaviour was not associated with a risk of dehydration. This could have due to the fact that solving such behavioural problems meant patient hydration was not compromised.

4.1.5. Social component

As far as the social component is concerned, the hours of staffing and characteristics of the nursing home failed to show any relationship with dehydration, but there was a link with institutionalisation, requiring a skilled level of care and it being winter. However, it needs to be underlined that these aspects have received only minimal attention in the studies conducted to date, with the majority of papers simply reflecting the fact that being dehydrated did not necessarily mean that the resident had received a poor quality of care (Dyck, 2007; Mukamel, 1997). In contrast, some authors did note that the behavioural patterns of health care professionals, family support and the environmental conditions of the nursing home could have an influence on the risk of dehydration (Lavizzo-Mourey et al., 1988; Murray et al., 2014).

4.2. Limitations of the review

One of the key factors to highlight in the process of paper selection was the concept of fluid intake, given that the terms dehydration and low fluid intake were often used indistinctively (Kayser-Jones et al., 1999). With this in mind, we thought it convenient to carefully monitor all of the papers that spoke of fluid intake and to include the term in the search strategy. Even so, in step 2 we found it advisable to 11 such references when their objective was to identify risk factors for low fluid intake rather than dehydration. However, in the final selection of papers, only that by Holben et al. (Holben et al., 1999) studied the relationship between fluid intake and dehydration and concluded that it was a determining factor.

The other limitation was the variability of the method used to diagnose dehydration (Table 1). This was due to the fact that there is no generally accepted gold standard for assessing the elderly; both analytical and observational methods are used to do this.

Furthermore, in the case of analytical methods, no cut off point has been established to determine dehydration in older people and this promotes variability in the risk factors associated with dehydration.

5. CONCLUSIONS

This scoping review centres on identifying risk factors associated with dehydration in institutionalised older people. In it, we have been able to analyse the different elements that interact with dehydration that are related to socio-demographic, clinical, functional, mental and social factors. The factors that were most frequently identified in this review were: age, gender, infection, end of life and dementia, with the largest number of these factors belonging to the clinical component. Moreover, although few studies explored geriatric residents in all of their components, it is possible to stress the fact that the most prevalent factors could not be modified. For this reason, interventions aimed at improving this situation must focus on the coexistence of these factors. It will therefore be necessary to adapt to the ageing process instead of trying to deal with these factors directly.

CONFLICTS OF INTEREST: None declared.

FUNDING: This work was supported by bridge funding for research projects provided by the University of Lleida.

ETHICAL APPROVAL: Not applicable.

REFERENCES

An Vandervoort, M.A., Van den Block, L., van der Steen, J.T., Volicer, L., Vander Stichele, R., Houttekier, D., Deliens, L., 2013. Nursing home residents dying with dementia in Flanders, Belgium: a nationwide postmortem study on clinical characteristics and quality of dying. J. Am. Med. Dir. Assoc. 14, 485–92. doi:http://dx.doi.org/10.1016/j.jamda.2013.01.016

Arksey, H., O'Malley, L., 2005. Scoping studies: towards a methodological framework. Int. J. Soc. Res. Methodol. 8, 19–32. doi:http://dx.doi.org/10.1080/1364557032000119616

Armstrong-Esther, C.A., Browne, K.D., Armstrong-Esther, D.C., Sander, L., 1996. The institutionalized elderly: dry to the bone! Int. J. Nurs. Stud. 33, 619–28. doi:http://dx.doi.org/10.1016/S0020-7489(96)00023-5

Bennett, J.A., 2000. Dehydration: Hazards and Benefits. Geriatr. Nurs. (Minneap). 21, 84–88. doi:http://dx.doi.org/10.1067/mgn.2000.107135

Bourdel-Marchasson, I., Proux, S., Dehail, P., Muller, F., Richard-Harston, S., Traissac, T., Rainfray, M., 2004. One-year incidence of hyperosmolar states and prognosis in a geriatric acute care unit. Gerontology 50, 171–6. doi:http://dx.doi.org/10.1159/000076775

Brandt, H.E., Deliens, L., Ooms, M.E., van der Steen, J.T., van der Wal, G., Ribbe, M.W., 2005. Symptoms, signs, problems, and diseases of terminally ill nursing home patients: a nationwide observational study in the Netherlands. Arch Intern Med 165, 314–20. doi:http://dx.doi.org/10.1001/archinte.165.3.314

Cacchione, P.Z., Culp, K., Laing, J., Tripp-Reimer, T., 2003. Clinical profile of acute confusion in the long-term care setting. Clin. Nurs. Res. 12, 145–58. doi:http://dx.doi.org/10.1177/1054773803012002003

Culp, K.R., Wakefield, B., Dyck, M.J., Cacchione, P.Z., DeCrane, S., Decker, S., 2004. Bioelectrical impedance analysis and other hydration parameters as risk factors for delirium in rural nursing home residents. J Gerontol A Biol Sci Med Sci. 59, 813–7. doi:http://dx.doi.org/10.1093/gerona/59.8.M813

Davies, I., O'Neill, P.A., McLean, K.A., Catania, J., Bennett, D., 1995. Age-associated alterations in thirst and arginine vasopressin in response to a water or sodium

load. Age Ageing 24, 151–9. doi:http://dx.doi.org/10.1093/ageing/24.2.151

Davis, K., Drey, N., Gould, D., 2009. What are scoping studies? A review of the nursing literature. Int. J. Nurs. Stud. 46, 1386–1400. doi:http://dx.doi.org/10.1016/j.ijnurstu.2009.02.010

DRIE – Dehydration Recognition in our Elders [WWW Document], n.d. URL http://driestudy.appspot.com/cohort.html (accessed 1.24.17).

Dyck, M.J., 2007. Nursing staffing and resident outcomes in nursing homes: weight loss and dehydration. J Nurs Care Qual. 22, 59–65.

Ellershaw, J.E., Sutcliffe, J.M., Saunders, C.M., 1995. Dehydration and the dying patient. J Pain Symptom Manag. 10, 192–7. doi:http://dx.doi.org/10.1016/0885-3924(94)00123-3

Godfrey, H., Cloete, J., Dymond, E., Long, A., 2012. An exploration of the hydration care of older people: A qualitative study. Int. J. Nurs. Stud. 49, 1200–11. doi:http://dx.doi.org/10.1016/j.ijnurstu.2012.04.009

Hajat, S., O'Connor, M., Kosatsky, T., 2010. Health effects of hot weather: from awareness of risk factors to effective health protection. Lancet 375, 856–863. doi:http://dx.doi.org/10.1016/S0140-6736(09)61711-6

Holben, D.H., Hassell, J.T., Williams, J.L., Helle, B., 1999. Fluid intake compared with established standards and symptoms of dehydration among elderly residents of a long-term-care facility. J. Am. Diet. Assoc. 99, 1447–50. doi:http://dx.doi.org/10.1016/S0002-8223(99)00351-X

Hooper, L., Bunn, D.K., Downing, A., Jimoh, F.O., Groves, J., Free, C., Cowap, V., Potter, J.F., Hunter, P.R., Shepstone, L., 2016. Which frail older people are dehydrated? the UK DRIE study. J. Gerontol. A. Biol. Sci. Med. Sci. 71, 1341–7. doi:http://dx.doi.org/10.1093/gerona/glv205

Hunt, S.A., Abraham, W.T., Chin, M.H., Feldman, A.M., Francis, G.S., Ganiats, T.G., Jessup, M., Konstam, M.A., Mancini, D.M., Michl, K., Oates, J.A., Rahko, P.S., Silver, M.A., Stevenson, L.W., Yancy, C.W., 2009. 2009 Focused Update Incorporated Into the ACC/AHA 2005 Guidelines for the Diagnosis and Management of Heart Failure in Adults. J. Am. Coll. Cardiol. 53, e1–e90. doi:http://dx.doi.org/10.1016/j.jacc.2008.11.013.

Johnson, P., Waldreus, N., Hahn, R., Stenström, H., Sjöstrand, F., 2015. Fluid retention

index predicts the 30-day mortality in geriatric care. Scand J Clin Lab Invest 75, 444–51. doi:http://dx.doi.org/10.3109/00365513.2015.1039057

Kayser-Jones, J., Schell, E.S., Porter, C., Barbaccia, J.C., Shaw, H., 1999. Factors contributing to dehydration in nursing homes: Inadequate staffing and lack of professional supervision. J. Am. Geriatr. Soc. 47, 1187–94. doi:http://dx.doi.org/10.1111/j.1532-5415.1999.tb05198.x

Koopmans, R.T., van der Sterren, K.J., van der Steen, J.T., 2007. The 'natural' endpoint of dementia: death from cachexia or dehydration following palliative care? Int J Geriatr Psychiatry. 22, 350–5. doi:http://dx.doi.org/10.1002/gps.1680

Lavizzo-Mourey, R., Johnson, J., Stolley, P., 1988. Risk factors for dehydration among elderly nursing home residents. J. Am. Geriatr. Soc. 36, 213–8. doi:http://dx.doi.org/10.1111/j.1532-5415.1988.tb01803.x

Léger, J.M., Moulias, R., Robert, P., Vellas, B., Chapuy, P.H., Monfort, J.C., Khoshnood, B., Bouee, S., Rebah, N., Gerard, D., 2002. Agitation and aggressiveness among the elderly population living in nursing or retirement homes in France. Int. Psychogeriatrics 14, 405–16. doi:http://dx.doi.org/10.1017/S1041610202008591

Mentes, J.C., 2006. A typology of oral hydration problems exhibited by frail nursing home residents. J. Gerontol. Nurs. 32, 13-9–1. doi:http://dx.doi.org/10.3928/0098-9134-20060101-09

Mentes, J.C., Wang, J., 2011. Measuring risk for dehydration in nursing home residents: evaluation of the dehydration risk appraisal checklist. Res. Gerontol. Nurs. 4, 148–56. doi:http://dx.doi.org/10.3928/19404921-20100504-02

Mukamel, D.B., 1997. Risk-adjusted outcome measures and quality of care in nursing homes. Med. Care 35, 367–85.

Murray, J., Doeltgen, S., Miller, M., Scholten, I., 2014. A survey of thickened fluid prescribing and monitoring practices of Australian health professionals. J. Eval. Clin. Pract. 20, 596–600. doi:http://dx.doi.org/10.1111/jep.12154

Reed, P.S., Zimmerman, S., Sloane, P.D., Williams, C.S., Boustani, M., 2005. Characteristics associated with low food and fluid intake in long-term care residents with dementia. Gerontologist 45, 74–80. doi:https://doi.org/10.1093/geront/45.suppl_1.74

Schols, J.M., De Groot, C.P., van der Cammen, T.J., Olde Rikkert, M.G., 2009. Preventing

and treating dehydration in the elderly during periods of illness and warm weather. J Nutr Health Aging. 13, 150–7. doi:http://dx.doi.org/10.1007/s12603-009-0023-z

Spangler, A.A., Chidester, J.C., 1998. Age, dependency, and other factors influencing fluid intake by long-term care residents. J. Nutr. Elder. 18, 21–35. doi:http://dx.doi.org/10.1300/J052v18n02_02

Spector, W.D., Fortinsky, R.H., 1998. Pressure ulcer prevalence in Ohio nursing homes: Clinical and facility correlates. J. Aging Health 10, 62–80. doi:http://dx.doi.org/10.1177/089826439801000104

Stuck, A.E., Siu, A.L., Wieland, G.D., Adams, J., Rubenstein, L.Z., 1993. Comprehensive geriatric assessment: a meta-analysis of controlled trials. Lancet 342, 1032–6. doi:https://doi.org/10.1016/0140-6736(93)92884-V

Tannen, A., Schü Tz, T., Smoliner, C., Dassen, T., Lahmann, N., 2011. Care problems and nursing interventions related to oral intake in German Nursing homes and hospitals: A descriptive mulitcentre study. Int. J. Nurs. Stud. 49, 378–385. doi:https://doi.org/10.1016/j.ijnurstu.2011.09.018

Thomas, D.R., Cote, T.R., Lawhorne, L., Levenson, S.A., Rubenstein, L.Z., Smith, D.A., Stefanacci, R.G., Tangalos, E.G., Morley, J.E., 2008. Understanding clinical dehydration and its treatment. J. Am. Med. Dir. Assoc. 9, 292–301. doi:https://doi.org/10.1016/j.jamda.2008.03.006

Vivanti, A., Harvey, K., Ash, S., 2010. Developing a quick and practical screen to improve the identification of poor hydration in geriatric and rehabilitative care. Arch. Gerontol. Geriatr. 50, 156–64. doi:https://doi.org/10.1016/j.archger.2009.03.003

Vivanti, A., Harvey, K., Ash, S., Battistutta, D., 2008. Clinical assessment of dehydration in older people admitted to hospital: What are the strongest indicators? Arch Gerontol Geriatr. 47, 340–55. doi:https://doi.org/10.1016/j.archger.2007.08.016

Wells, G.A., Shea, B., O'Connell, D., Peterson, J., Welch, V., Losos, M., Tugwell, P., 2007. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses [WWW Document]. URL http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp (accessed 3.30.17).

Wolff, A., Stuckler, D., McKee, M., 2015. Are patients admitted to hospitals from care homes dehydrated? A retrospective analysis of hypernatraemia and in-hospital mortality. J. R. Soc. Med. 108, 259–65. doi:https://doi.org/10.1177/0141076814566260

Wu, S.J., Wang, H.H., Yeh, S.H., Wang, Y.H., Yang, Y.M., 2011. Hydration status of nursing home residents in Taiwan: A cross-sectional study. J. Adv. Nurs. 67, 583–90. doi:https://doi.org/10.1111/j.1365-2648.2010.05514.x

2. Paper II: La deshidratación y sus factores asociados. Análisis de la realidad en una residencia de Lleida

Status: pending to send

Authors (in signing order): Masot O, Lavedán A*, Nuin C, Escobar-Bravo MA, Miranda J, Botigué T	
Title: La deshidratación y sus factores asociados. Análisis de la realidad en una residencia de Lleida	
Year: 2018	*Key (A: article, R: review)*: A

* Corresponding author

TÍTULO: La deshidratación y sus factores asociados. Análisis de la realidad en una residencia de Lleida

RESUMEN

Objetivo: Estimar la prevalencia de deshidratación e identificar los factores asociados a la misma en las personas mayores de una residencia asistida en la ciudad de Lleida.

Metodología: Estudio descriptivo y transversal. La muestra fue compuesta por el total de residentes, todos ellos mayores de 65 años. Los datos recogidos fueron la deshidratación (BUN/Cr < 21) y variables sociodemográficas, clínicas, funcionales y mentales.

Resultados: La prevalencia de deshidratación fue del 75,5% en el total de la muestra (96 residentes). Tras los análisis multivariados, el ser mujer (OR = 9,37; IC 95% 2,15 – 40,87), tener una ingesta de líquidos inferior a 1.500 ml (OR = 2,16; IC 95% 1,38 – 8,51), el riesgo de aparición de UPP (OR = 1,68; IC 95% 1,35 – 6,93) y presentar disfagia (OR = 4,53; IC 95% 2,31 – 15,56) fueron factores asociados de forma independiente a la deshidratación.

Conclusiones: Tres de cada 4 residentes presentaron deshidratación. Este estudio demuestra que el ser mujer, la ingesta inferior a 1.500 ml, el riesgo de UPP y la disfagia son variables independientes asociadas a la deshidratación. Estos cuatro factores pueden ser posibles objetivos para el abordaje de la deshidratación en personas mayores institucionalizadas.

PALABRAS CLAVE: deshidratación; factores asociados; ancianos; residencia.

TITLE: Dehydration and its associated factors. Analysis of the reality in a nursing home in Lleida

ABSTRACT

Aim: To estimate the prevalence of dehydration and identify the factors associated with this in the older people of an assisted nursing home in the city of Lleida.

Methodology: Cross-sectional study. The sample was composed by the total number of residents, all of whom were over 65 years old. The data collected were dehydration (BUN/Cr < 21) and sociodemographic, clinical, functional and mental variables.

Results: The prevalence of dehydration was 75.5% in the total sample (96 residents). After multivariate analyses, being female (OR = 9.37; 95% CI 2.15 – 40.87), having a fluid intake < 1500 mL (OR = 2.16; 95% CI 1.38 – 8.51), the risk of developing pressure ulcers (OR = 1.68; 95% CI 1.35 - 6.93) and having dysphagia (OR = 4.53; 95% CI 2.31 – 15.56) were factors associated independently to dehydration.

Conclusions: Three out of every four residents presented dehydration. This study shows that being a woman, the fluid intake < 1500 mL, the risk of pressure ulcers and dysphagia are independent variables associated with dehydration. These four factors may be possible targets for the approach to dehydration in institutionalized elderly people.

KEYWORDS: dehydration; associated factors; aged; nursing home.

INTRODUCCIÓN

La deshidratación, un término utilizado para reflejar estados fisiológicos basados en el desequilibrio entre la ingesta y pérdida de líquido y el estado de Na^+ que le acompaña, es muy común en las personas mayores (1). Además, éstas experimentan una serie de cambios fisiológicos propios del proceso de envejecimiento que las hace más vulnerables (2). Concretamente a nivel residencial, investigadores y profesionales han observado que mantener una hidratación adecuada es un desafío constante (3–5).

En este sentido, la prevalencia de deshidratación en personas mayores institucionalizadas puede oscilar entre el 12% y el 50% (6–9). Además, existen diversos factores que pueden asociarse a ella tanto a nivel clínico, funcional, mental como social. Según una revisión reciente de la bibliografía (10), los factores asociados a la deshidratación más frecuentes en las personas mayores institucionalizadas son la edad, el sexo femenino, tener infecciones de repetición, la demencia y estar en situación de final de vida.

Todo ello hace que los residentes sean especialmente vulnerables a la deshidratación, un problema importante y responsable de muchas hospitalizaciones y que está estrechamente relacionado con el aumento de la mortalidad (11,12).

Así pues, la deshidratación en las personas mayores institucionalizadas constituye todo un reto para los profesionales de la salud, para las instituciones y administraciones. Se cree que una comprensión más clara en el contexto español de sus factores asociados sería importante para evaluar las necesidades y llevar a cabo estrategias de intervención. Por este motivo se planteó el siguiente estudio, con el objetivo de estimar la prevalencia de deshidratación e identificar los factores asociados a la misma en las personas mayores de una residencia asistida.

METODOLOGÍA

Diseño del estudio

Se trata de un estudio descriptivo y transversal, realizado en las personas mayores de 65 años institucionalizadas en una residencia asistida.

Sujetos del estudio

El estudio se llevó a cabo en la *Residència i centre de dia Lleida-Balàfia* ubicada en la ciudad de Lleida. La muestra incluía a todos los residentes del centro, el cual consta de 96 camas residenciales. No se establecieron criterios de exclusión. Antes de comenzar a recopilar los datos, los residentes y/o miembros de sus familias fueron informados de la finalidad y objetivos del estudio y, posteriormente, dieron su conformidad a participar mediante la firma del consentimiento informado.

Variables e instrumentos de medida

Se elaboró un cuestionario basado en las diferentes variables de estudio. Éstas se seleccionaron a partir de los resultados de una reciente revisión del tema realizada con anterioridad por nuestro grupo de investigación (10).

La variable dependiente fue la deshidratación, definida con el parámetro analítico BUN/Cr < 21 (8). En relación al resto de las variables, las características sociodemográficas seleccionadas fueron edad y sexo. Por otro lado, las variables clínicas fueron las infecciones urinarias (registradas durante el año anterior y analizadas retrospectivamente); el diagnóstico médico de enfermedad renal, cardiovascular, accidente cardiovascular y diabetes; padecer más de 4 enfermedades crónicas, tener los ojos hundidos y consumir laxantes o más de 4 fármacos al día. Además, se registró la ingesta de todos los líquidos ingeridos diariamente durante una semana, considerándose una baja ingesta hídrica si el promedio por día era inferior a 1.500 ml.

Asimismo, se recogieron los siguientes instrumentos de medida:

- Para evaluar el riesgo de sufrir UPP se utilizó la escala de Braden (13,14) que consta de 6 ítems y determina que se tiene un riesgo alto si se obtiene una puntuación ≤ 12 puntos; un riesgo moderado si el resultado es de 13-14 puntos; un riesgo bajo si se tiene ≤ 15-16 puntos si < 75 años de edad o ≤ 15-18 puntos si ≥ 75 años de edad; el resto de puntaciones se considera sin riesgo.
- Las actividades básicas de la vida diaria (ABVD) se evaluaron mediante el índice de Barthel (15,16) que evalúa 10 actividades y su puntuación oscila entre 0 y 100. Ésta se interpreta de la siguiente forma: < 20 puntos, totalmente dependiente; de 21 a 60 puntos, una dependencia grave; de 61 a 90 puntos una dependencia moderada; de 91 a 99 puntos una dependencia baja y 100 significa independencia.
- Con MMSE (17–19) se evaluó el estado cognitivo con un rango de puntuación de 0 a 30 puntos, identificando el deterioro con puntuaciones ≤ 23.
- Y finalmente, el Método de Exploración Clínica Volumen-Viscosidad (V-VST) (20) que evalúa la disfagia y determina que la prueba es positiva si aparece cualquier signo clínico de alteración de la seguridad o eficacia en la deglución.

Finalmente, otras variables relacionadas con la condición mental fueron:

- Agresividad: se evaluó a través del ítem "G" de la Quality Of Life in Late-Stage Dementia Scale. Este ítem responde a si el residente estuvo irritable o agresivo durante la última semana (se enojó, maldijo, empujó o intentó lastimar a otros) (21,22).
- Agitación: se evaluó a través del ítem 5 "agitación" de la escala de Cornell para la depresión, valorado durante la última semana. De acuerdo con la escala, se consideró agitación si los residentes presentaban inquietud, escurrimiento de manos o tirones de cabello (23,24).
- Delirio: se evaluó a través del ítem 19 "delirio" de la escala de Cornell para la depresión, valorado durante la última semana. Según la escala, se consideró agitación si los residentes presentaban delirios congruentes como delirios de pobreza, enfermedad o de pérdida (23,24).

- Confusión: se evaluó a través del ítem "estado mental" de la Escala de Riesgo de Caídas Downton (25,26).

Recogida de datos

Se elaboró un cuestionario basado en las variables del estudio que fue cumplimentado a partir de la historia clínica informatizada de cada residente. En caso de que alguno de los datos necesitara comprobación o no se hubiera valorado previamente, fue valorado in situ por el personal del centro, previamente entrenado con el fin de garantizar que se siguieran los mismos procedimientos.

Análisis estadístico

Se realizó un análisis descriptivo de la muestra, utilizando medidas de tendencia central y de dispersión o medidas de distribución de frecuencias, en función de la naturaleza de las variables.

Para identificar los factores que se asociaban a la deshidratación, primero, se llevaron a cabo análisis bivariados. Dependiendo de la naturaleza de las variables, se utilizaron el test de chi-cuadrados o la t-student. Posteriormente, aquellos que obtuvieron un nivel de significación estadística < 0,25 se incorporaron en la regresión logística, de acuerdo con las recomendaciones de Hosmer y Lemeshow (27), para saber cuáles de ellos se asociaron independientemente con la deshidratación. En estos modelos, el nivel de significación aceptado fue $p < 0,05$. Todos los análisis estadísticos se realizaron con el software SPSS versión 24.

RESULTADOS

La muestra total estudiada fue de 96 individuos con una media de edad de 86,6 años (±7,1), de los cuales el 80,2% eran mujeres. En referencia al problema principal, la prevalencia de deshidratación fue del 75,5% (IC 95% 65,5 – 85,5), siendo en hombres

del 47,1% (IC 95% 12,5 – 81,7) y en mujeres del 81,1% (IC 95% 72,3 – 91,3). El resto de características de la muestra se describen en la tabla 1.

Tabla 1. Características de la muestra

Variables sociodemográficas		n %			n %
Edad[1]		86,6(7,1)	Sexo	Hombre	19(19,8)
				Mujer	77(80,2)
Variables estado de salud (clínicas)		n %			n %
Ingesta hídrica	≥ 1.500 ml/día	62 (64,6)	Ojos hundidos	No	82 (85,4)
	< 1.500 ml/día	34 (35,4)		Sí	14 (14,6)
Infección urinaria	No	49 (51,0)	Riesgo de UPP	Sin riesgo	8 (8,3)
	Sí	47 (49,0)		Riesgo bajo	11 (11,5)
Enfermedad renal	No	56 (58,3)		Riesgo moderado	28 (29,2)
	Sí	40 (41,7)		Alto riesgo	49 (51,0)
Variables estado de salud (clínicas)		n %			n %
Insuficiencia cardiaca congestiva	No	79 (82,3)	Disfagia	No	50 (52,1)
	Sí	17 (17,7)		Sí	46 (47,9)
Accidente cerebrovascular	No	75 (78,1)	Laxantes	No	33 (34,4)
	Sí	21 (21,9)		Sí	63 (65,6)
Diabetes	No	68 (70,8)	> 4 fármacos	No	21 (21,9)
	Sí	28 (29,2)		Sí	75 (78,1)
> 4 enfermedades crónicas	No	29 (30,2)			
	Sí	67 (69,8)			
Variables estado de salud (funcionalidad)		n %			n %
Discapacidad funcional básica	Independencia	3 (3,1)			
	Dependencia escasa	3 (3,1)		Dependencia severa	27 (28,1)
	Dependencia moderada	21 (21,9)		Dependencia total	42 (43,8)
Variables estado de salud (mental)		n %			n %
Deterioro cognitivo	No	26 (27,1)	Delirios	No	92 (95,8)
	Sí	70 (72,9)		Sí	4 (4,2)
Agresividad	No	50 (52,1)	Confusión	No	44 (45,8)
	Sí	46 (47,9)		Sí	52 (54,2)
Agitación	No	74 (77,1)			
	Sí	22 (22,9)			

[1]Mediana y desviación estándar (DE); n: número de residentes; %: porcentaje de residentes; UPP: úlceras por presión

Destacar que en relación al estado de salud y, concretamente, a las variables clínicas, la media de la ingesta hídrica diaria fue de 1.717,3 ml (± 565,2 ml/día), siendo el 35,4% de los residentes los que bebían < 1.500 ml/día. A nivel patológico, casi la mitad de los residentes presentaban disfagia y el 69,8% de los residentes padecían más de 4 enfermedades crónicas. Referente al riesgo de aparición de UPP, el 51,0% tenía un riesgo alto de aparición; el 29,2%, un riesgo moderado; el 11,5%, un riesgo bajo y solo el 8,3% no presentaba ningún riesgo de padecer UPP. Por lo que se refiere al consumo de fármacos, el 78,1% ingería más de 4 fármacos diferentes al día.

A nivel funcional, casi todos los residentes presentaban algún tipo de dependencia para las ABVD: el 21,9% presentaba una dependencia moderada; el 28,1%, severa; y el 43,8%, una dependencia total. Por último, a nivel mental, el 72,9% de los residentes padecía deterioro cognitivo y el 47,9% y el 54,2 había presentado algún episodio de agresividad y confusión en la última semana, respectivamente.

Por otro lado, en la tabla 2 se muestran los factores que se asociaron significativamente a la deshidratación en el análisis bivariado. En primer lugar, a nivel sociodemográfico, se asoció ser mujer (p = 0,003). En referencia al estado clínico, se asociaron tres variables, la ingesta hídrica < 1.500ml/día (p = 0,028), tener riesgo de aparición de UPP (p = 0,029) y la disfagia (p = 0,018). Asimismo, a nivel funcional se asoció tener dependencia funcional para las ABVD (p = 0,033). Finalmente, a nivel mental solo se asociaron los episodios de agresividad (p = 0,017) y delirios (según recomendaciones de Hosmer y Lemeshow (27)) registrados en la última semana.

Tabla 2. Factores sociodemográficos y de estado de salud asociados a la deshidratación

		Deshidratación				p
		No		Sí		
Factores sociodemográficos		n	%	n	%	
Edad[1]		85,7	(8,1)	86,9	(6,8)	0,469
Sexo	Hombre	9	(39,1)	8	(11,3)	0,003**
	Mujer	14	(60,9)	63	(88,7)	

[1]Mediana y desviación estándar (DE); n: número de residentes; %: porcentaje de residentes; **La correlación es significativa al nivel 0,05

Tabla 2 (continuación)

		Deshidratación				p
		No		Sí		
Factores estado de salud (clínico)		n	%	n	%	
Ingesta hídrica	≥ 1.500 ml/día	35	(79,5)	26	(51,9)	0,028**
	< 1.500 ml/día	9	(20,5)	24	(48,1)	
Infección urinaria	No	12	(52,2)	36	(50,7)	0,902
	Sí	11	(47,8)	35	(49,3)	
Enfermedad renal	No	13	(56,5)	41	(57,7)	0,918
	Sí	10	(43,5)	30	(42,3)	
Insuficiencia cardiaca congestiva	No	20	(87,0)	57	(80,3)	0,470
	Sí	3	(13,0)	14	(19,7)	
Accidente cerebrovascular	No	19	(82,6)	54	(76,1)	0,512
	Sí	4	(17,4)	17	(23,9)	
Diabetes	No	17	(73,9)	49	(69,0)	0,655
	Sí	6	(26,1)	22	(31,0)	
> 4 enfermedades crónicas	No	8	(34,8)	20	(28,2)	0,547
	Sí	15	(65,2)	51	(71,8)	
Ojos hundidos	No	21	(91,3)	59	(83,1)	0,337
	Sí	2	(8,7)	12	(16,9)	
Riesgo de UPP	No	12	(34,3)	6	(10,2)	0,029**
	Sí	23	(65,7)	53	(89,8)	
Disfagia	No	33	(76,7)	16	(30,8)	0,018**
	Sí	9	(23,3)	36	(69,2)	
Laxantes	No	10	(43,5)	23	(32,4)	0,333
	Sí	13	(56,5)	48	(67,6)	
> 4 fármacos	No	5	(21,7)	15	(21,1)	0,950
	Sí	18	(78,3)	56	(78,9)	
Factores estado de salud (funcional)						
Discapacidad funcional básica	No	4	(17,4)	2	(2,8)	0,033**
	Sí	19	(82,6)	69	(97,2)	
Factores estado de salud (mental)						
Deterioro cognitivo	No	5	(21,7)	21	(29,6)	0,465
	Sí	18	(78,3)	50	(70,4)	
Agresividad	No	42	(72,4)	7	(19,4)	0,017**
	Sí	16	(27,6)	29	(80,6)	
Agitación	No	18	(78,3)	55	(77,5)	0,937
	Sí	5	(21,7)	16	(22,5)	

n: número de residentes; %: porcentaje de residentes; *La correlación es significativa al nivel 0,25; **La correlación es significativa al nivel 0,05

Tabla 2 (continuación)

Factores estado de salud (mental)		Deshidratación No n	%	Deshidratación Sí n	%	p
Delirios	No	69	(97,2)	21	(91,3)	0,225*
	Sí	2	(2,8)	2	(8,7)	
Confusión	No	13	(56,5)	31	(43,7)	0,283
	Sí	10	(43,5)	40	(56,3)	

n: número de residentes; %: porcentaje de residentes; *La correlación es significativa al nivel 0,25

Después de identificar las variables significativas en los análisis bivariados anteriores e introducirlos en la regresión logística, los factores que se asociaron de forma independiente a la deshidratación fueron ser mujer, la ingesta < 1.500 ml/día, el riesgo de aparición de UPP y la disfagia (tabla 3).

Tabla 3. Regresión logística de los factores asociados a la deshidratación

Factores	Deshidratación OR	IC 95%	p
Sexo (mujer)	9,37	2,15 – 40,87	0,003**
Ingesta hídrica (< 1.500 ml/día)	2,16	1,38 – 8,51	0,036*
Riesgo UPP	1,68	1,35 – 6,93	0,047*
Disfagia	4,53	2,31 – 15,56	0,025*
Discapacidad funcional	1,04	0,99 – 1,08	0,088
Agresividad	1,95	0,60 – 6,31	0,264
Delirios	5,64	0,65 – 49,04	0,117

OR: odds ratio; IC: intervalo de confianza; *La correlación es significativa al nivel 0,05; **La correlación es significativa al nivel 0,01

DISCUSIÓN

El presente estudio analizó la prevalencia y los factores asociados a la deshidratación en las personas mayores que vivían en una residencia asistida. La prevalencia de deshidratación, según el parámetro sanguíneo BUN/Cr < 21, fue del 75,5%. Este dato fue claramente superior al reportado por otros autores. En este sentido, Culp y cols. (8) estudiaron la deshidratación con el mismo parámetro y punto de corte obteniendo una prevalencia de 30,3% en los residentes sin delirio y del 43,5% en los que presentaban esta condición mental. Las grandes diferencias entre los estudios pueden deberse a

que el sistema residencial español, a diferencia de otros países, se caracteriza por tener un perfil de residentes con un peor estado de salud, lo que puede conllevar a un mayor riesgo de deshidratación.

Asimismo, los factores de deshidratación identificados en este estudio fueron cuatro. A nivel sociodemográfico, ser mujer resultó ser un condicionante de la deshidratación, teniendo nueve veces más de posibilidades de estar deshidratadas que los hombres. En este sentido, otros autores también han relacionado este factor con un peor estado hídrico (3,6,28,29). Esto es debido a que durante el proceso de envejecimiento se producen una serie de cambios metabólicos que son más prominentes en el sexo femenino, provocando una reducción de la masa muscular y un aumento de la masa magra, lo que desencadena un descenso del agua corporal total (30).

Por otra parte, los demás factores asociados a la deshidratación estuvieron relacionados con el estado clínico. En primer lugar, tener una baja ingesta hídrica supuso incrementar por dos el riesgo de estar deshidratado. De acuerdo con Hooper y cols. (6), la deshidratación por pérdida de agua puede ser el resultado de la ingesta insuficiente de líquidos, dado que si las personas mayores no repone adecuadamente los líquidos puede aparecer una alteración del equilibrio electrolítico (31,32). En este sentido, el estudio de Holben y cols. (33) es uno de los pocos que evalúa la relación entre la deshidratación y la baja ingesta hídrica, manifestando que esta asociación no solo se produce con el diagnóstico de deshidratación sino también con la sintomatología asociada a la misma, como son los ojos hundidos.

Otro factor que en el presente estudio se asoció a la deshidratación fue el riesgo de aparición de UPP. Con la deshidratación la piel se vuelve más frágil y, por consiguiente, más susceptible de sufrir heridas (34). Por lo tanto, aunque la metodología del presente estudio no permita examinar la direccionalidad de los factores, es cierto que basándonos en la literatura existente se puede deducir que este riesgo puede llegar a ser una consecuencia de la deshidratación y no al revés (35). Es decir, que la deshidratación puede provocar un mayor riesgo de aparición de UPP por la repercusión en el estado de la piel. No obstante, el hecho de padecer una UPP, variable no analizada en este estudio, sí puede ser un factor de riesgo de la deshidratación, por la pérdida insensible de líquido que producen este tipo de heridas, tal y como exponen los autores Spector y Fortinsky (36).

Por último, la disfagia también resultó ser un factor asociado independientemente a la deshidratación. En este sentido, otros estudios también han demostrado que tener dificultad para deglutir (1,4,37) está estrechamente relacionado con estar deshidratado (38–40), debido a la inseguridad y la ineficacia de su deglución.

Limitaciones del estudio

La primera limitación del estudio es su propio diseño. Al ser transversal no permite clarificar la direccionalidad entre la deshidratación y los factores que se asociaron. No obstante, dada la evidencia y la explicación teórica de los factores, se ha podido interpretar la relación causal entre ellos.
Por otra parte, no existe un estándar de oro para el diagnóstico de la deshidratación lo que dificulta la comparación de los resultados con otros estudios de diseño parecido. Además, añadido a esto, tampoco hay un consenso en el punto de corte de los parámetros analíticos utilizados como indicadores de deshidratación. Para combatirlo, se seleccionó uno de los parámetros analíticos más usados para detectar la deshidratación en las personas mayores, el BUN/Cr.

Y, por último, al ser un estudio realizado en una única residencia y con una muestra reducida de individuos limita la extrapolación de los resultados al resto del sistema residencial español. No obstante, al no encontrarse evidencia en este país sobre el problema de la deshidratación en personas mayores institucionalizadas, se considera que los resultados aportados pueden ser la base para futuras investigaciones. Por ejemplo, estudios que permitan abordar estos factores y mejorar, así, la hidratación de los residentes.

CONCLUSIONES

Este trabajo ofrece un reflejo del que es el primer estudio realizado de estas características en España. En él se demuestra que la prevalencia de deshidratación en las personas mayores que viven en residencias puede llegar a ser muy elevada, en este caso del 75,5%. Además, constata que los factores que se asocian a la deshidratación son ser mujer, tener una ingesta hídrica insuficiente, riesgo de aparición de UPP y la disfagia. Así pues, el presente estudio puede ser la base de futuras investigaciones en el estado español que ayuden a clarificar la direccionalidad de los factores y cuáles

pueden ser las estrategias más eficaces para mejorar el estado de hidratación de las personas mayores institucionalizadas en residencias geriátricas.

FINANCIACIÓN: el presente trabajo ha sido financiado mediante las "Ayudas puente para proyectos de investigación. Año 2017" de la Universidad de Lleida.

CONFLICTOS DE INTERESES: ninguno

REFERENCIAS

1. Leibovitz A, Baumoehl Y, Lubart E, Yaina A, Platinovitz N, Segal R. Dehydration among long-term care elderly patients with oropharyngeal dysphagia. Gerontology. 2007;53(4):179–83.
2. Schols JM, De Groot CP, van der Cammen TJ, Olde Rikkert MG. Preventing and treating dehydration in the elderly during periods of illness and warm weather. J Nutr Health Aging. 2009;13(2):150–7.
3. Lavizzo-Mourey R, Johnson J, Stolley P. Risk factors for dehydration among elderly nursing home residents. J Am Geriatr Soc. 1988;36(3):213–8.
4. Kayser-Jones J, Schell ES, Porter C, Barbaccia JC, Shaw H. Factors contributing to dehydration in nursing homes: inadequate staffing and lack of professional supervision. J Am Geriatr Soc. 1999;47(10):1187–94.
5. Mentes J, Culp K, Maas M, Rantz M. Acute confusion indicators: risk factors and prevalence using MDS data. Res Nurs Health. 1999;22(2):95–105.
6. Hooper L, Bunn DK, Downing A, Jimoh FO, Groves J, Free C, et al. Which Frail Older People Are Dehydrated? The UK DRIE Study. J Gerontol A Biol Sci Med Sci. 2016;71(10):1341–7.
7. Wolff A, Stuckler D, McKee M. Are patients admitted to hospitals from care homes dehydrated? A retrospective analysis of hypernatraemia and in-hospital mortality. J R Soc Med. 2015;108(7):259–65.
8. Culp KR, Wakefield B, Dyck MJ, Cacchione PZ, DeCrane S, Decker S. Bioelectrical impedance analysis and other hydration parameters as risk factors for delirium in rural nursing home residents. J Gerontol A Biol Sci Med Sci. 2004;59(8):813–7.
9. Ellershaw JE, Sutcliffe JM, Saunders CM. Dehydration and the dying patient. J

Pain Symptom Manage. 1995;10(3):192–7.

10. Masot O, Lavedán A, Nuin C, Escobar-Bravo MA, Miranda J, Botigué T. Risk factors associated with dehydration in older people living in nursing homes: Scoping review. Int J Nurs Stud. 2018;82:90–8.
11. Ramos Cordero P, Nieto López-Guerrero J, Serrano Garijo P. Requerimientos hídricos en diferentes edades y en situaciones especiales: Requerimientos hídricos de los ancianos. In: Martínez Álvarez JR, Iglesias Rosado C, editors. El Libro Blanco de la Hidratación. Madrid: Ediciones CINCA; 2006. p. 92–102.
12. Sheehy CM, Perry PA, Cromwell SL. Dehydration: biological considerations, age-related changes, and risk factors in older adults. Biol Res Nurs. 1999;1(1):30–7.
13. Bergstrom N, Braden BJ, Laguzza A, Holman V. The Braden Scale for predicting pressure sore risk. Nurs Res. 1987;36(4):205–10.
14. Bernal MC, Curcio CL, Chacón AJ, Gómez JF, Botero AM. Validez y fiabilidad de la escala de Braden para predecir riesgo de úlceras por presión en ancianos. Rev Esp Geriatr Gerontol. 2001;36(5):281–6.
15. Mahoney F l, Barthel DW. Functional evaluation: the Barthel Index. Md State Med J. 1965;14:61–5.
16. Shah S, Vanclay F, Cooper B. Improving the sensitivity of the Barthel Index for stroke rehabilitation. J Clin Epidemiol. 1989;42(8):703–9.
17. Folstein MF, Folstein SE, McHugh PR. Mini-Mental state: a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12(3):189–98.
18. Lobo A, Esquerra J, Gomez Burgada F, Sala JM, Seva A. El Mini-Exámen Cognoscitivo: un test sencillo y práctico para detectar alteraciones intelectuales en pacientes médicos. Actas Luso Esp Neurol Psiquiatr. 1979;7(3):189–202.
19. Escribano-Aparicio M V, Pérez-Dively M, García-García FJ, Pérez-Martín A, Romero L, Ferrer G, et al. Validación del MMSE de Folstein en una población española de bajo nivel educativo. Rev Esp Geriatr Gerontol. 1999;34(6):319–26.
20. Clavé P, Arreola V, Romea M, Medina L, Palomera E, Serra-Prat M. Accuracy of the volume–viscosity swallow test for clinical screening of oropharyngeal dysphagia and aspiration. Clin Nutr. 2008;27(6):806–15.
21. Weiner MF, Martin-Cook K, Svetlik DA, Saine K, Foster B, Fontaine CS. The

quality of life in late-stage dementia (QUALID) scale. J Am Med Dir Assoc. 2000;1(3):114–6.

22. Lucas-Carrasco R, Gómez-Benito J, Rejas J, Brod M. The Spanish version of the dementia quality of life questionnaire: A validation study. Aging Ment Health. 2011;15(4):482–9.
23. Alexopoulos GS, Abrams RC, Young RC, Shamoian CA, Alexopoulus GS, Abrams RC, et al. Cornell Scale for Depression in Dementia. Biol Psychiatry. 1988;23(3):271–84.
24. Pujol J, Azpiazu P, Salamero M, Cuevas R. Sintomatología depresiva en la demencia. Escala de Cornell: validación de la versión en castellano. Rev Neurol. 2001;33(4):397–8.
25. Downton JH. Falls in the elderly. In: Brockklehurst's Textbook of Geriatric Medicine and Gerontology. 4 ed. Churchill Livinsgstone; 1992. p. 318–23.
26. Aranda-Gallardo M, Enriquez de Luna-Rodriguez M, Vazquez-Blanco MJ, Canca-Sanchez JC, Moya-Suarez AB, Morales-Asencio JM. Diagnostic validity of the STRATIFY and Downton instruments for evaluating the risk of falls by hospitalised acute-care patients: a multicentre longitudinal study. BMC Health Serv Res. 2017;17(1):277.
27. Hosmer DW, Lemeshow S. Applied logistic regression. 2n ed. New York: John Wiley & Sons; 2000.
28. Wu SJ, Wang HH, Yeh SH, Wang YH, Yang YM. Hydration status of nursing home residents in Taiwan: a cross-sectional study. J Adv Nurs. 2011;67(3):583–90.
29. Mukamel DB. Risk-adjusted outcome measures and quality of care in nursing homes. Med Care. 1997;35(4):367–85.
30. Tannen A, Schütz T, Smoliner C, Dassen T, Lahmann N. Care problems and nursing interventions related to oral intake in German Nursing homes and hospitals: A descriptive mulitcentre study. Int J Nurs Stud. 2011;49(4):378–85.
31. Bennett JA, Thomas V, Riegel B. Unrecognized chronic dehydration in older adults: examining prevalence rate and risk factors. J Gerontol Nurs. 2004;30(11):22–8.
32. Colling JC, Owen TR, McCreedy MR. Urine volumes and voiding patterns among incontinent nursing home residents. Residents at highest risk for dehydration

are often the most difficult to track. Geriatr Nurs (Minneap). 1994;15(4):188–92.

33. Holben DH, Hassell JT, Williams JL, Helle B. Fluid intake compared with established standards and symptoms of dehydration among elderly residents of a long-term-care facility. J Am Diet Assoc. 1999;99(11):1447–50.
34. Pressure ulcers. Two major concerns: involuntary weight loss and dehydration. Heal Care Food Nutr Focus [Internet]. 2002 Sep [cited 2017 Jan 10];19(1):11–2. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12233228
35. Rolland Y, Kim MJ, Gammack JK, Wilson MM, Thomas DR, Morley JE. Office management of weight loss in older persons. Am J Med. 2006;119(2):1019–26.
36. Spector WD, Fortinsky RH. Pressure ulcer prevalence in Ohio nursing homes: Clinical and facility correlates. J Aging Health. 1998;10(1):62–80.
37. Mentes JC, Wang J. Measuring risk for dehydration in nursing home residents: evaluation of the dehydration risk appraisal checklist. Res Gerontol Nurs. 2011;4(2):148–56.
38. Satyanarayana DA, Kulkarni PK, Shivakumar HG. Gels and jellies as a dosage form for dysphagia patients: a review. Curr Drug ther. 2011;6(2):79–86.
39. Cichero J, Clavé P. Stepping stones to living well with dysphagia. Nestle Nutr Work Ser. 2012;72:1664–2147.
40. Bratlund C V, O'Donoghue CR, Rocchiccioli JT. Dehydration and dysphagia: Challenges in the older adult. J Med Speech Lang Pathol. 2010;18(3):1–10.

3. Paper III: Prevalence and risk factors associated with low fluid intake in institutionalized elderly residents: a pilot study

Status: accepted, pending to publish

Authors (in signing order): Botigué T, Masot O*, Miranda J, Nuin C, Viladrosa M and Lavedán A, Zwakhalen S.	
Title: Prevalence and risk factors associated with low fluid intake in institutionalized elderly residents	
Journal (title, volume, start and end page): Journal of the American Medical Directors Association	
Year: 2018	*Key (A: article, R: review)*: A
Impact factor: 5.775	*Quartile and area:* 1Q (4/44), Geriatrics and Gerontology

* Corresponding author

TITLE: Prevalence and risk factors associated with low fluid intake in institutionalized elderly residents

ABSTRACT:

Objective: The aim of this study was to determine the prevalence of low fluid intake in institutionalized elderly residents and the associated factors.

Design: This was a cross-sectional study.

Setting and Participants: The study was carried out at a nursing home with a capacity for 156 residents, aged over 65 years old.

Measures: Data were collected on the fluids consumed by each resident over a period of one week. Information relating to sociodemographic variables and to residents' health, nutrition and hydration status was also collected.

Results: Of 53 residents, 34% ingested less than 1500 mL/day. The main factors with a bigger correlation associated with low fluid intake were cognitive and functional impairment, the risk of suffering pressure ulcers, being undernourished, a texture-modified diet, dysphagia, impaired swallowing safety, and BUN:creatinine ratio.

Conclusions: The results obtained highlight the scale of low fluid intake in nursing homes and also aid to identify and understand the factors associated with this problem. The findings could help us to develop specific strategies to promote the intake of liquids and thereby reduce the incidence of dehydration in nursing homes.

KEYWORDS: fluid intake; risk factors; elderly; nursing home; long-term care.

1. INTRODUCTION

Low fluid intake may alter the hydration status and electrolyte balance with adverse effects on health.[1] As a result, appropriate oral hydration in nursing homes should be considered an essential part of the care provided to residents, who are often fragile and have complex medical conditions, with quality attention.[2] Providing older adults who live in nursing homes with a correct level of oral hydration is a constant challenge.[3] Gaspar[4] explored the differences in the recommended intake using four different standards. He recommended individualizing how much the resident should drink based on height and weight. In this way, and considering the health condition of the resident,[5] the recommended daily fluid intake may range from 1,500 to 2,500 mL.[4] Skipper's formula[6] is considered the most effective to individualize fluid intake, since it guarantees the consumption of at least 1,500 mL, whether at a low or high weight.[7] The calculation of this standard consists of adding 100 mL/Kg for the first 10 Kg of weight, 50 mL/Kg for the next 10 Kg and 15 mL/Kg for the remaining Kg. Even so, numerous studies have shown that fluid intake tends to fall far short of recommended daily requirements[8,9] and that between 50% and 92% of residents register insufficient levels of fluid intake.[2]

This problem is largely attributable to physiological changes associated with age and the physical and cognitive conditions presented by older adults,[10,11] who often have difficulty hydrating themselves. As a result, it is common to find older adults with electrolyte imbalances which make them increasingly susceptible to minor environmental and physiological stresses that could result in dehydration and related acute health problems.[2] Moreover, in the study by Mahowald et al.,[12] the overall mortality of 52% was related to hypernatremia. In another study,[13] subjects suffering from plasma hypertonicity had a greater likelihood (47.8%) to die than normotonic subjects (35.1%). Although this difference was no significant within the following four years, by year six, a twofold difference in mortality was observed, being 2.6 times more likely to die than normotonic subjects. All of these consequences imply a greater risk of hospitalization and increased costs for the health care system.[14,15]

By improving strategies related to fluid intake, it should be possible to reduce the incidence of health problems that derive from dehydration.[16] This explains our decision to undertake the present study on the prevalence of problems associated with fluid intake in institutionalized elderly residents and to try to identify the factors associated with this problem and the individuals most at risk.

2. METHODS

This cross-sectional study involved institutionalized older adults at a nursing home, which has capacity for 156 residents. The project was approved by an ethics committee.

2.1. Measurement instruments

Data relating to the dependent variable "fluid intake", were collected for 24 hours per day, over a period of one week, and the daily average fluid intake was recorded. Moreover, the fluid intake was compared with Skipper's formula recommendations.[6] Fluid intake referred to all the liquids ingested, such as water, juice, milk, coffee latte and gelatin. The glasses used to drink were measuring cups. In the participating nursing home, a caregiver is always responsible for the same residents during his/her workday. Residents with mild functional dependence always carry a 1L bottle of water, which is refilled by the staff. At mealtimes, the caregiver always supervises what the resident eats and drinks, and he/she records the total intake in a file. In case of high functional dependence, caregivers are in charge of providing drinks and recording the full intake in a file.

The other variables monitored were sociodemographic indicators: age (recoded from the date of birth) and gender. Urinary infections registered over the previous year were recorded in electronic patient files and retrospectively analyzed. According to McGeer 1991's criteria,[17] urinary tract infections were diagnosed in the following way: if there were symptomatology of acute change in the residents' urine character, in their mental status or acute functional decline in the activities of daily living, a urine

test strip was analyzed. With a positive result, in terms of leukocytosis, the physician prescribed antibiotic and re-evaluated the resident after 8-10 days. After the re-evaluation, if the test strip was again positive and the urine aspect remained doubtful, a urine sample was cultured to assess whether antibiotic was resistant. On the other hand, if a negative test strip came out and the physician doubted that symptomatology exposed something else, the urine sample was cultured and the physician expected the results before prescribing antibiotic. Regarding the health condition, the cognitive state of the nursing home residents was evaluated using the Mini-Mental State Examination (MMSE)[18] (MMSE ≤ 23: signs of cognitive impairment), their functional state was recorded using the Barthel Index[19,20] (0-20: total dependence; 21-60: severe dependence; 61-90: moderate dependence; 91-99: low dependence and 100: independence), and the risk of them suffering pressure ulcers was evaluated with the Braden Scale[21] (≤ 12: high risk; 13-14: moderate risk; ≤ 15-16 if < 75 years old or ≤ 15-18 if > 75 years old: low risk; and the rest of the points are at without risk). The residents' nutritional status was measured using the Mini Nutritional Assessment (MNA)[22] (24-30: normal nutritional status; 17-23.5: at risk of malnutrition; < 17: malnourished), while diet texture, dysphagia to liquid viscosity and clinical signs of impaired safety and efficacy of swallow were assessed using the Volume-Viscosity Swallow Test (V-VST).[23] This test was assessed by expert health professionals when the residents were at rest. Dehydration was evaluated using the plasma blood urea nitrogen:creatinine ratio (BUN:Cr > 21)[24], serum sodium (Na+> 150 mmol/L) and serum osmolarity (> 300 mmol/L).[25]

2.2. Procedure

To obtain the relevant data, a questionnaire was drawn up based on the different study variables explained before, which were selected from the literature. This was then completed by personal health professionals, based on the computerized clinical history. Residents were selected randomly. No specific exclusion criteria existed. Before collecting the data, the residents and/or members of their family, were informed of the objectives of the study and subsequently gave their approval by signing an informed consent form.

2.3. Statistical analyses

A descriptive analysis of the variables was carried out in order to study and evaluate the association between fluid intake and the different factors. This was done using the Pearson's rank-order correlation for the quantitative variables and the t-test for the different categories. In the correlations, we used the mean of daily fluid intake. The data were analyzed using IBM SPSS Statistics 24, and the level of significance applied for all analyses was $p < 0.05$.

3. RESULTS

A total of 53 residents were examined; the majority (79.2%) were women and the average age was 86.5 years (*SD* 8.1). The average daily fluid intake ranged from 737 to 3,440 mL/day with a mean intake of 1,768.5 mL/day (*SD* 542.2), although 34.0% of the residents ingested less than 1,500 mL/day (Figure 1). In the case of infections, 52.8% of the residents had suffered a urinary infection in the previous year. The residents' average fluid intake was compared with the recommended intake as defined by Skipper's formula. Using this, the differences between daily fluid intake and the standard calculated were inadequate for 94.3% of the residents. The mean difference between what the residents drank and the amount of fluid required was -410.9 mL (range = -1,644.6 - 1,217.0 mL, *SD* 525.2 mL). Therefore, 5.7% had correct fluid intake, 79.2% drank less than the calculated Skipper standard, and 15.1% drank more fluid than recommended.

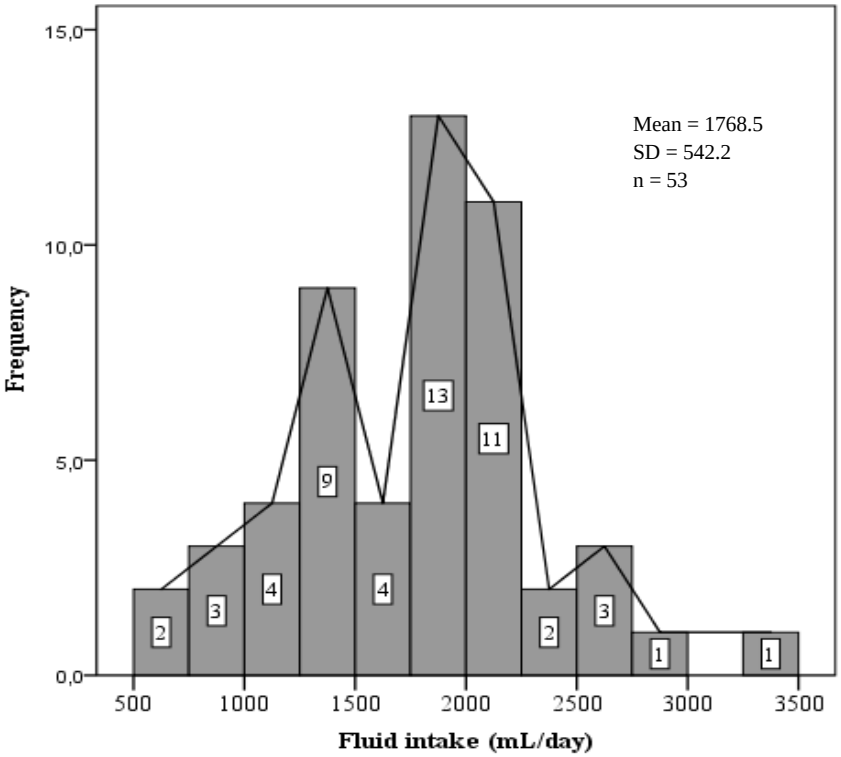

Figure 2. Range of fluid intake

With respect to their general state of health, 71.7% of residents showed signs of cognitive impairment (MMSE ≤ 23), 67.9% had severe functional dependence (Barthel Index < 61), and 47.2% were at risk of suffering pressure ulcers (Braden Scale ≤ 15–16 if < 75 years old or ≤ 15–18 if > 75 years old). With regard to nutrition, 64.2% were at risk of suffering malnutrition (MNA 17–23.5), with 7.5% being malnourished (MNA < 17); 32.1% were currently being fed a texture-modified diet; 34.0% presented signs of dysphagia (V-VST: positive in liquid viscosity); and 35.8% and 28.3%, respectively, had impaired swallowing safety (V-VST: positive in changes in voice quality, cough, and/or a decrease in oxygen saturation < 3%) and swallowing efficacy (V-VST: positive in impaired labial seal, oral or pharyngeal residue, and/or piecemeal deglutition). In relation to hydration status, 77.4% of the residents had a BUN:Cr > 21, none had a Na^+ > 150 mmol/L, and 28.3% a serum osmolarity > 300 mmol/L.

The correlation of fluid intake and main risk factors (MMSE, MNA, Barthel Index, and Braden Scale) all ranged between 0.5 and 0.6. Thus, the factors associated with low fluid intake were low scores on the MMSE ($p < 0.001$), Barthel Index ($p < 0.001$), and Braden Scale ($p < 0.001$). With respect to the level of nutrition, the individuals who scored the fewest points in the MNA ($p < 0.001$)—those on a texture-modified diet ($p = 0.003$), those presenting signs of dysphagia to liquid viscosity ($p = 0.029$), and those

with impaired swallowing safety (p = 0.046)—were also the ones who exhibited the lowest levels of fluid intake. Dehydration was only associated with low fluid intake BUN:Cr > 21 (p = 0.017). In contrast, factors such as age, sex, the number of urinary infections, changes in swallowing efficacy, Na^+ > 150 mmol/L, and serum osmolality > 300 mmol/L proved non-significant (Tables 1 and 2).

Table 1. Correlation between fluid intake and quantitative variables

		Age	Number of urinary infections	MMSE	MNA	Barthel Index	Braden Scale
Fluid intake (mL/day)	Pearson's correlation	-0.074	-0.103	0.504**	0.540**	0.522**	0.595**
	p Value	0.600	0.465	0.000	0.000	0.000	0.000

MMSE, Mini-Mental State Examination; MNA, Mini Nutritional Assessment; *The correlation is significant at the 0.05 level; ** The correlation is significant at the 0.01 level

Table 2. Characteristics of the study population and mean and *SD* of fluid intake in the qualitative variables

Factors		n	%	Fluid intake (mL/day) Mean	*SD*	*p* Value
Gender	Male	11	20.8	1770.1	864.5	0.992
	Female	42	79.2	1768.1	436.5	
Texture-modified diet	No	36	67.9	1917.1	477.7	0.003**
	Yes	17	32.1	1453.9	548.9	
Dysphagia to liquid viscosity	No	35	66.0	1884.4	413.6	0.029*
	Yes	18	34.0	1543.2	689.6	
Impaired swallowing safety	No	34	64.2	1878.8	418.5	0.046*
	Yes	19	35.8	1571.1	681.1	
Impaired swallowing efficacy	No	38	71.7	1727.6	524.2	0.387
	Yes	15	28.3	1872.2	591.0	
BUN:Cr < 21	No	12	22.6	2093.5	569.3	0.017*
	Yes	41	77.4	1673.4	502.0	
Na^+ > 150 mmol/L†	No	53	100.0	1768.5	542.1	
Serum osmolarity >300mmol/L	No	23	71.7	1821.6	546.3	0.260
	Yes	30	28.3	1634.0	525.4	

n: number of residents; %: percentage of residents; *SD*, standard deviation; BUN:Cr, plasma blood urea nitrogen: creatinine ratio; Na^+, Serum Sodium; † No residents with $Na^+ \leq 150$ mmol/L; *The correlation is significant at the 0.05 level; ** The correlation is significant at the 0.01 level

As showed in Figure 1, five residents had a fluid intake of less than 1,000 mL/day. The majority (3/5 residents) of them were women, with a mean age of 86.6 years old (*SD* 13.4). It can be seen that the data of age and gender are similar with the total sample. Their average daily fluid intake was 850.45 mL/day (range = 737–850.45 mL, *SD* 105.4). Across Skipper's formula, the deficit in meeting the estimated total fluid requirement ranged from -1,644.6 to -815.7 mL/day, with a mean of -1,181.2 (*SD* 317.9). In relation to the risk factors associated with low fluid intake, all five residents had signs of cognitive impairment (MMSE ≤ 23) and were at risk of suffering pressure ulcers (Braden Scale ≤ 15–16 if < 75 years old or ≤ 15–18 if > 75 years old). In relation to functional impairment, 80% were totally dependent (Barthel Index ≤ 20), and the other 20% were severely dependent (Barthel Index < 60). At a nutritional level, 40% were malnourished (MNA < 17), and 60% were at risk of malnutrition (MNA 17–23.5). Most of these residents (4/5) were on a texture-modified diet, had signs of dysphagia to liquid viscosity, and had impaired swallowing safety. Regarding measures related to hydration status, 100% presented BUN:Cr > 21, 40% had an altered serum osmolarity, and none had > 150 mmol/L values in Na^+.

One year later, the two residents with an intake of 907 mL/day have passed away and the other 3 residents have worsened their health status. The resident who had had the lowest intake (737 mL/day) has decreased his MNA score from 16.5 to 12.6, keeping the same Barthel Index score (0 points). The baseline situation of the second resident with a lower intake (739 mL/day) has worsened both in the nutritional state (MNA from 20 to 17.5) and the functional status (Barthel Index from 25 to 10). Regarding the third resident alive, who had had an intake of 963 mL/day, he has had a score of 12 in the MNA (4 points less than a year ago) and the same score in the Barthel Index (0 points). Finally, none of the MMSE or Braden Scale scores have changed.

4. DISCUSSION

This cross-sectional study analyzed the prevalence and factors associated with low fluid intake by institutionalized elderly residents living in a nursing home. The prevalence of low fluid intake was 34% and 79.2% of the residents drank less than the

Skipper's standard. As factors associated with low fluid intake, cognitive and functional impairment, the risk of suffering pressure ulcers, being undernourished or at risk, a texture-modified diet, dysphagia, impaired swallowing safety, and BUN:creatinine ratio were identified.

Referring the prevalence of low fluid intake, although the average daily fluid intake was 1,768.5 mL (SD 542.2), the 34% of the residents drank less than 1500mL/day, which was below that reported in other studies.[8,9] This could have been due to variations in the length of the data collection period. For example, in our own case, fluid intake results were collected over a week and for 24 hours a day. In contrast, in other investigations, such data were collected only at mealtimes (61.8%)[8] or over a period of three days (53.8%).[9] Along these lines, the most appropriate way of collecting information on fluid intake would have been over 24 hours and every day for a week, as this would make it possible to establish the real pattern of fluid intake. The importance of this lies in the fact that there are various organizational factors that could influence the final result. One of these would be shift work,[26] as there could be differences in workload among the morning, afternoon, and night shifts. Other factors could be informal interactions[26] and insufficient staff ratios,[27] which tend to be more frequent on weekends, when family members participate more in the care process. In addition, there tend to be more staff rotations and fewer staff on duty.

In relation to the differences between the daily fluid intake and what Skipper's formula recommended,[6] 79.2% of the residents drank below the recommendations in our study. Gaspar[4] compared three studies, which used the same formula as ours to determine the percentage of residents that not met the recommendation of fluid intake. This prevalence ranged between 49 to 90%. From this finding a question arises: are these formulas adapted to the peculiarities of the elderly?

To answer this question, first of all, it is necessary to take into account what is produced physiologically during the aging process. In this way, the body is able to regulate its hydration levels in order to compensate for any alteration.[28] In this process two elements are in charge: thirst and arginine vasopressin (ADH). In order to

stimulate thirst, the plasma decreases and thus increases the level of concentration of the solute in the interstitial fluid. Then, through osmotic pressure, the fluid of the intracellular compartment moves to the extracellular. As a result, it leads to intracellular dehydration, which by means of the osmoreceptors gives the order to the hypothalamus to produce stimulation of thirst.[29] On the other hand, to stop the loss of water, ADH stimulates the medulla within the kidney to produce more highly concentrated urine, from which lower urine output could well be adequate for maintaining electrolyte balance, blood pressure, and other parameters that depend on hydration.[30]

However, the ability to feel thirsty and the kidney function can be disrupted by the ageing process.[31,32] Consequently, the capacity to concentrate urine and retain fluid can decrease. This theory is tested by Davies et al.,[32] who compared the response of the mechanisms regulating the water balance in rehydration between a control group consisting of young adults and another group made up of elders. The results showed that men aged over 70 years had lower resting ADH levels than men aged less than 40 years. In the same way, dehydration vasopressin levels rose faster in the older men ($p = 0.02$). Relating to thirst, there was no variation with age.

So, in this way, the European Food Safety Authority[33] state that adequate intakes of water for the elderly, therefore, should not be based solely on observed intakes, but should take into account the decreases in renal concentrating capacity with age and the decrease in thirst sensitivity. Added to this, the American Medical Directors Association[34] focuses on several aspects related to the risk factors associated with the development of dehydration such as altered thirst, decreased cognitive function, increased fluid losses, kidney problems and limitations in oral intake. Thus, it can be observed that the formulas to calculate the recommendation of the fluid intake do not take into account the physiology of regulation the water balance in the elderly and the factors associated with this phenomenon. In spite of this, what is obvious is that those residents who drink below their requirements, their state of health gets worse in the medium term, as is evident in the follow-up of individuals who drank < 1000 mL/day.

Therefore, it is necessary to explain why the percentage of residents not taking the recommended individual intake is so high. In this sense, various clinical factors were associated with low fluid intake, with all of these relating to the residents' health, nutritional and hydration status. With respect to health condition, cognitive impairment was a factor associated with low fluid intake. Numerous studies have concurred on this finding. In fact, in one of the most recent studies,[35] over 50% of subjects with dementia had low fluid intake. This relationship could be associated with cognitive impairment causing people to forget to drink, while, at the same time, those affected by this condition require help and need more time to carry out otherwise routine actions.[36] This latter group can also be associated with functional impairment, which is another factor identified in our study: the residents with the lowest point scores on the Barthel Index had low fluid intake, a situation that has also been noted by several other authors.[3] Finally, a greater risk of suffering pressure ulcers was also associated with low fluid intake. In this case, it is already well known and accepted that low fluid intake can cause a reduction in skin turgor and, as a result, increase the risk of suffering pressure ulcers; appropriate hydration is vital for maintaining skin integrity.[7]

At the nutritional level, the residents with the lowest MNA scores had low levels of fluid intake. This was logical, because when there is a reduction in food intake, there is a corresponding reduction in fluid intake.[8] Other nutritional factors associated with a low average fluid intake were a texture-modified diet, dysphagia, and impaired swallowing safety. Along these lines, other investigations have reported that residents with problems swallowing were four times more likely to suffer dehydration than those who could swallow normally.[25] One aspect that could justify this finding is the fact that some residents with dysphagia to liquid viscosity need thickened liquids. On occasion, residents drink less or refuse to drink thickened liquids, because they perceive it as an unpleasant experience.[37]

Regarding hydration status, it is known that dehydration is related to low fluid intake.[7] In this study, only the analytical parameter BUN:Cr was identified as an associated factor. The two other parameters were not associated, since Na^+ was needed to calculate the serum osmolarity and no resident had a Na^+ alteration (> 150meq/L). We

decided to explore dehydration with three different analytical parameters, because there is no generally accepted gold standard for assessing dehydration in the elderly.[38] Furthermore, no cut-off point has been established to determine dehydration in older people. Therefore, we employed the most used cut-off points identified in the literature for this population.[24,25]

The association of these factors mentioned above was reinforced in the analysis of the five cases with the lowest fluid intake, where it can be observed that all of them are present in these residents. This confirms that they are the most important factors associated with low fluid intake.

As limitations, it is also necessary to mention the fact that the relatively small number of subjects considered in this study and also the single site limit the possibility of generalizing the findings and restrict the power of the obtained results. Furthermore, due to the cross-sectional nature of the design of this study, it is not possible to know the directionality of the factors associated with low fluid intake. Even so, we think that the results obtained provide a good base from which to continue investigating in this area and to plan future interventions.

Finally, it should be underlined that this investigation has helped to orient us in the identification of factors associated with low fluid intake and to establish lines of action to reduce these factors. Although it is very difficult to change the base situation of certain factors, such as cognitive or functional impairment, it is possible to think of actions that can facilitate the accessibility of residents to drinks both during and between meals, verbally encouraging them to drink more[2,9] and to use glasses with intense colors.[39] In the case of residents with dementia, this type of glass can help capture their attention, because of their difficulty distinguishing objects in their environment.[39] At the same time, colors can also trigger caregivers to provide drinks. With regard to the risk of pressure ulcers appearing, this risk could be reduced by correct hydration and hygiene and by increasing the frequency of going to the bathroom and changing incontinent garments, thus allowing more fluid intake.[9,40]

As can be observed, based on this research, it will be possible to formulate future lines of research with diligent, low-cost actions that can be highly effective in reducing the adverse effects of low fluid intake. So, the evidence shows that a positive effect on the health of the residents can be obtained through increasing their fluid intake.[41–43]

5. CONCLUSIONS

Our study shows the importance of monitoring the intake of liquids in nursing homes, particularly as 34% of our sample had a fluid intake of less than 1,500 mL/day, and 79.2% drank less than the calculated Skipper's standard. It is necessary to identify the population at risk, but to do this, we must also know the risk factors associated with this condition. According to our study, cognitive and functional impairment, the risk of suffering pressure ulcers, undernourishment, a texture-modified diet, dysphagia to liquid viscosity, impaired swallowing safety, and BUN:Cr are the key factors to monitor. Identifying and understanding these factors should help us to design specific strategies to increase the intake of liquids and reduce the incidence of dehydration amongst residents in nursing homes. Nevertheless, we should have standards to determine the recommended fluid intake in the elderly that consider the physiological changes characteristic of the aging process.

FUNDING SOURCES: This work was supported by bridge funding for research projects. (The bridge funding is explained in the "Title Page (Containing author details)" document)

ACKNOWLEDGEMENTS: Author contributions are defined in the "Title Page (Containing author details)" document.

CONFLICTS OF INTEREST: No conflicts of interest.

REFERENCE

1. Hooper L, Bunn DK, Downing A, et al. Which Frail Older People Are Dehydrated? The

UK DRIE Study. J Gerontol A Biol Sci Med Sci. 2016;71:1341–7. http://doi.org/10.1093/gerona/glv205.

2. Mentes JC, Culp K. Reducing hydration-linked events in nursing home residents. Clin Nurs Res. 2003;12:210–25; discussion 226–8. http://doi.org/10.1177/1054773803252996.

3. Armstrong-Esther CA, Browne KD, Armstrong-Esther DC, Sander L. The institutionalized elderly: dry to the bone! Int J Nurs Stud. 1996;33:619–28. http://doi.org/10.1016/S0020-7489(96)00023-5.

4. Gaspar PM. Comparison of four standards for determining adequate water intake of nursing home residents. Res Theory Nurs Pr. 2011;25:11–22. https://doi.org/10.1891/1541-6577.25.1.11.

5. Hunt SA, Abraham WT, Chin MH, et al. 2009 Focused Update Incorporated Into the ACC/AHA 2005 Guidelines for the Diagnosis and Management of Heart Failure in Adults. J Am Coll Cardiol. 2009;53:e1–90. http://dx.doi.org/10.1016/j.jacc.2008.11.013.

6. Skipper A. Monitoring and complications of enteral feeding. In: Skipper, A E, editor. Dietitian's Handbook of Enteral and Parenteral Nutrition. Rockville: Aspen Publishers; 1993.

7. Holben DH, Hassell JT, Williams JL, Helle B. Fluid intake compared with established standards and symptoms of dehydration among elderly residents of a long-term-care facility. J Am Diet Assoc. 1999;99:1447–50. https://doi.org/10.1016/S0002-8223(99)00351-X.

8. Reed PS, Zimmerman S, Sloane PD, et al. Characteristics associated with low food and fluid intake in long-term care residents with dementia. Gerontologist. 2005;45:74–80. http://doi.org/10.1093/geront/45.suppl_1.74.

9. Simmons SF, Alessi C, Schnelle JF. An intervention to increase fluid intake in nursing home residents: prompting and preference compliance. J Am Geriatr Soc. 2001;49:926–33. http://doi.org/10.1046/j.1532-5415.2001.49183.x.

10. Thomas DR, Cote TR, Lawhorne L, et al. Understanding clinical dehydration and its treatment. J Am Med Dir Assoc. 2008;9:292–301. http://doi.org/10.1016/j.jamda.2008.03.006.

11. Spangler AA, Chidester JC. Age, dependency and other factors influencing fluid intake by long term care residents. J Nutr Elder. 1999;18:21–35.

http://doi.org/10.1300/J052v18n02_02.

12. Mahowald JM, Himmelstein DU. Hypernatremia in the elderly: relation to infection and mortality. J Am Geriatr Soc. 1981;29:177–80. http://doi.org/ 10.1111/j.1532-5415.1981.tb01761.x.

13. Stookey JD, Purser JL, Pieper CF, Cohen HJ. Plasma hypertonicity: another marker of frailty? J Am Geriatr Soc. 2004;52:1313–20. http://doi.org/10.1111/j.1532-5415.2004.52361.x.

14. Salahudeen AK, Doshi SM, Shah P. The frequency, cost, and clinical outcomes of hypernatremia in patients hospitalized to a comprehensive cancer center. Support Care Cancer. 2013;21:1871–8. http://doi.org/10.1007/s00520-013-1734-6.

15. Xiao H, Barber J, Campbell ES. Economic burden of dehydration among hospitalized elderly patients. Am J Heal Syst Pharm. 2004;61:2534–40.

16. Davidhizar R, Dunn CL, Hart AN. A review of the literature on how important water is to the world's elderly population. Int Nurs Rev. 2004;51:159–66; discussion 134. http://doi.org/10.1111/j.1466-7657.2004.00224.x.

17. McGeer A, Campbell B, Emori TG, et al. Definitions of infection for surveillance in long-term care facilities. Am J Infect Control. 1991;19(1):1–7. http://doi.org/10.1016/0196-6553(91)90154-5.

18. Folstein MF, Folstein SE, McHugh PR. Mini-Mental state: a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12:189–98. https://doi.org/10.1016/0022-3956(75)90026-6.

19. Mahoney Fl, Barthel DW. Functional evaluation: the Barthel Index. Md State Med J. 1965;14:61–5.

20. Shah S, Vanclay F, Cooper B. Improving the sensitivity of the Barthel Index for stroke rehabilitation. J Clin Epidemiol. 1989;42:703–9. https://doi.org/ 10.1016/0895-4356(89)90065-6.

21. Bergstrom N, Braden BJ, Laguzza A, Holman V. The Braden Scale for predicting pressure sore risk. Nurs Res. 1987;36:205–10.

22. Guigoz Y, Vellas B, Garry PJ. Mini Nutritional Assessment: A practical assessment tool for grading the nutritional state of elderly patients. Facts Res Gerontol. 1997;4:15–59. https://doi.org/10.1016/S0899-9007(98)00171-3.

23. Clavé P, Arreola V, Romea M, et al. Accuracy of the volume–viscosity swallow test

for clinical screening of oropharyngeal dysphagia and aspiration. Clin Nutr. 2008;27:806–15. http://doi.org/10.1016/j.clnu.2008.06.011.

24. Culp KR, Wakefield B, Dyck MJ, et al. Bioelectrical impedance analysis and other hydration parameters as risk factors for delirium in rural nursing home residents. J Gerontol A Biol Sci Med Sci. 2004;59:813–7. http://dx.doi.org/10.1093/gerona/59.8.M813.

25. Mentes JC, Wang J. Measuring risk for dehydration in nursing home residents: evaluation of the dehydration risk appraisal checklist. Res Gerontol Nurs. 2011;4:148–56. https://doi.org/10.3928/19404921-20100504-02.

26. Estabrooks CA, Squires JE, Hayduk L, et al. The influence of organizational context on best practice use by care aides in residential long-term care settings. J Am Med Dir Assoc. 2015;16:537.e1–537.e10. https://doi.org/10.1016/j.jamda.2015.03.009.

27. Sloane PD, Ivey J, Helton M, et al. Nutritional issues in long-term care. J Am Med Dir Assoc. 2008;9:476–85. https://doi.org/10.1016/j.jamda.2008.03.005.

28. Gilmour J, Penny S. Hydration & ageing. New Zeal Nurs Journal. 1991;84(10):15-7.

29. Grossman SP. Thirst and sodium appetite: physiological basis. San Diego, CA: Academic Press, Inc.; 1990.

30. Tortora GJ, Derrickson B. Principles of anatomy and physiology. 13ª. Buenos Aires: Editorial Médica Panamericana; 2013.

31. Sheehy CM, Perry PA, Cromwell SL. Dehydration: biological considerations, age-related changes, and risk factors in older adults. Biol Res Nurs. 1999;1(1):30-7. https://doi.org/ 10.1177/109980049900100105.

32. Davies I, O'Neill PA, McLean KA, et al. Age-associated alterations in thirst and arginine vasopressin in response to a water or sodium load. Age Ageing. 1995;24(2):151-9. https://doi.org/10.1093/ageing/24.2.151.

33. European Food Safety Authority (EFSA). Scientific opinion on dietary reference values for water. EFSA J. 2010;8(3):1459.

34. American Medical Directors Association (AMDA). Dehydration and fluid maintenance in the long-term care setting. Clinical Practice Guideline. Columbia, MD: AMDA; 2009.

35. Gaff L, Jones J, Davidson IH, Bannerman E. A study of fluid provision and consumption in elderly patients in a long-stay rehabilitation hospital. J Hum Nutr Diet.

2015;28:384–9. http://doi.org/10.1111/jhn.12294.

36. Wu SJ, Wang HH, Yeh SH, et al. Hydration status of nursing home residents in Taiwan: a cross-sectional study. J Adv Nurs. 2011;67:583–90. http://doi.org/10.1111/j.1365-2648.2010.05514.x.

37. Garcia JM, Chambers E IV, Molander M. Thickened liquids: Practice patterns of speech-language pathologists. Am J Speech-Language Pathol. 2005;14(1):4–13. https://doi.org/10.1044/1058-0360(2005/003).

38. Masot O, Lavedán A, Nuin C, et al. Risk factors associated with dehydration in older people living in nursing homes: Scoping review. Int J Nurs Stud. 2018;82:90–8. https://doi.org/10.1016/j.ijnurstu.2018.03.020.

39. Dunne TE, Neargarder SA, Cipolloni PB, Cronin-Golomb A. Visual contrast enhances food and liquid intake in advanced Alzheimer's disease. Clin Nutr. 2004;23:533–8. https://doi.org/ 10.1016/j.clnu.2003.09.015.

40. Schnelle JF, Leung FW, Rao SS, et al. A controlled trial of an intervention to improve urinary and fecal incontinence and constipation. J Am Geriatr Soc. 2010;58:1504–11. https://doi.org/10.1111/j.1532-5415.2010.02978.x.

41. Culp K, Mentes J, Wakefield B. Hydration and acute confusion in long-term care residents. West J Nurs Res. 2003;25(3):251-66; discussion 267-73. https://doi.org/10.1177/0193945902250409.

42. Robinson SB, Rosher RB. Can a beverage cart help improve hydration? Geriatr Nurs. 2002;23(4):208-11. https://doi.org/10.1067/mgn.2002.126967.

43. Welch IK, Campbell S, Crowley R. Oral hydration solution effects on fuid status of the elderly. J Nutr Elder. 1996;16(1):1-10. https://doi.org/10.1300/J052v16n01_01.

4. Paper IV: ¿Cómo mejorar la hidratación y la ingesta hídrica en las personas mayores institucionalizadas? Una revisión de la literatura científica

Status: accepted, pending to publish

Authors (in signing order): Masot O, Iglesias Millán A, Nuin C, Miranda J, Lavedán A* y Botigué T	
Title: ¿Cómo mejorar la hidratación y la ingesta hídrica en las personas mayores institucionalizadas? Una revisión de la literatura científica	
Journal (title, volume, start and end page): Nutrición Hospitalaria	
Year: 2018	*Key (A: article, R: review)*: R
Impact factor (JCR): 0.747 Impact factor (SJR): 0.411	*Quartile and area (JCR):* 4Q (68/81), Nutrition and Dietetics *Quartile and area (SJR):* 3Q, Nutrition and Dietetics
DOI: 10.20960/nh.1885	

*Corresponding autor

TÍTULO: ¿Cómo mejorar la hidratación y la ingesta hídrica en las personas mayores institucionalizadas? Una revisión de la literatura científica

RESUMEN

Introducción: Los residentes son vulnerables a sufrir deshidratación por los cambios fisiológicos y las limitaciones físicas y cognitivas que padecen.

Objetivo: Para manejar esta situación, se ha decidido evaluar las intervenciones que se llevan a cabo para el manejo de la deshidratación y la baja ingesta hídrica en las personas mayores institucionalizadas en residencias geriátricas.

Métodos: Se realizó una revisión de la literatura científica siguiendo la metodología PRISMA mediante búsquedas sistemáticas en las bases de datos PubMed, Scopus, CINAHL y otras fuentes. De un total de 3.379 artículos extraídos, se seleccionaron 11 estudios para su análisis. Además, se avaluó su calidad a través de Cochrane y la Newcastle-Ottawa Scale.

Resultados: El riesgo de sesgo de los estudios fue medio en su mayoría. En cuanto a los resultados, las intervenciones se clasificaron según fuesen invasivas o no invasivas. Las intervenciones invasivas fueron la sueroterapia intravenosa y/o subcutánea y su efectividad estuvo relacionada con la mejora clínica de la deshidratación. No obstante, aparecieron reacciones locales. Las no invasivas se centraron en la asistencia individualizada, la estimulación para beber más y tener en cuenta las preferencias de cada residente, produciendo un aumento de la ingesta y una mejora en los parámetros analíticos.

Conclusiones: Dadas las peculiaridades de la población mayor institucionalizada, ambos tipos de intervención han demostrado tener un efecto positivo en la mejora de la hidratación. No obstante, las intervenciones no invasivas han confirmado ser más eficientes dada su sencillez de aplicación y provocar menos efectos adversos.

PALABRAS CLAVE: deshidratación; ingesta hídrica; intervención; anciano; residencias.

TITTLE: How to improve hydration and fluid intake in institutionalized older people? A scoping review

ABSTRACT

Background: Residents are vulnerable to suffer of dehydration due to physiological changes and the physical and cognitive limitations.

Aim: To handle this situation, it has been decided to evaluate the interventions those are carried out for the management of dehydration and low fluid intake in older people living in nursing homes.

Methods: The revised scientific literature review methodology of PRISMA was applied. An electronic database search was performed in PubMed, Scopus, CINAHL and other sources databases. The literature search was carried out between October 2016 and January 2017. Out of a total of 3,379 articles extracted, 11 studies were selected for analysis. In addition, its quality was assessed through Cochrane and the Newcastle-Ottawa Scale.

Results: The risk of bias in the studies was mostly medium. Regarding the results, the interventions were classified according to whether they were invasive or non-invasive. The invasive interventions were intravenous and/or subcutaneous fluid therapy. Its effectiveness was related to the clinical improvement of dehydration. However, local reactions appeared. The non-invasive ones focused on the individualized assistance, the stimulation to drink more and take into account the preferences of each resident, producing an increase in fluid intake and an improvement in the analytical parameters.

Conclusions: Given the peculiarities of the institutionalized elderly population, both types of intervention have been shown to have a positive effect on improving hydration. Nonetheless, non-invasive interventions have confirmed to be more efficient given their simplicity of application and cause fewer adverse effects.

KEY WORDS: dehydration; fluid intake; intervention; aged; nursing homes.

TEXTO PRINCIPAL DEL MANUSCRITO

Introducción

Durante las últimas décadas, se ha producido un incremento del envejecimiento poblacional, provocando uno de los cambios sociales más significativos en los países desarrollados. En España, la población mayor de 65 años durante el 2016 representó el 18,2% del total de la población con la posibilidad de llegar al 20,3% en el año 2021 (1,2). Este envejecimiento tiene consecuencias para la sociedad en su conjunto, ya que las necesidades sanitarias y sociales aumentan con la edad, de manera que si no se da una respuesta adecuada, aumenta el riesgo de institucionalización (3). En este sentido, preservar la calidad de vida de las personas mayores institucionalizadas constituye todo un reto, ya que son vulnerables a la aparición de complicaciones como es la deshidratación (4).

Mantener una hidratación oral adecuada en las personas mayores que viven en residencias es un desafío constante (4), complicándose aún más por los cambios fisiológicos que acompañan al envejecimiento al disminuir la sensación de sed y la capacidad del organismo para mantener el balance hídrico (5). Asimismo, numerosos estudios han señalado que su ingesta hídrica (IH) está muy por debajo del requerimiento diario recomendado (6,7), observándose que es inadecuada entre el 50% y el 92% de las personas institucionalizadas (8).

Además, existen diversos factores que pueden contribuir a una insuficiente IH. Concretamente, Gaspar (9) examinó la ingesta de agua a partir de los alimentos y líquidos, mostrando que la baja IH se asociaba a la edad, un estado funcional limitado, necesitar ayuda para comer y tener problemas del habla. De hecho, también se ha observado que el deterioro cognitivo y la incontinencia son factores asociados a la misma (4,7). Como consecuencia, cuando las personas mayores no consumen una cantidad adecuada de líquidos, son más susceptibles de padecer infección del tracto urinario, neumonía, UPP, hipotensión, confusión y desorientación. Asimismo, se producen desequilibrios electrolíticos como la hipernatremia, hiponatremia e

hiperpotasemia, provocando una mayor demanda y gasto sanitario (10–12) y pudiendo alcanzar tasas de mortalidad superiores al 50% (13).

Por lo tanto, dada la elevada incidencia de deshidratación y baja IH, así como las consecuencias que todo ello conlleva, se consideró necesario conocer cómo mejorar la hidratación de las personas mayores institucionalizadas. Por esta razón, el objetivo de esta revisión fue evaluar las intervenciones que se llevan a cabo para el manejo de la deshidratación y la baja IH en las personas mayores que viven en residencias.

Materiales y métodos

Se desarrolló la técnica de revisión de la literatura científica, que consiste en hacer un "mapeo" de la literatura y de la evidencia científica, con el objetivo de exponer los resultados de investigaciones existentes sobre un tema específico (14). El modelo metodológico utilizado ha sido el de PRISMA (15).

Criterios de elegibilidad

La pregunta de investigación diseñada para abordar el problema y construir las estrategias de búsquedas fue: ¿Qué intervenciones se llevan a cabo para el manejo de la deshidratación y la baja IH en las personas mayores de 65 años institucionalizadas en residencias? Los criterios para la inclusión de los artículos fueron estudios de intervención para mejorar la hidratación o la IH o de carácter observacional en personas mayores institucionalizadas en residencias. Por otra parte, los realizados en otros niveles asistenciales fueron excluidos. Asimismo, no se establecieron límites en el idioma o la fecha de publicación, por las pocas investigaciones realizadas en esta área.

Fuentes de información

Las bases de datos bibliográficas consultadas fueron PubMed, Scopus y CINAHL, además de realizar una búsqueda secundaria a través de las referencias incluidas en

los artículos. El proceso para la identificación de los estudios se realizó hasta marzo de 2018.

Búsqueda y selección de los estudios

Los términos utilizados para crear las estrategias de búsqueda variaron ligeramente entre las bases de datos, incluyendo en todas ellas los siguientes conceptos: "dehydration" and "hydration", "fluid intake", "hypernatremia", "water loss", "thirst", "drink*", "fluid therapy", "rehydration solutions", "promoting fluid intake", "*thickened", "beverages", "aged", "nursing home" y "long-term care". Se extrajeron 3.358 artículos de las bases de datos y 16 de la revisión de las referencias de los artículos finalmente incluidos.

La selección de los estudios se realizó basándose en los criterios de inclusión. En primer lugar, los resultados de las búsquedas fueron importados a Mendeley (https://www.mendeley.com) para realizar el chequeo de duplicidad, siendo eliminados 1.158. En segundo lugar, se procedió a la discriminación de los estudios mediante la lectura transversal de los títulos y resúmenes. De éstos, 2.100 fueron descartados, siendo 121 los artículos potencialmente elegibles. Posteriormente, se analizó la relevancia de cada uno de los resúmenes, eliminando en este proceso 81. Finalmente, se examinó el texto completo de los 40 artículos restantes, siendo elegidos 11 para su análisis (figura 1).

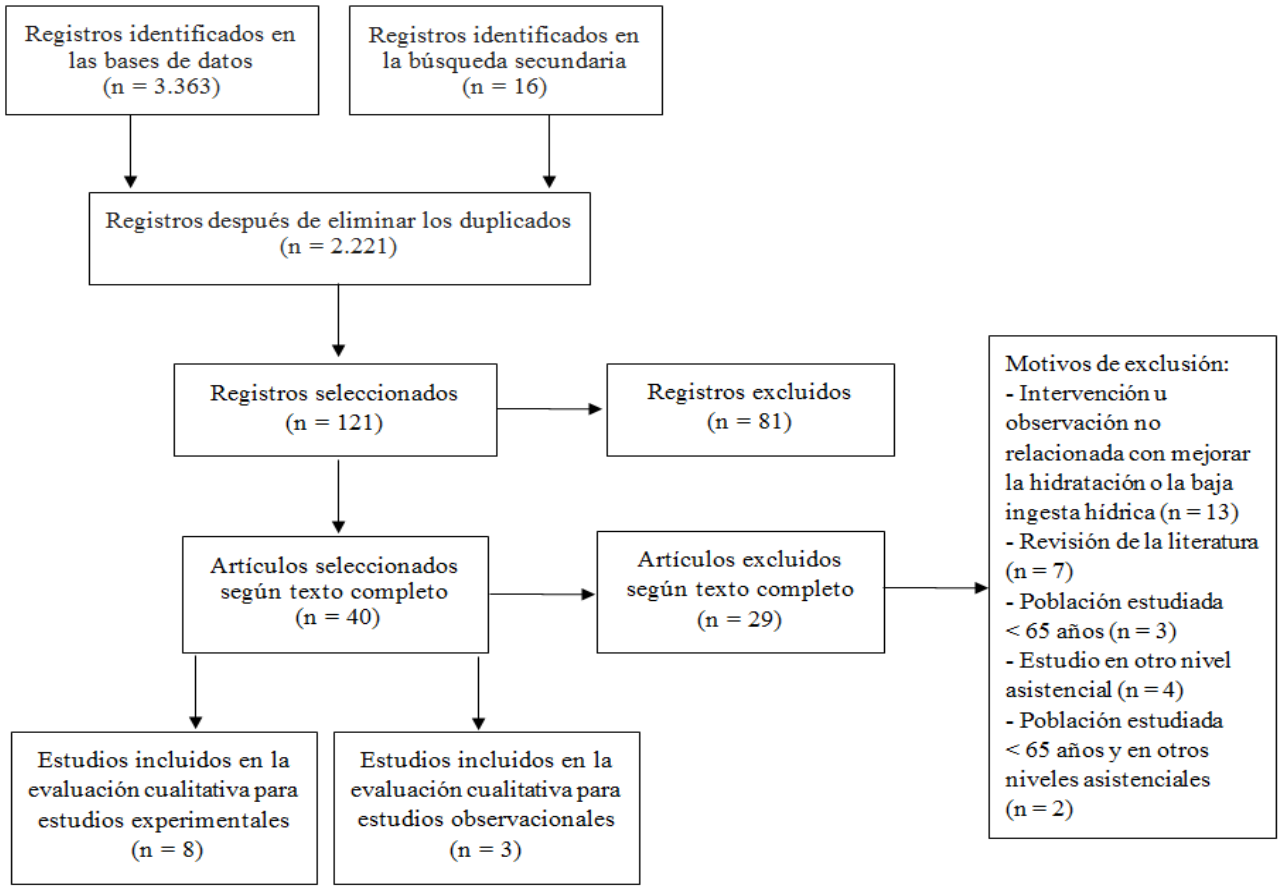

Figura 1. Diagrama de flujo PRISMA

Proceso de recopilación de datos

Se realizó un análisis de los 11 artículos finalmente elegidos. Todo el proceso de selección y análisis lo realizaron dos investigadoras de manera independiente (OM y AI) y en caso de ambigüedad o incertidumbre, la decisión final se tomó por consenso en reuniones en las que participaron todas las investigadoras.

Ítems de los datos

Se analizó la información relativa a: autor/es, año de publicación, país, diseño, población y duración del estudio, intervención u observación y resultados. Por otra parte, los resultados de las intervenciones fueron clasificados según su naturaleza, ya fuesen invasivas o no invasivas.

Rigor científico

Aunque en las revisiones de la literatura no sea una prioridad el análisis de la calidad de los artículos incluidos en su análisis final (14), se ha examinado el riesgo de sesgo a través de la Cochrane *Handbook for Systematic Reviews of Interventions* (16) para estudios de intervención (figura 2) y de la *Newcastle-Ottawa Scale* (17) para los observacionales (tabla I).

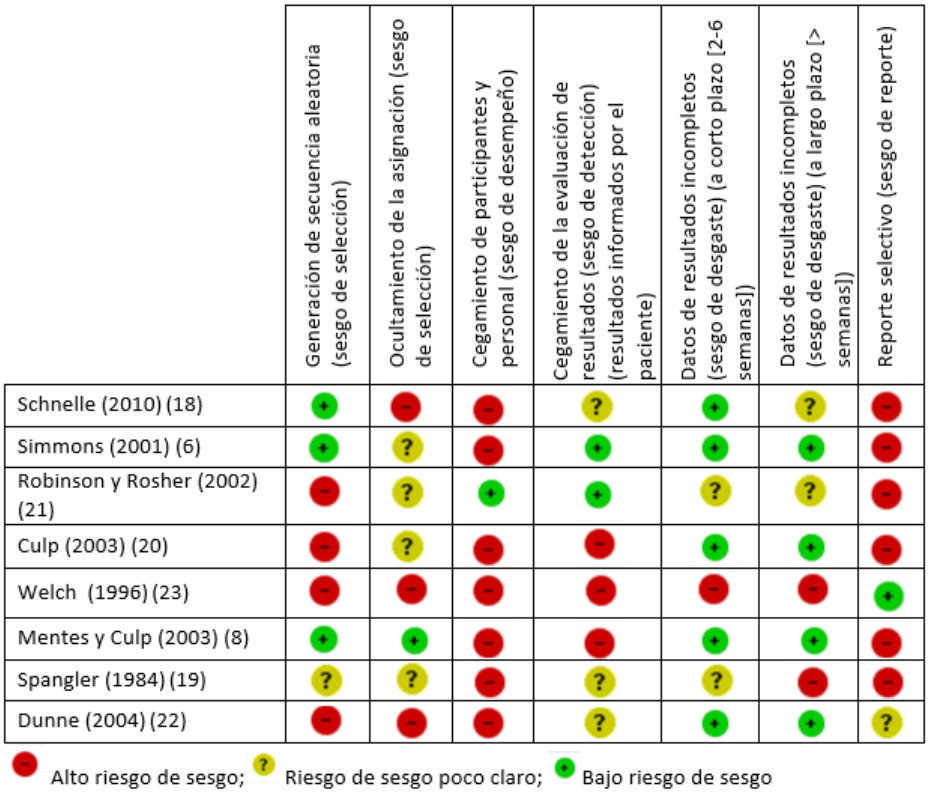

Figura 2. Resumen del riesgo de sesgo de los estudios de intervención (Cochrane)

Tabla I. Riesgo de sesgo de los estudios observacionales transversales y de cohortes

	Sesgo de selección					Sesgo de comparabilidad	Sesgo de resultado				Total
	Representati-vidad	Determinación de la exposición	Tasa de no respuesta	Selección cohorte no expuesta	Resultado de interés no presente al inicio		Evaluación de los resultados	Prueba estadística	Tiempo de seguimiento	Adecuación del seguimiento de la cohorte	
Arinzon y cols. (2004) (24)	1	2	0	n/a	n/a	1	2	1	n/a	n/a	7
Hussain y Warshaw (1996) (25)	1	2	0	n/a	n/a	1	2	1	n/a	n/a	7
Dasgupta y cols. (2000) (26)	1	1	n/a	0	0	1	1	n/a	0	1	5

0: alto riesgo de sesgo; 1 o 2: bajo riesgo de sesgo; n/a: no aplicable

Resultados

Las intervenciones analizadas se han clasificado según fueren invasivas y no invasivas, siendo cinco de ellas multicomponente, es decir, basadas en más de una intervención. A continuación, se detallan las características y resultados de los estudios seleccionados (tabla II).

Tabla II. Descripción de las características y resultados de los estudios seleccionados

Autores y año de publicación	País	Diseño del estudio	Población y duración del estudio	Intervención / Observación	Resultados
Schnelle (2010) (18)	EEUU	Ensayo aleatorio controlado	6 r n = 112 GC = 54 GI = 58 d: 12 s	GI: Programa multicomponente	+ ↑ IH y el control de la incontinencia urinaria. Mejoraron aspectos de la defecación. - No mejoró el control de la incontinencia fecal.
Simmons (2001) (6)	EEUU	Ensayo aleatorio controlado	2 r n = 63 GC = 15 GI = 48 d: 32 s	GI: Programa multicomponente	+ ↑ IH entre las comidas, en los residentes con deterioro cognitivo y con incontinencia urinaria. Mejoraron los valores analíticos de deshidratación. - No existieron otras diferencias en el estado de salud.
Robinson y Rosher (2002) (21)	EEUU	Cuasi-experimental	n = 51 d: 9 s	Programa multicomponente	+ ↑ agua corporal total, mejoraron aspectos de la defecación, ↓ las caídas y los costes de deshidratación. - La mitad no alcanzaron el objetivo de IH.
Culp (2003) (20)	EEUU	Cuasi-experimental	7 r n = 98 GC = 45 GI = 53 d: 4 s	GI: proporcionar más bebidas entre comidas	+ Mejoraron los niveles de leucocitos en sangre, de gravedad específica en orina y su color. ↑ líquido extracelular. - No diferencias entre el agua corporal total, el deterioro cognitivo y la confusión aguda.
Arinzon (2004) (24)	Israel	Observacional (retrospectivo)	3 r n = 57 d: 9 meses	Observar los resultados después de la hipodermoclisis	+ Mejoró la clínica de deshidratación, el estado cognitivo, la IH oral y los parámetros analíticos. - Complicaciones locales leves.
Welch (1996) (23)	EEUU	Cuasi-experimental, estudio piloto	n = 13 d: 5 días	Solución de rehidratación oral	+ ↑ IH. Mejoraron los parámetros analíticos y no perdieron peso.

EEUU: Estados Unidos; r: residencias; n: número de población participante; GC: grupo control (aplican cuidados habituales); GI: grupo intervención; d: duración; s: semanas; BUN: nitrógeno ureico en sangre; Cr: creatinina; Na+: sodio

Tabla II (continuación)

Autores y año de publicación	País	Diseño del estudio	Población y duración del estudio	Intervención / Observación	Resultados
Hussain y Warshaw (1996) (25)	EEUU	Observacional (retrospectivo)	2 r n = 36 d: 2 años	Observar los resultados después de la hipodermoclisis	+ La mayoría volvió a la situación clínica y funcional basal. - No cambios en BUN/Cr ni en Na^+. Complicaciones locales.
Mentes y Culp (2003) (8)	EEUU	Cuasi-experimental	4 r n = 49 GC = 25 GI = 24 d: 8 s	GI: Programa multicomponente	- Resultados no significativos: ↓ gravedad específica y el color de la orina fue más claro en el GI. No ↑ IH y algunos no alcanzaron la IH calculada. No mejoraron los episodios agudos.
Dasgupta (2000)(26)	Canadá	Observacional (prospectivo)	n = 55 d: 5 s	Comparar la hidratación mediante vía subcutánea o intravenosa	+ Ambos provocaron una mejora clínica. En la hipodermoclisis hubo menos efectos adversos. - No cambios en los parámetros analíticos. No diferencias en el nº de veces que se cambiaron los catéteres ni en la sobrecarga de fluido.
Spangler (1984) (19)	EEUU	Cuasi-experimental	n = 30 d: 50 días	Programa multicomponente	+ ↑ IH, mejoró el control de la incontinencia fecal y urinaria, ↓ humedad en el pañal. Tras la intervención, ninguno presentó deshidratación.
Dunne (2004) (22)	EEUU	Cuasi-experimental	Estudio 1: n = 9; d: 30 días Estudio 2: n = 9; d: 70 días	Utilizar diferentes colores de vajilla	+ El 84% ↑ su IH durante el periodo donde se utilizaron colores de tono alto. - Las intervenciones con rojo, azul y blanco de bajo contraste no fueron eficaces para ↑ la IH.

EEUU: Estados Unidos; r: residencias; n: número de población participante; GC: grupo control (aplican cuidados habituales); GI: grupo intervención; d: duración; s: semanas; BUN: nitrógeno ureico en sangre; Cr: creatinina; Na^+: sodio

Intervenciones no invasivas

En relación a los estudios con intervenciones no invasivas multicomponente, Schnelle y cols. (18) incluyeron una mayor asistencia al baño, cambio de la ropa húmeda y ofrecimiento de una variedad de aperitivos y bebidas entre las comidas. En el grupo intervención (GI) se constató una ganancia neta en la IH diaria total (399,24 ml/día SD: 186,31). Asimismo, aumentaron tanto el control de la incontinencia urinaria como algunos aspectos relacionados con la defecación, como la disminución de la presión anal o el aumento de los movimientos intestinales. Simmons y cols. (6), facilitaron la asistencia al baño combinado con estímulos verbales entre las comidas distribuidos en 3 fases: (1) en las primeras 16 semanas los estímulos verbales se realizaron 4 veces al día, (2) las siguientes 8 semanas, 8 veces y (3) en las últimas 8 semanas se aplicó la fase 2 más ofrecer bebidas según las preferencias de los residentes. Como resultado obtuvieron un aumento de la IH entre las comidas: en la fase uno, 476,13 ml (SD: 295,73) y en la dos, 632,87 ml (SD: 375,78). En la fase tres, la media de la IH diaria aumentó significativamente respeto a la fase dos ($p < 0,001$). Los residentes con deterioro cognitivo y/o con incontinencia urinaria también aumentaron su ingesta. Además, el GI obtuvo valores significativamente más bajos de BUN/Cr y osmolaridad que el grupo control (GC) ($p <0,041$). Por otra parte, en un estudio similar previo, Spangler y cols. (19) diseñaron un programa multicomponente donde se acudía a las habitaciones cada hora y media con un carro y se ofrecía una variedad de bebidas y asistencia al baño. Con ello consiguieron aumentar la IH y un mayor control de la incontinencia fecal y urinaria. Al finalizar su estudio, ningún residente presentó signos de deshidratación.

En otro estudio multicomponente realizado por Mentes y Culp (8) se ofreció más bebidas entre las comidas y se administró 180 ml con los medicamentos. Dado que el GC y GI no fueron homogéneos al inicio, no se produjeron diferencias significativas en relación a la gravedad específica, el color de la orina ni en la IH ingerida. Tampoco se apreciaron diferencias en la disminución de los efectos relacionados con la deshidratación. Por otro lado, los mismos autores realizaron otro estudio donde solo se ofreció más bebidas entre las comidas (20), mejorando la ingesta del GI y siendo el

color de la orina más claro que en el GC (p = 0,01). No obstante, en la semana 4 no hubo diferencia estadísticamente significativa en la IH entre ambos grupos.

Otros estudios tuvieron en cuenta la influencia del color de los recipientes en la IH. Robinson y Rosher (21) combinaron el ofrecimiento de bebidas variadas en recipientes coloridos de alto contraste con una atención individualizada, consiguiendo un aumento del número de deposiciones, de movimientos intestinales y una disminución en el consumo de laxantes. Además, midieron el líquido extracelular a través del análisis de la impedancia bioléctrica, corroborando su aumento y, por consiguiente, la mejora del estado de hidratación de los residentes. En relación al coste económico, el promedio de ahorro en el manejo de las consecuencias de la deshidratación fue de $103 por residente y semana. Dunne y cols. (22) llevaron a cabo dos estudios cuasi-experimentales donde se analizaba el efecto que producía el uso de diferentes colores de vajilla en la IH. Los resultados fueron similares en ambos estudios. Utilizando colores de tono alto, los residentes consiguieron un aumento medio del 24,6% en el consumo de alimentos (p < 0,001) y del 83,7% en los líquidos (p < 0,001).

En referencia a las intervenciones con suplementos orales, Welch y cols. (23) administraron una solución de rehidratación oral diaria aumentando la IH en 94 ml, los valores medios de laboratorio disminuyeron (Na^+, BUN, Cr y osmolaridad sérica) y los niveles de hemoglobina y hematocrito aumentaron.

Intervenciones invasivas

En relación a las intervenciones invasivas basadas en la hipodermoclisis, Arinzon y cols. (24) observaron los efectos de este tratamiento, pautado en la mayoría de los casos por deshidratación (64%) o enfermedad febril (21%). El promedio del volumen diario administrado fue de 1.161 ml/día (SD: 197,4). Entre los resultados positivos, cabe destacar que ningún participante desarrolló signos de sobrecarga de líquidos y se apreció una mejora funcional significativa después del tratamiento (p = 0,011), debido a la recuperación de la ingesta oral, así como una mejora en el deterioro cognitivo (p <0,05). Referente a los parámetros sanguíneos, los principales elementos indicativos

de deshidratación mejoraron (urea $p < 0,001$, Cr $p < 0,001$ y Na^+ $p = 0,05$), aunque se produjeron complicaciones locales leves en el 12% de residentes.

En el estudio de Hussain y Warshaw (25), la hipodermoclisis fue prescrita en su mayoría como consecuencia de procesos infecciosos (71%), observándose que la gran mayoría volvió a su situación basal previa. Cabe señalar que no se produjeron cambios estadísticamente significativos en la concentración de BUN/Cr ni de Na^+ y que la zona de punción se cambió en el 42% de los casos.

Finalmente, Dasgupta y cols. (26) compararon el efecto de la hidratación según fuese vía intravenosa o subcutánea. Por vía intravenosa, se administraron líquidos en los casos de deshidratación por un proceso agudo, mientras que la hipodermoclisis se administró en la deshidratación secundaria a procesos crónicos. Ambos tratamientos provocaron una mejora clínica sin diferencias significativas entre ellos. Tampoco existieron diferencias en los parámetros sanguíneos, en el número de veces que se cambiaron los catéteres ni en la sobrecarga de líquido. No obstante, sí que demostraron que la hipodermoclisis provocaba menos complicaciones (hinchazón, enrojecimiento u obstrucción) que la terapia intravenosa ($p = 0,02$), por lo que los autores recomendaron que la terapia invasiva de elección ante una baja IH fuese la vía subcutánea.

Discusión

En esta revisión se incluyeron 11 artículos, de los cuales 8 fueron estudios experimentales y 3 observacionales. Las intervenciones se clasificaron según fueran no invasivas o invasivas.

Intervenciones no invasivas

Las intervenciones no invasivas corresponden a aquellos procedimientos que no agreden química o mecánicamente al cuerpo. Para garantizar la hidratación de las personas de edad avanzada, la técnica más simple es consumir la cantidad necesaria

de líquidos. Pero, ¿cuánto debería beber este colectivo? La IH recomendada puede variar de los 1.500 hasta los 2.500 ml (27), dependiendo del peso corporal (28) y del estado de salud (29). Teniendo en cuenta estas características, tres estudios analizados en la revisión calcularon la IH necesaria para cada residente a través de dos fórmulas distintas (8,20,23). En primer lugar, Welch y cols. (23) utilizaron el estándar de 30 ml/kg/día. Sin embargo, este estándar podría no ser útil en personas delgadas u obesas y en personas mayores frágiles (30). En cambio, la fórmula de Skipper (28), utilizada en los otros dos estudios (8,20), es considerada más efectiva para la gente mayor, ya que garantiza el consumo de al menos 1.500 ml, tengan un peso bajo o alto (31). El cálculo de este estándar consiste en sumar 100 ml/kg para los primeros 10 kg de peso, 50 ml/kg para los siguientes 10 kg y 15 ml/kg para los kg restantes, lo que permite ajustarse a los extremos en el peso corporal.

No obstante, en ocasiones, ingerir tal cantidad de líquidos representa un dilema importante dado las peculiaridades de las personas mayores institucionalizadas. Por ello, se hace necesario realizar intervenciones con la finalidad de garantizar estos estándares. Entre las más diligentes y al mismo tiempo de bajo coste están el ofrecimiento de bebidas entre las comidas y la estimulación de los residentes para que beban más. Éstas conllevan un incremento de la IH de hasta el 81% (6,8,18–20). En este sentido, Godfrey y cols. (32) proponen que, para solventar los problemas de accesibilidad y de pérdida de memoria de los residentes, los profesionales y familiares deben insistir para que beban más, ya que cuando los residentes ingieren la misma cantidad distribuida a lo largo del día, realizan un esfuerzo físico y psicológico menor (33).

Además, ofrecer al residente una variedad de bebidas según sus preferencias también resulta efectivo para aumentar la IH (6,18,19). Tales resultados concuerdan con otros autores, los cuales afirman que el sabor influye en la motivación del residente para beber (13) y que ingerir lo que les gusta les evoca gratos recuerdos, aumentando sus ganas de beber (32).

En este sentido, la Sociedad Española de Geriatría y Gerontología (34) expone que el agua mineral natural es la opción más recomendable para mantener una correcta hidratación en las personas mayores. Igualmente, propone combinarla con alternativas que pueden ser más apetecibles como leche, zumos naturales, infusiones, caldos, sopas, entre otros. No obstante, y de acuerdo con los estudios analizados en esta revisión (6,18,19,21), la importancia no solo recae en el tipo de bebida consumida, sino en aspectos como la estimulación, la variabilidad, las preferencias de cada residente y la accesibilidad a ellas, que en su conjunto aumentarán la ingesta hídrica.

Por otro lado, la utilización de vasos de colores intensos en vez de bajo contraste también produce un aumento de la IH (21,22). Así pues, en los residentes con demencia, que tienen dificultad para distinguir los objetos del entorno, les ayudará a captar su atención (22). Sin embargo, los colores no solo influyen en el residente sino también en el personal sanitario. Por ejemplo, el rojo produce un efecto visual de alerta constante, lo que les hace recordar que tienen que darles de beber (35).

En cuanto a la efectividad de los suplementos orales, Welch y cols. (23) confirman que una solución de rehidratación oral basada en una composición de electrolitos mejora los resultados analíticos indicadores de deshidratación. Por lo tanto y de acuerdo con otros autores (36,37), los suplementos orales basados en carbohidratos y electrolitos resultan eficaces para mejorar los indicadores sanguíneos de deshidratación.

Finalmente, dado que la incontinencia es un factor que influye en la disminución de la IH, Simmons y cols. (6) y Spangler y cols. (19) adaptaron el horario de uso del servicio a las necesidades de cada residente y Schnelle y cols. (18) ofrecieron la posibilidad de acudir al baño y cambiar el pañal siempre que lo desearan, aumentando con ello la IH. En este sentido, la individualización de los cuidados en las personas mayores funcionalmente dependientes para ir al baño permite no modificar su IH por el temor a la incontinencia urinaria si no tienen tiempo de llegar al baño o por la desagradable sensación de convivir con el pañal y la ropa húmedas (4).

Intervenciones invasivas

Las intervenciones invasivas corresponden a aquellos procedimientos que agreden química o mecánicamente al cuerpo, como es el caso de la vía subcutánea e intravenosa. Según la revisión realizada, las intervenciones invasivas a nivel residencial se centran en la hidratación vía subcutánea (24,25). No obstante, Dasgupta y cols. (26), que compararon el efecto de la hidratación subcutánea e intravenosa, concluyen que a pesar de la efectividad de las dos técnicas, la hipodermoclisis provoca menos complicaciones en la zona de punción que la terapia intravenosa. A modo de ejemplo, investigaciones como la realizada por Duems y Ariño (38) demuestran que la terapia intravenosa provoca más extravasación, edema e infección local que la hipodermoclisis. Asimismo, la investigación realizada por O'Keeffe y Lavan (39) refleja que el 80% de los residentes con terapia intravenosa presentaron agitación relacionada con la infusión, frente al 37% de los pacientes con hipodermoclisis ($p = 0,005$).

Además, los pacientes perciben la hipodermoclisis como una técnica menos invasiva que la intravenosa (40) siendo, por lo tanto, el tratamiento de elección en situaciones no urgentes para residentes que requieren fluidos parenterales (26).

Limitaciones de la revisión

A nivel metodológico, las revisiones de la literatura científica pueden sesgar la información recogida, dependiendo de las bases de datos y las palabras clave utilizadas durante el proceso. No obstante, el presente estudio ha evaluado la mayor parte de la literatura existente mediante la realización de búsquedas sistematizadas en las tres bases de datos más importantes sobre el tema, en la literatura gris y en la bibliografía derivada de artículos científicos. Además, las estrategias de búsqueda se han construido considerando todos los sinónimos de las palabras clave y no se ha limitado el idioma ni la fecha de publicación.

En relación a la calidad de los estudios, su análisis en este tipo de revisión no es una prioridad (14). No obstante, se ha creído pertinente analizar el riesgo de sesgo de cada estudio incluido en la selección final para aportar una mayor calidad en la interpretación de los resultados. Así pues, aunque existan algunos estudios con el riesgo de sesgo alto, en su mayoría es medio, lo que aporta validez al análisis de los resultados.

Conclusiones

Esta revisión se centra en conocer qué intervenciones se llevan a cabo para el manejo de la deshidratación y la baja IH en las personas mayores institucionalizadas en residencias. Las intervenciones no invasivas están relacionadas con una asistencia individualizada, estimulación para beber más y ofrecer diferentes bebidas entre las comidas, siendo las invasivas la hidratación por vía subcutánea e intravenosa. Como resultados, se ha evidenciado una mayor efectividad y menores efectos adversos en las intervenciones no invasivas, en términos de aumento de la IH, mayor control de la incontinencia, disminución del consumo de laxantes, mejora de los parámetros analíticos y ausencia de efectos adversos.

Por último, cabe resaltar que aunque no se haya encontrado evidencia en el contexto residencial español, las intervenciones analizadas pueden abrir futuras líneas de investigación en España dada la factibilidad de su aplicación. Así pues, esta revisión puede ser la base para formular directrices y conseguir una correcta hidratación de las personas mayores institucionalizadas.

Financiación: El presente trabajo ha sido financiado por la “Ayuda puente para proyectos de investigación. Año 2017” de la Universidad de Lleida. La entidad patrocinadora ha dispuesto financiación para la publicación del trabajo.

Conflictos de intereses: ninguno

Referencias

1. Instituto Nacional de Estadística. Cifras de población. Población residente en España [Internet]. 2016 [citado 19 de agosto de 2017]. Disponible en: http://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176951&menu=ultiDatos&idp=1254735572981

2. Abellán García A, García Ayala A, Pujol Rodríguez R. Un perfil de las personas mayores en España, 2017. Indicadores estadísticos básicos. Madrid: Informes Envejecimiento en red no 15; 2017. p. 48.

3. Sociedad española de geriatría y gerontología (SEGG). Justificación, concepto e importancia de los síndromes geriátricos. En: Tratado de geriatría para residentes. 1ed ed. Madrid: International Marketing & Comunication. S.A.; 2007. p. 143–50.

4. Armstrong-Esther CA, Browne KD, Armstrong-Esther DC, Sander L. The institutionalized elderly: dry to the bone! Int J Nurs Stud. 1996;33(6):619–28. DOI: 10.1016/S0020-7489(96)00023-5.

5. Bunn D, Jimoh F, Wilsher SH, Hooper L. Increasing fluid intake and reducing dehydration risk in older people living in long-term care: a systematic review. J Am Med Dir Assoc. 2015;16(2):101–13. DOI: 10.1016/j.jamda.2014.10.016.

6. Simmons SF, Alessi C, Schnelle JF. An intervention to increase fluid intake in nursing home residents: prompting and preference compliance. J Am Geriatr Soc. 2001;49(7):926–33. DOI: 10.1046/j.1532-5415.2001.49183.x.

7. Reed PS, Zimmerman S, Sloane PD, Williams CS, Boustani M. Characteristics associated with low food and fluid intake in long-term care residents with dementia. Gerontologist. 2005;45(1):74–80. DOI: 10.1093/geront/45.suppl_1.74.

8. Mentes JC, Culp K. Reducing hydration-linked events in nursing home residents. Clin Nurs Res. 2003;12(3):210-25-8. DOI: 10.1177/1054773803252996.

9. Gaspar PM. Water intake of nursing home residents. J Gerontol Nurs. 1999;25(4):23–9. DOI: 10.3928/0098-9134-19990401-06.

10. Gómez Ayala A. Grandes síndromes geriátricos. Rev Farm Prof. 2005;19(6):70–4.

11. Kim S. Preventable hospitalizations of dehydration: implications of inadequate primary health care in the United States. Ann Epidemiol. 2007;17(9):736. DOI: 10.1016/j.annepidem.2007.07.043.

12. Xiao H, Barber J, Campbell ES. Economic burden of dehydration among hospitalized elderly patients. Am J Health Syst Pharm. 2004;61(23):2534–40.

13. Kayser-Jones J, Schell ES, Porter C, Barbaccia JC, Shaw H. Factors contributing to dehydration in nursing homes: inadequate staffing and lack of professional supervision. J Am Geriatr Soc. 1999;47(10):1187–94. DOI: 10.1111/j.1532-5415.1999.tb05198.x.

14. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19–32. DOI: 10.1080/1364557032000119616.

15. Urrútia G, Bonfill X. PRISMA declaration: A proposal to improve the publication of systematic reviews and meta-analyses. Med Clin (Barc). 2010;135(11):507–11. DOI: 10.1016/j.medcli.2010.01.015.

16. Higgins J, Green S, editores. Cochrane Handbook for Systematic Reviews of Intervention. version 5. The Cochrane Collaboration; 2011. p. 206-221.

17. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, y cols. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses [Internet]. 2007 [citado 30 de marzo de 2017]. Disponible en: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp

18. Schnelle JF, Leung FW, Rao SS, Beuscher L, Keeler E, Clift JW, y cols. A controlled trial of an intervention to improve urinary and fecal incontinence and constipation. J Am Geriatr Soc. 2010;58(8):1504–11. DOI: 10.1111/j.1532-5415.2010.02978.x.

19. Spangler PF, Risley TR, Bilyew DD. The management of dehydration and incontinence in nonambulatory geriatric patients. J Appl Behav Anal. 1984;17(3):397–401. DOI: 10.1901/jaba.1984.17-397.

20. Culp K, Mentes J, Wakefield B. Hydration and acute confusion in long-term care residents. West J Nurs Res. 2003;25(3):251–66; discusión 267–73. DOI: 10.1177/0193945902250409.

21. Robinson SB, Rosher RB. Can a beverage cart help improve hydration? Geriatr Nurs (Minneap). 2002;23(4):208–11. DOI: 10.1067/mgn.2002.126967.

22. Dunne TE, Neargarder SA, Cipolloni PB, Cronin-Golomb A. Visual contrast enhances food and liquid intake in advanced Alzheimer's disease. Clin Nutr. 2004;23(4):533–8. DOI: 10.1016/j.clnu.2003.09.015.

23. Welch IK, Campbell S, Crowley R. Oral hydration solution effects on fluid status of the elderly. J Nutr Elder. 1996;16(1):1–10. DOI: 10.1300/J052v16n01_01.

24. Arinzon Z, Feldman J, Fidelman Z, Gepstein R, Berner YN. Hypodermoclysis (subcutaneous infusion) effective mode of treatment of dehydration in long-term care patients. Arch Gerontol Geriatr. 2004;38(2):167–73. DOI: 10.1016/j.archger.2003.09.003.

25. Hussain NA, Warshaw G. Utility of clysis for hydration in nursing home residents. J Am Geriatr Soc. 1996;44(8):969–73. DOI: 10.1111/j.1532-5415.1996.tb01870.x.

26. Dasgupta M, Binns MA, Rochon PA. Subcutaneous fluid infusion in a long-term care setting. J Am Geriatr Soc. 2000;48(7):795–9. DOI: 10.1111/j.1532-5415.2000.tb04755.x.

27. Gaspar PM. Comparison of four standards for determining adequate water intake of nursing home residents. Res Theory Nurs Pr. 2011;25(1):11–22. DOI: 10.1891/0889-7182.25.1.11.

28. Skipper A. Monitoring and complications of enteral feeding. En: Skipper, A E, editor. Dietitian's Handbook of Enteral and Parenteral Nutrition. Rockville: Aspen Publishers; 1993. p. 298.

29. Hunt SA, Abraham WT, Chin MH, Feldman AM, Francis GS, Ganiats TG, y cols. 2009 Focused Update Incorporated Into the ACC/AHA 2005 Guidelines for the Diagnosis and Management of Heart Failure in Adults. J Am Coll Cardiol. 2009;53(15):e1–90. DOI: 10.1016/j.jacc.2008.11.013.

30. Mentes J. Oral hydration in older adults: greater awareness is needed in preventing, recognizing, and treating dehydration. Am J Nurs. 2006;106(6):40–49; quiz 50.

31. Holben DH, Hassell JT, Williams JL, Helle B. Fluid intake compared with established standards and symptoms of dehydration among elderly residents of a long-term-care facility. J Am Diet Assoc. 1999;99(11):1447–50. DOI: 10.1016/S0002-8223(99)00351-X.

32. Godfrey H, Cloete J, Dymond E, Long A. An exploration of the hydration care of older people: a qualitative study. Int J Nurs Stud. 2012 Oct;49(10):1200–11. DOI: 10.1016/j.ijnurstu.2012.04.009.

33. Schols JM, De Groot CP, van der Cammen TJ, Olde Rikkert MG. Preventing and treating dehydration in the elderly during periods of illness and warm weather. J Nutr Health Aging. 2009;13(2):150–7. DOI: 10.1007/s12603-009-0023-z.

34. Casado A, Garea E, Gil P, Moreno N, Ramos P, Rodríguez J. Guía de buena práctica clínica en Geriatría: hidratación y salud. Madrid: IMC; 2011

35. Hollis S. Using red jugs to improve hydration. Nurs Times. 2011;107(28):21.

36. Weinberg AD, Minaker KL. Dehydration. Evaluation in management in older adults. Council on Scientific Affairs American Medical Association. JAMA. 1995;274(19):1552–6. DOI: 10.1001/jama.1995.03530190066035..

37. Wotton K, Crannitch K, Munt R. Prevalence, risk factors and strategies to prevent dehydration in older adults. Contemp Nurse. 2008;31(1):44–56..

38. Duems Noriega O, Ariño Blasco S. Eficacia de la vía subcutánea frente a la hidratación intravenosa en el paciente anciano hospitalizado: estudio controlado aleatorizado. Rev Esp Geriatr Gerontol. 2014;49(3):103–7. DOI: 10.1016/J.REGG.2013.12.003.

39. O'Keeffe ST, Lavan JN. Subcutaneous fluids in elderly hospital patients with cognitive impairment. Gerontology. 1996;42(1):36–9. DOI: 10.1159/000213768.

40. Slesak G, Schnürle JW, Kinzel E, Jakob J, Dietz K. Comparison of subcutaneous and intravenous rehydration in geriatric patients: a randomized trial. J Am Geriatr Soc. 2003;51(2):155–60. DOI: 10.1046/j.1532-5415.2003.51052.x.

CHAPTER 5

General discussion

Capítulo 5. Discusión general

En primer lugar, es necesario destacar que el proyecto en el que se enmarca la presente tesis fue diseñado para conocer y analizar el problema de la deshidratación en personas mayores institucionalizadas que vivían en residencias geriátricas y, así, poder identificar las mejores prácticas para abordar dicha situación. De este modo, se propone la presente tesis como reflejo del primer estudio de estas características realizado hasta la actualidad en nuestro territorio, dado que no se ha encontrado evidencia sobre este tema en el sistema residencial español.

Para su desarrollo, se propusieron cuatro objetivos que corresponden a cada uno de los artículos realizados. A continuación, se expone detalladamente como surgieron cada uno de ellos.

Para la elaboración del cuestionario que se utilizaría para la recogida de datos del proyecto, era necesario conocer cuáles eran los factores de riesgo de la deshidratación en esta población (objetivo 1). Para ello, se desarrolló una *scoping review* (artículo I) que fue clave para definir las variables objeto de estudio.

Posteriormente, se llevó a cabo el estudio descriptivo y transversal que permitió conocer la magnitud de la deshidratación en una residencia de la ciudad de Lleida e identificar sus factores asociados (objetivo 2, artículo II). Uno de los resultados más destacados fue la asociación significativa entre la deshidratación y la baja ingesta hídrica. Conociendo la gran influencia que existe entre ambas condiciones, tal y como también se refleja en los resultados del artículo I, se consideró oportuno profundizar y analizar el problema de la baja ingesta hídrica para comprender mejor dicha relación.

Con la misma muestra, se estableció la prevalencia de la baja ingesta y se analizaron los factores que se asociaban a esta (objetivo 3, artículo III). Después de ver que había factores coincidentes con los resultados del artículo II y teniendo en cuenta que la baja ingesta hídrica es una de las principales causas de aparición de deshidratación, se consideró que lo más adecuado antes de diseñar una estrategia para su abordaje, era

conocer qué intervenciones se habían llevado a cabo hasta la fecha para mejorar la hidratación y la ingesta de líquidos en las personas mayores institucionalizadas. Con el fin de conocer estas acciones (objetivo 4), se llevó a cabo una *scoping review* (artículo IV).

1. Discusión de los resultados

A continuación se discuten los resultados de los cuatro artículos que componen la tesis de acuerdo con la prevalencia y los factores de la deshidratación, la relación entre la deshidratación y la baja ingesta hídrica, y las intervenciones para el manejo de ambas.

1.1. Prevalencia y factores asociados a la deshidratación

Para conocer la magnitud de la deshidratación y sus factores asociados se llevó a cabo una *scoping review* (artículo I) titulada *Risk factors associated with dehydration in older people living in nursing homes: Scoping review*. En ella se analizaron los estudios existentes que describían los factores asociados a la deshidratación en la población mayor institucionalizada. Al finalizar el proceso de selección de los artículos, sólo 16 cumplieron los criterios de inclusión señalados en la metodología. Los resultados fueron clasificados según la valoración geriátrica integral (VGI) (1), ya que esta permite su clasificación des de una perspectiva holística. A su vez, para estimar la prevalencia de deshidratación e identificar los factores asociados, se llevó a cabo un estudio descriptivo y transversal en personas mayores de 65 años institucionalizadas en una residencia de Lleida. Los resultados se describen de forma detallada en el artículo II "La deshidratación y sus factores asociados. Análisis de la realidad en una residencia de Lleida".

La prevalencia de deshidratación según los estudios incluidos en la *scoping review* osciló entre el 12% y el 50% (2–11). En cambio, en nuestro estudio, fue del 75,5% (IC 95% 65,5 – 85,5). La variabilidad de los resultados puede ser debida a que los estudios analizados en la revisión utilizaron diferentes métodos para su diagnóstico. No obstante, si se comparan las prevalencias medidas con el mismo parámetro que se

utilizó en nuestro estudio (BUN/Cr < 21), tenemos la prevalencia más elevada detectada hasta la fecha. Esta diferencia se cree que puede deberse al perfil del residente que vive en el sistema residencial español, el cual se caracteriza por tener un peor estado de salud, lo que puede conllevar un mayor riesgo de deshidratación.

En relación al primer componente de la VGI, el sociodemográfico, los factores identificados en la revisión fueron la edad y el sexo (mujer). No obstante, en nuestro estudio únicamente se asoció de manera independiente el ser mujer (OR = 9,37; IC 95% 2,15 – 40,87). La influencia de la edad radica en que durante el proceso de envejecimiento se exacerban los cambios físicos y fisiológicos que condicionan la capacidad de regulación hídrica (12). Sin embargo, se trata de un colectivo que se caracteriza por ser mayoritariamente femenino (13), en el que estos cambios se ven agravados (14) debido a la reducción del contenido total del agua corporal (22), lo que induce aún más a la deshidratación.

En referencia al componente clínico de la VGI, los factores de deshidratación coincidentes en ambos artículos fueron las UPP, la disfagia y la baja ingesta hídrica. En primer lugar y en relación a las UPP, en la revisión se identificó como factor el hecho de tener una UPP, por la pérdida insensible de líquido que esta comporta (15), mientras que en nuestro estudio fue el riesgo de padecerla (la variable “tener UPP” no había sido recogida). En este sentido, no se ha encontrado evidencia de que el riesgo sea un factor que provoque deshidratación, sino más bien una consecuencia de la misma (16), dado que provoca la fragilidad de la piel y por consiguiente que sea más susceptible a sufrir daños (17). No obstante, el diseño transversal del estudio no permite confirmar la direccionalidad de los datos.

El segundo factor a nivel clínico fue tener alterada la función de la deglución. Según nuestros resultados, los residentes con disfagia fueron cuatro veces más propensos a sufrir deshidratación (OR = 4,53; IC 95% 2,3 – 15,6), condición que coincide con los resultados mostrados en el estudio de Mentes y Wang (18) (OR = 3,7; IC 95% 1,3 – 10,8), identificado en la *scoping review*. La disfagia es un trastorno común en las personas mayores provocado por algunas de las patologías más prevalentes en este

colectivo: accidentes cerebrovasculares y enfermedades degenerativas (19–22), las cuales también fueron identificadas como factores de riesgo de la deshidratación en el artículo de revisión. Además, los residentes con disfagia necesitan espesar los líquidos antes de ingerirlos para garantizar la seguridad en la deglución. Para ello, utilizan espesantes comerciales que modifican el sabor original de las bebidas y las convierten en artificiales y poco agradables (23), hecho que provoca que las rehúsen y aumente el riesgo de deshidratación.

El último factor clínico de la deshidratación coincidente en ambos estudios fue tener una insuficiente ingesta hídrica (< 1.500ml/día), teniendo según nuestros resultados el doble de probabilidades de estar deshidratado (OR = 2,16; IC 95% 1,38 – 8,51). Esta relación se debe a que cuando una persona mayor no bebe una cantidad suficiente de líquidos se produce un aumento de los niveles séricos de Na^+, lo que repercute en el traspaso de líquidos de los compartimientos intracelulares a los extracelulares, provocando una deshidratación celular y, en consecuencia, una hipernatremia (24).

1.2. Relación entre la deshidratación y la baja ingesta hídrica

Dado que la baja ingesta hídrica resultó ser un factor asociado a la deshidratación en los artículos I y II, y los que estaban deshidratados ingerían menos líquidos en el artículo III (p = 0,017), en este apartado se analiza con más profundidad la relación entre ambas condiciones.

En el análisis de los factores asociados, se vio que los hay que coinciden en ambas situaciones, lo que refuerza dicha analogía. Estos fueron el riesgo de aparición de UPP y la disfagia. Referente al primero, dado que las dos provocan un efecto negativo en la calidad y resistencia de la piel, favorecen el riesgo de UPP (15). Y en relación a la disfagia, se asocia con que los residentes con este problema tienden a beber menos, tal y como se explica en el apartado anterior.

A pesar de que los resultados de la presente tesis confirman esta relación, se deben considerar como dos conceptos distintos. Este aspecto ya fue debatido en el artículo I,

ya que se detectó que muchos autores usaban indistintamente ambos términos. Por lo tanto, se hace necesario definirlos para clarificar dichos conceptos.

Por un lado, se considera deshidratación cuando se produce una alteración del balance electrolítico, causada por procesos agudos como vómitos, diarrea y pérdidas de sangre o, también, por un insuficiente aporte hídrico (25). Por otro, el término baja ingesta hídrica corresponde a una media diaria de líquidos inferior a la recomendada (26). Por lo tanto, una persona puede estar deshidratada ingiriendo los líquidos adecuados. Así pues, se podría decir que la baja ingesta hídrica es una de las causas de la aparición de deshidratación, pero no la única, por lo que no sería apropiado equiparar ambos términos. En este sentido, una revisión de Cochrane realizada Hooper y cols. (27) concluye que no se debe utilizar la baja ingesta hídrica como único determinante para evaluarla.

Finalmente, cabe destacar que son considerados un estándar de calidad en las residencias geriátricas (28). Kayser-Jones (29) expone que la deshidratación no se produce mayoritariamente por una enfermedad o por tomar diuréticos, sino porque el personal sanitario no proporciona una cantidad de líquidos suficiente para beber a los residentes. Además, Mukamel (30) analizó la calidad asistencial de 550 residencias del Estado de Nueva York, concluyendo que la deshidratación es un indicador clave en la calidad asistencial porque su presencia aporta información sobre si el residente tiene un acceso libre al agua o una atención inadecuada en el subministro de líquidos.

1.3. Intervenciones para el manejo de la deshidratación y la baja ingesta hídrica

Por último, se decidió realizar una *scoping review* para conocer qué intervenciones existían para el manejo de la deshidratación y la baja ingesta hídrica y su efectividad. Siguiendo los criterios de inclusión e exclusión expuestos en la metodología, solo se incluyeron 11 artículos del total de 3.379 identificados inicialmente. Las intervenciones analizadas se clasificaron según fuesen invasivas y no invasivas.

Por un lado, las intervenciones invasivas corresponden a aquellos procedimientos que terminan penetrando en el cuerpo humano. Según la revisión realizada, la mayoría de las intervenciones se centran en la hipodermocilisis, demostrando su gran efectividad en términos de mejora clínica y de los parámetros analíticos indicadores de deshidratación (31,32). Asimismo, el único estudio que ha comparado el efecto de la hidratación entre la vía subcutánea y la intravenosa, concluye que a pesar de que ambas técnicas son efectivas, la hipodermoclisis provoca menos complicaciones en la zona de punción (32). Además, otros estudios le atribuyen a la vía intravenosa más efectos adversos como son la extravasación de la vía, edema e infección local (33) y agitación del residente (34). Slesak y cols. (35) añaden que los pacientes aprecian la hipodermoclisis como la técnica menos invasiva. Por lo tanto, después de analizar toda la información, se recomienda la hipodermoclisis en las personas mayores institucionalizadas como tratamiento de elección cuando se precise una técnica invasiva no urgente (32).

Por otro lado, las intervenciones no invasivas corresponden a aquellos procedimientos que no agreden química o mecánicamente al cuerpo. De acuerdo con los resultados obtenidos, una forma de intervenir en la baja ingesta hídrica es ofrecer varias bebidas entre las comidas, ya que puede incrementarla en hasta un 81% (36–40). Esto se debe a que beber pocas cantidades de forma constante provoca un efecto físico y psicológico positivo en el residente. Además, es usual que el residente conviva con una dependencia funcional que le limite su capacidad para beber y le suponga un esfuerzo hacerlo de manera autónoma. Así pues, dividir la ingesta en diferentes momentos del día ayuda a disminuir el esfuerzo que tienen que hacer estos residentes (36).

Asimismo, también están dirigidas a reducir al máximo los efectos de la incontinencia urinaria (37,39). Su explicación radica en que los residentes funcionalmente dependientes para ir al baño sin deterioro cognitivo grave, dejan de beber por el temor a orinarse encima y convivir con la prenda húmeda durante horas antes de que el personal sanitario se las cambie (41). Así pues, se ha visto que si el residente puede acudir al baño frecuentemente y se le cambian los dispositivos para el control de la

incontinencia cuando estén húmedos (37–39), se consigue que la ingesta hídrica aumente considerablemente (399,24 ml/día SD: 186,31) (37).

Por otro lado, la revisión también refleja que existe acciones diligentes no invasivas que permiten aumentar la ingesta de líquidos de los residentes con demencia. En primer lugar, animarles para que beben más resultó la acción más efectiva para este colectivo en el estudio multicompomente de An Vandervoort (42). Esta estrategia permite recordar al residente que aún no ha bebido, dado que la memoria que se ve afectada en los primeros estadios de la enfermedad es la de corto plazo. Por otro lado, en esta *scoping review* también se vio que utilizar vasos de colores intensos tiene una gran efectividad (43,44). Esta efectividad se produce básicamente por dos razones. La primera se atribuye a que los colores intensos provocan una alerta constante para los profesionales sanitarios encargados de administrar las bebidas y para los familiares que colaboran en los cuidados (44). Y, en segundo lugar, los colores de tono alto influyen positivamente en una de las consecuencias de la demencia cuando al paciente le cuesta distinguir los objetos de su entorno. Con el uso de vasos de colores se capta más fácilmente su atención y tienden a beber más (45).

2. Limitaciones generales de los artículos

2.1. Limitaciones generales de las scoping reviews

A nivel metodológico, las *scoping reviews* (artículos I y IV) pueden mostrar sesgos por la información recopilada, en relación a las bases de datos y las palabras clave utilizadas durante el proceso. En todo caso, se cree que habiendo realizado la búsqueda de las dos revisiones en las tres bases de datos más importantes sobre esta temática, en la literatura gris y en la bibliografía derivada de los artículos seleccionados, se ha podido abarcar toda la información existente sobre el tema. Además, las estrategias de búsqueda han sido consensuadas por un grupo de expertos y se han construido teniendo en cuenta todos los sinónimos de las palabras clave. Igualmente, no se ha limitado el idioma o la fecha de publicación por la poca evidencia existente sobre esta temática.

En relación con la calidad de los estudios, es conocido que su análisis en este tipo de revisiones no es una prioridad (46). Sin embargo, se ha considerado pertinente analizar el riesgo de sesgo de cada estudio incluido en la selección final para proporcionar una mayor calidad en la interpretación de los resultados. Así pues, la calidad de los artículos es en su mayoría es media, por lo que contribuye a la validez del análisis de los resultados.

2.2. Limitaciones generales del estudio descriptivo y transversal

En relación al estudio descriptivo y transversal (artículos II y III), la primera limitación hace referencia al tipo de diseño del estudio. El análisis transversal de los datos no permite clarificar la dirección de la relación entre la deshidratación, la baja ingesta hídrica y sus factores asociados. No obstante, mediante la evidencia y la explicación teórica de los factores, se ha podido interpretar la relación causal entre ellos.

La segunda limitación fue la falta de consenso existente en el estándar para el diagnóstico de la deshidratación en las personas mayores. Asimismo, en el caso de los parámetros analíticos tampoco existe consenso en el punto de corte para determinarla. Para combatirlo, se seleccionó uno de los parámetros analíticos más usados para detectar la deshidratación en gente mayor, el BUN/Cr (5).

Finalmente, aunque quizá no es una limitación como tal, bien es cierto que la muestra del estudio es reducida, lo que limita la posibilidad de generalizar los hallazgos y restringe el poder de los resultados obtenidos. No obstante, al no encontrarse evidencia en nuestro contexto sobre el problema de la deshidratación en personas mayores institucionalizadas, se considera que los resultados aportados pueden servir de base para futuras investigaciones.

Referencias

1. Stuck AE, Siu AL, Wieland GD, Adams J, Rubenstein LZ. Comprehensive geriatric assessment: a meta-analysis of controlled trials. Lancet. 1993;342(8878):1032–6.
2. Mentes JC. A typology of oral hydration problems exhibited by frail nursing home residents. J Gerontol Nurs. 2006;32(1):13-9-1.
3. Léger JM, Moulias R, Robert P, Vellas B, Chapuy PH, Monfort JC, et al. Agitation and aggressiveness among the elderly population living in nursing or retirement homes in France. Int Psychogeriatrics. 2002;14(4):405–16.
4. Wolff A, Stuckler D, McKee M. Are patients admitted to hospitals from care homes dehydrated? A retrospective analysis of hypernatraemia and in-hospital mortality. J R Soc Med. 2015;108(7):259–65.
5. Culp KR, Wakefield B, Dyck MJ, Cacchione PZ, DeCrane S, Decker S. Bioelectrical impedance analysis and other hydration parameters as risk factors for delirium in rural nursing home residents. J Gerontol A Biol Sci Med Sci. 2004;59(8):813–7.
6. Cacchione PZ, Culp K, Laing J, Tripp-Reimer T. Clinical profile of acute confusion in the long-term care setting. Clin Nurs Res. 2003;12(2):145–58.
7. Ellershaw JE, Sutcliffe JM, Saunders CM. Dehydration and the dying patient. J Pain Symptom Manage. 1995;10(3):192–7.
8. Holben DH, Hassell JT, Williams JL, Helle B. Fluid intake compared with established standards and symptoms of dehydration among elderly residents of a long-term-care facility. J Am Diet Assoc. 1999;99(11):1447–50.
9. Wu SJ, Wang HH, Yeh SH, Wang YH, Yang YM. Hydration status of nursing home residents in Taiwan: a cross-sectional study. J Adv Nurs. 2011;67(3):583–90.
10. Koopmans R, van der Sterren K, van der Steen J. The 'natural' endpoint of dementia: death from cachexia or dehydration following palliative care? Int J Geriatr Psychiatry. 2007;22(4):350–5.
11. Hooper L, Bunn DK, Downing A, Jimoh FO, Groves J, Free C, et al. Which frail older people are dehydrated? The UK DRIE study. J Gerontol A Biol Sci Med Sci. 2016;71(10):1341–7.
12. Davies I, O'Neill PA, McLean KA, Catania J, Bennett D. Age-associated alterations

in thirst and arginine vasopressin in response to a water or sodium load. Age Ageing. 1995;24(2):151–9.

13. Zueras Castillo M, Ajenjo Cosp P. Persones grans institucionalitzades a Catalunya: quantes són i com són? Artic Rev Catalana Sociol. 2016;31(2):5–23.
14. Tannen A, Schü Tz T, Smoliner C, Dassen T, Lahmann N. Care problems and nursing interventions related to oral intake in German Nursing homes and hospitals: A descriptive mulitcentre study. Int J Nurs Stud. 2011;49(4):378–85.
15. Spector WD, Fortinsky RH. Pressure ulcer prevalence in Ohio nursing homes: Clinical and facility correlates. J Aging Health. 1998;10(1):62–80.
16. Rolland Y, Kim MJ, Gammack JK, Wilson MM, Thomas DR, Morley JE. Office management of weight loss in older persons. Am J Med. 2006;119(2):1019–26.
17. Pressure ulcers. Two major concerns: involuntary weight loss and dehydration. Health Care Food Nutr Focus [Internet]. 2002 Sep [cited 2017 Jan 10];19(1):11–2. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12233228
18. Mentes JC, Wang J. Measuring risk for dehydration in nursing home residents: evaluation of the dehydration risk appraisal checklist. Res Gerontol Nurs. 2011;4(2):148–56.
19. Mentes JC, Wang J. Measuring risk for dehydration in nursing home residents: evaluation of the dehydration risk appraisal checklist. Res Gerontol Nurs. 2011;4(2):148–56.
20. Kayser-Jones J, Schell ES, Porter C, Barbaccia JC, Shaw H. Factors contributing to dehydration in nursing homes: inadequate staffing and lack of professional supervision. J Am Geriatr Soc. 1999;47(10):1187–94.
21. Leibovitz A, Baumoehl Y, Lubart E, Yaina A, Platinovitz N, Segal R. Dehydration among long-term care elderly patients with oropharyngeal dysphagia. Gerontology. 2007;53(4):179–83.
22. Abellán García A, García Ayala A, Pujol Rodríguez R. Un perfil de las personas mayores en España, 2017. Indicadores estadísticos básicos. Madrid: Informes Envejecimiento en red n^{o} 15; 2017. 48 p.
23. Garcia JM, Chambers 4th E, Molander M. Thickened liquids: Practice patterns of speech-language pathologists. Am J Speech-Language Pathol. 2005;14(1):4–13.
24. Koch CA, Fulop T. Clinical aspects of changes in water and sodium homeostasis

in the elderly. Rev Endocr Metab Disord. 2017;18(1):49–66.

25. Bennett JA, Thomas V, Riegel B. Unrecognized chronic dehydration in older adults: examining prevalence rate and risk factors. J Gerontol Nurs. 2004;30(11):22–8.
26. Gaspar PM. Comparison of four standards for determining adequate water intake of nursing home residents. Res Theory Nurs Pr. 2011;25(1):11–22.
27. Hooper L, Abdelhamid A, Attreed NJ, Campbell WW, Channell AM, Chassagne P, et al. Clinical symptoms, signs and tests for identification of impending and current water-loss dehydration in older people. Cochrane database Syst Rev. 2015;(4):CD009647.
28. Jensdóttir AB, Rantz M, Hjaltadóttir I, Gudmundsdòttir H, Rook M, Grando V. International comparison of quality indicators in United States, Icelandic and Canadian nursing facilities. Int Nurs Rev. 2003;50(2):79–84.
29. Kayser-Jones J. Malnutrition, dehydration, and starvation in the midst of plenty: the political impact of qualitative inquiry. Qual Health Res. 2002;12(10):1391–405.
30. Mukamel DB. Risk-adjusted outcome measures and quality of care in nursing homes. Med Care. 1997;35(4):367–85.
31. Arinzon Z, Feldman J, Fidelman Z, Gepstein R, Berner YN. Hypodermoclysis (subcutaneous infusion) effective mode of treatment of dehydration in long-term care patients. Arch Gerontol Geriatr. 2004;38(2):167–73.
32. Dasgupta M, Binns MA, Rochon PA. Subcutaneous fluid infusion in a long-term care setting. J Am Geriatr Soc. 2000;48(7):795–9.
33. Duems Noriega O, Ariño Blasco S. Eficacia de la vía subcutánea frente a la hidratación intravenosa en el paciente anciano hospitalizado: estudio controlado aleatorizado. Rev Esp Geriatr Gerontol. 2014;49(3):103–7.
34. O'Keeffe ST, Lavan JN. Subcutaneous fluids in elderly hospital patients with cognitive impairment. Gerontology. 1996;42(1):36–9.
35. Slesak G, Schnürle JW, Kinzel E, Jakob J, Dietz K. Comparison of subcutaneous and intravenous rehydration in geriatric patients: a randomized trial. J Am Geriatr Soc. 2003;51(2):155–60.
36. Culp K, Mentes J, Wakefield B. Hydration and acute confusion in long-term care

residents. West J Nurs Res. 2003;25(3):251–66; discussion 267–73.

37. Schnelle JF, Leung FW, Rao SS, Beuscher L, Keeler E, Clift JW, et al. A controlled trial of an intervention to improve urinary and fecal incontinence and constipation. J Am Geriatr Soc. 2010;58(8):1504–11.

38. Simmons SF, Alessi C, Schnelle JF. An intervention to increase fluid intake in nursing home residents: prompting and preference compliance. J Am Geriatr Soc. 2001;49(7):926–33.

39. Spangler PF, Risley TR, Bilyew DD. The management of dehydration and incontinence in nonambulatory geriatric patients. J Appl Behav Anal. 1984;17(3):397–401.

40. Mentes JC, Culp K. Reducing hydration-linked events in nursing home residents. Clin Nurs Res. 2003;12(3):210-25-8.

41. Armstrong-Esther CA, Browne KD, Armstrong-Esther DC, Sander L. The institutionalized elderly: dry to the bone! Int J Nurs Stud. 1996;33(6):619–28.

42. An Vandervoort MA, Van den Block L, van der Steen JT, Volicer L, Vander Stichele R, Houttekier D, et al. Nursing home residents dying with dementia in Flanders, Belgium: a nationwide postmortem study on clinical characteristics and quality of dying. J Am Med Dir Assoc. 2013;14(7):485–92.

43. Robinson SB, Rosher RB. Can a beverage cart help improve hydration? Geriatr Nurs. 2002;23(4):208–11.

44. Dunne TE, Neargarder SA, Cipolloni PB, Cronin-Golomb A. Visual contrast enhances food and liquid intake in advanced Alzheimer's disease. Clin Nutr. 2004;23(4):533–8.

45. Hollis S. Using red jugs to improve hydration. Nurs Times. 2011;107(28):21.

46. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19–32.

CHAPTER 6

Conclusions

Chapter 6. Conclusions

In this chapter the conclusions of the thesis are shown, responding to each one of the proposed objectives:

Objective 1: To identify and assess the risk factors associated with dehydration in older people living in nursing homes on an international level (paper I).

- The elements interacted with dehydration were related to sociodemographic, clinical, functional, mental and social factors.
- The factors that were most frequently identified were: age, sex, infections, end-of-life situation and dementia.
- Chiefly, the most prevalent factors cannot be modified and are related to the physiology of aging.

Objective 2: To estimate the prevalence of dehydration and identify the factors associated with it in the older people living in an assisted nursing home in Lleida (paper II).

- The prevalence of dehydration in the sample studied was 75.5% (95% CI 65.5-85.5).
- The factors that were associated independently with dehydration were being female, having a low fluid intake, the risk of suffering from pressure ulcers and dysphagia.

Objective 3: To establish the prevalence of low fluid intake in institutionalised older residents in Lleida and to analyse the factors associated with this (paper III).

- 34% of the sample drank less than 1500 mL/day and 94.3% did not ingest the individualised recommendation calculated according to Skipper's formula.
- The factors associated with low fluid intake were: cognitive and functional impairment, the risk of suffering from pressure ulcers, malnutrition, eating a textured diet, dysphagia to liquids, safety problems on swallowing and dehydration.

Objective 4: To identify and evaluate the interventions carried out for the management of dehydration and low fluid intake in older people living in nursing homes on an international level (paper IV).

- The interventions were classified according to whether they were invasive or non-invasive. The invasive ones were intravenous and/or subcutaneous fluid therapy. The non-invasive ones were focused on individualised assistance, the stimulation to drink more and taking into account the preferences of each resident.
- Both types of intervention have a positive effect on improving hydration. However, the non-invasive ones have been confirmed to be more efficient, because they have a greater control of incontinence, decrease the consumption of laxatives, improve the analytical parameters and also they do not present adverse effects.

CHAPTER 7

Health implications

Chapter 7. Health implications

After having analysed dehydration and low fluid intake problems in greater depth, it is believed that the practical utility of the results of this thesis can affect five fundamental areas of clinical practice and care:

1. **Knowledge of the magnitude of dehydration and low fluid intake.** Currently, dehydration is not being evaluated, and residents' daily fluid intake is not recorded in the Spanish nursing home system. The data presented in this doctoral thesis emphasize the importance of evaluating dehydration and low fluid intake. Therefore, it is believed that both conditions should be included in the health status assessments carried out by the nursing staff.

   Therefore, it is also understood that they are not being intervened on. With the present thesis, these problems have been quantified, which will make health professionals in these institutions aware of the importance of their detection and stimulate them to change their clinical practice.
2. **Identify the factors associated with dehydration and low fluid intake.** With the identification of the factors associated with both conditions, strategies centred on them can be designed. These will lead to a reduction in the consequences they cause in the residents, and, thus, improve the quality of the care provided.
3. **Design of an intervention based on the factors detected.** As can be seen in the results of the scoping review about the approach to dehydration and low fluid intake, it is possible to formulate future lines of research with diligent and low-cost actions that take into account the factors that are associated with both conditions. They can be highly effective to improve the hydration status of the resident. In this respect, this nursing home and the research team are working to carry out a quasi-experimental study to improve the fluid intake of its residents.
4. **Development of an evidence-based clinical practice guide.** The knowledge of the magnitude of the dehydration problem and its factors can be used as a basis for the establishment of guidelines for the improvement of the practice in

institutions. This knowledge can allow "Guides of Clinical practice" to be designed, incorporating efficient management models focused on the patient.

5. **Dissemination at other care levels.** Given that dehydration is also a prevalent problem in hospitalised older people, the results will be reported to the different hospital services that take care of this type of patient. They will thus be able to take it into account to improve the quality of care of their services.

Regarding social and healthcare policies, the *Plan Estatal de Investigación Científica y Técnica y de Innovación 2017-2020*, on the challenge in health, demographic change and well-being, highlights as fundamental aspects that should be considered: (a) the investigation of diseases with higher prevalence; (b) clinical research of human diseases; (c) public health and health services; (d) the rehabilitation and development of assisted environments aimed at addressing chronicity; (f) the biological basis of the disease and (g) the development of nanomedicine and personalized medicine in which the challenge is to treat the individual and not the disease. In this respect, the results of this thesis provide the essential information to establish the bases that can be used to design new strategies to provide adequate hydration in the elderly. In this way, the Spanish residential system will be able to maximize resources to implement activities aimed at preventing and detecting early dehydration. Moreover, in the long term, these results can allow an extension of the culture of health and, finally, a reduction in the burden of the disease on the whole of society.

Finally, it can be said that a greater efficiency in the attention, identifying the problems and planning the care centred on the residents would contribute to a better management of the health cost and to a greater well-being of the attended population. In addition, the integration of research into clinical practice would favour a higher quality of health services, with efficient prevention, diagnosis and treatment, as well as more ethical and individualised care for residents.

CHAPTER 8

Appendix

Chapter 8. Appendix

Appendix 1. A comprehensive nursing assessment checklist to identify residents at high risk of decreased fluid intake

I. Symptoms of dehydration warranting immediate medical and nursing interventions		Fever		Increased lethargy
		Thirst (not reliable indicator in elders)		Daily weight loss
		Dry warm skin		Increased confusion, greater than usual
		Dry mucous membranes		Change in baseline mental function
		More than one lengthwise division of the tongue (furrowed)		Constipation
		Decreased urinary output		Sunken eyes (severe dehydration)
		Concentrated urine		Tachycardia (severe dehydration)
		Muscular weakness		Hypotension (severe dehydration)
		Diminished skin turgor less than usual baseline (test over sternum or forehead		
II. Factors associated with hydration problems		Age 85 or older		Fluid intake of ≤ 1500ml (do not include caffeinated drinks) Attach 2 to 3 days of intake and output_____
		Physical immobility		Documented impaired oral intake over the past 1 to 2 weeks
		Current dysphagia; mechanical problems in swallowing		Currently on intake and output monitoring
		Cognitive impairment (unable to request fluids; unaware of thirst)		Resident spends most of the day outdoors in dry and hot temperatures 27ºC or warmer

II. Factors associated with hydration problems		Incontinent of urine			Resident is active or exercises for at least 30 minutes daily of every other day	
III. Problems increasing vulnerability	**Medical**		Hypertension			Central nervous system disorders
			Kidney disease			Osteoarthritis
			Congestive heart failure			Osteoporosis
			Any type of dementia			Uncontrolled diabetes
	Dietary restrictions		Fluids			Potassium
			Salt			Protein
	Medications		Diuretics	List:		
			Tricyclic antidepressants or lithium	List:		
			Regular use of laxatives	List:		
	Medical history		Dehydration			Vomiting
			Fever			Infections
			Diarrhoea			Difficulty swallowing
	Immediate return from		One day or greater hospitalization			Eye surgery
			Diagnostic testing requiring use of dyes			One-day clinic visit
			Dental surgery			Any test requiring administration of nothing by mouth after midnight
IV. Laboratory reports showing steady increases in		Sodium			Haematocrit	
		Serum blood urea nitrogen			Serum osmolality	
		Creatinine			Urine specific gravity	

Appendix 2. Dehydration risk appraisal checklist

		Absent	Present
Personal factors	1. Age older than 85		
	2. Female gender		
Significant health conditions / situations	3. Cognitively impaired (MMSE score <24)		
	4. Depression (GDS score >6)		
	5. Semi-dependent in ADLs		
	6. Urinary incontinence		
	7. Diabetes*		
	8. Congestive heart failure*		
	9. Dementia diagnosis		
	10. Cerebrovascular accident*		
	11. Major psychiatric disorders*		
	12. Renal disease*		
	13. ≥4 chronic health conditions*		
	14. Malnutrition*		
	15. Repeated infections		
	16. History of dehydration		
	17. Fluid intake <1500 mL/day*		
	18. Fever*		
	19. Vomiting or diarrhoea*		
	20. Nothing-by-mouth status *		
Intake behaviours	21. Has difficulty swallowing / chokes		
	22. Abnormal body mass index (BMI < 21 o > 27)		
	23. Poor eater (eats < 50% of food)		
	24. Receiving IV fluid therapy*		
	25. Receives tube feedings*		
	26. Requires assistance to drink		
	27. Can drink independently but forgets		
	28. Holds food / fluid in mouth*		
	29. Drools*		
	30. Spills out food / fluid*		
	31. Spits out food / fluid*		
Medications	32. > 4 medications*		
	33. Diuretics		
	34. Psychotropic: antipsychotic, antidepressants, anxiolytics		
	35. Laxatives		
	36. Steroids*		
Laboratory abnormalities	37. Urine specific gravity > 1.020*		
	38. Urine colour dark yellow > 4*		
	39. BUN/Creatinine > 20:1*		
	40. Serum sodium > 150meq/L*		
	41. Serum osmolality > 300mmol/Kg*		
	42. Haematocrit > normal*		

* It is a component of the original sacle; MMSE = Mini-Mental State Examination; GDS = Geriatric Depression Scale; ADLs = activities of daily living.

Appendix 3. Geriatric dehydration screening tool

1. Record systolic blood pressure (SBP) in a lying position:

If sitting, need to be supine for more than 2 min, SBP on lying = _____ (mmHg)

If able, ask client to stand during the following questions:

2. Inspection of tongue for dryness

- □ Normal
- □ Dry
- □ Very dry
- □ Unable to complete

3. Sternum skin turgor (timed using a second hand) upon pinching, note the number of seconds for skin to return to normal

- □ 0 or 1 s
- □ 2 or more seconds
- □ Unable to complete

4. Do you ever feel thirsty?

- □ Yes
- □ No
- □ Unable to complete

5. Did you feel thirsty yesterday?

- □ Yes
- □ No
- □ Unable to complete

6. Do you have difficulty moving your shoulders, arms or hands?

- □ Yes
- □ No
- □ Unable to complete

7. In the past 2 weeks, did pain interfere with your daily activities?

- □ Yes
- □ No

- Unable to complete

8. In the past 2 weeks did you have problems with pain of any kind?

- Yes
- No
- Unable to complete

9. In the last 2 weeks, did you drop something?

- Yes
- No
- Unable to complete

10. How many times have you had a headache in the past week?

- On 1 < occasions
- No occasions
- Unable to complete

11. Once 2 min has elapsed since standing, record SBP in the standing position: client can now be seated again SBP on standing: _____ (mmHg)

12. The change in SBP on standing

- No, or increase
- Decrease up to 20 mmHg
- Decrease 20–29 mmHg
- Decrease 30 mmHg or more
- Unable to complete

13. Weight (measured)

- If female:

- 50 kg or more
- Under 50 kg

- If male:

- 70 kg or more
- Under 70 kg
- Unable to complete

Appendix 4. Residència i Center de Dia per a Gent Gran Lleida-Balàfia authorisation

Generalitat de Catalunya
Institut Català d'Assistència i Serveis Socials
Residència i Centre de Dia per a Gent Gran Lleida-Balàfia

Gestió de Serveis Sanitaris

Dra. Ma. Teresa Botigué
Departament d'Infermeria
Universitat de Lleida

Estimada Dra. Botigué,

Una vegada valorat el projecte d'investigació **"Prevalença i factors de risc de la deshidratació en usuaris/àries institucionalitzats en residències assistides de gent gran**, accepto que es desenvolupi en la Residència i Centre de Dia per a Gent Gran Lleida – Balàfia, gestionada per l'empresa pública del Departament de Salut de la Generalitat de Catalunya, Gestió de Serveis Sanitaris.

Atentament,

Pilar Sanmartin Saura
Directora de l'Àrea Social
Gestió de Serveis Sanitaris

Appendix 5. The University Hospital Arnau de Vilanova Clinical Research Ethics Committee of Lleida report

Institut Català de la Salut
Hospital Universitari
Arnau de Vilanova

El Comité Ético de Investigación Clínica en la reunión de 26 de noviembre de 2015, acta 11/2015, informó favorablemente la solicitud del proyecto de investigación titulado: **"Prevalença i factors de risc de la deshidratació en usuaris institucionalitzats en residències assistides de gent gran"**, con la Dra. Mª Teresa Botigué como investigadora en la Facultat d'infermeria de la UdL, y consideró que:

- Se cumplen los requisitos necesarios de idoneidad del protocolo en relación a los objetivos del estudio y que están justificados los riesgos y molestias previsibles para los sujetos participantes.
- La capacitad del investigador y los medios de que dispone son apropiados para llevar a cabo el estudio.
- Es adecuado el procedimiento para obtener el consentimiento informado de los sujetos que participan en el estudio.

Lleida, 17 de diciembre de 2015

Joan Antoni Schoenenberger
Presidente

Generalitat de Catalunya
Departament de Salut

Appendix 6. Informative sheet

HOJA INFORMATIVA PARA EL RESIDENTE / FAMILIAR

TÍTULO DEL ESTUDIO: Prevalencia y factores de riesgo de la deshidratación en usuarios institucionalizados en residencias asistidas para personas mayores

INVESTIGADORA PRINCIPAL: Dra. Teresa Botigué Satorra. Profesora del Departamento de Enfermería y Fisioterapia de la Universidad de Lleida.

Nos dirigimos a usted para informarle sobre un estudio de investigación y para invitarle a participar. Nuestra intención es sólo que usted reciba la información correcta y suficiente para que pueda evaluar y juzgar, si quiere o no participar en este estudio. Por ello, le ruego que lea esta hoja informativa con atención, pudiendo consultar con las personas que considere oportunas, y nosotros le aclararemos las dudas que le puedan surgir.

Debe saber que su participación en este estudio es voluntaria y que puede decidir no participar o cambiar su decisión y retirar su consentimiento en cualquier momento.

El estudio consiste en describir la prevalencia y los factores de riesgo de la deshidratación en los pacientes que están institucionalizados en la "Residència i Centre de Dia per a Gent Gran Lleida-Balàfia" ubicada en la ciudad de Lleida y conocer la valoración que hacen los profesionales asistenciales de atención directa de la situación de los residentes en cuanto a la deshidratación.

En este sentido, se recogerá de cada residente la edad, el sexo, el estado civil, el nivel de estudios y los años de institucionalización. Referente a la salud, también se recogerán datos relacionados con la comorbilidad, el deterioro cognitivo, la discapacidad básica, el estado nutricional, la ingesta hídrica diaria y la disfagia. Por otra parte, se medirá el peso, la talla, el índice de masa corporal, la circunferencia de la pantorrilla y del brazo y se observarán los parámetros analíticos de los últimos 6 meses.

Cada uno de los datos de los pacientes se recogerá a través de la historia clínica personalizada e informatizada del centro. En caso de que alguno de los datos necesitas comprobación o no se hubiera valorado previamente, será valorada in situ.

En ningún caso, el estudio podrá comportar peligro adicional para su salud. En el caso de que usted no pudiera beneficiarse de los posibles avances que aporte nuestra investigación, sí

podrán ser importantes para otros pacientes el futuro. En todo caso, si aparecen resultados que puedan ser importantes para usted, le serán dados a conocer.
Todos los registros o datos que pudieran identificarlo serán protegidos con acceso estrictamente restringido a su archivo. Sólo el número de participante le identificará en el tratamiento y análisis de esta información.

El tratamiento, la comunicación y la cesión de los datos de carácter personal de todos los sujetos participantes se ajustará a lo dispuesto en la Ley Orgánica 15/99 de 13 de diciembre de protección de datos de carácter personal. De acuerdo a lo que establece la legislación mencionada, usted puede ejercer los derechos de acceso, modificación, oposición y cancelación de los datos. Los datos recogidos para el estudio estarán identificadas mediante un código numérico y solamente los miembros del equipo de investigación podrán relacionar estos datos con usted y con su historia clínica. Por lo tanto, su identidad no será revelada a ninguna persona.

Appendix 7. Informed consent

Yo,....., en representación de:

- ☐ .....
- ☐ yo mismo

He leído la hoja de información que se me ha entregado.

He podido hacer preguntas sobre el estudio.

He recibido suficiente información sobre el estudio.

He hablado con: .....

Comprendo que mi participación es voluntaria.

Comprendo que puedo retirarme del estudio:

- Cuando quiera.
- Sin tener que dar explicaciones.
- Sin que esto repercuta en mis cuidados médicos.

Presto libremente mi conformidad pera participar en el estudio,

Fecha: .....

Firma:

.....