

**General nutritional recommendations
in care of neurological elderly
patients with dysphagia**
Nursing based recommendations

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| Abstract <p>Ageing is a current and prevalent phenomenon within global populations. Neurological disorders compose a majority of geriatric syndromes and hence a high prevalence of dysphagia among aging (60+ years) adults. Even though patients with neurological illnesses with dysphagia usually suffer of malnutrition and dehydration, still these consequences are underdiagnosed and often untreated; leading the elderly people with neurological dysphagia to poor health outcomes and even morbidity.</p> <p>The aim of the study is to evaluate dysphagia and nutrition in elderly patients with neurological problems. The purpose of the article is to gather information about general nursing intervention to tackle the dysphagia challenges in elderly neurological patients, and thus, maintain an optimal nutritional intake.</p> <p>Research data was collected from four databases; Cinahl Plus full-text, Cochrane Library, Medline and PubMed. Moreover, open access Google Scholar database was used to search additional articles. Using an elaborate inclusion and exclusion criteria and through a thorough critical analysis of obtained data, 13 articles qualified for the review. Data analysis and generation of results was conducted using content analysis.</p> <p>The results were assorted in three main categories: facilitating swallowing of different food consistency for elderly with neurological dysphagia, implementing various tube feeding methods and continuous evaluation of nutritional care needed. The applicability of the results has to be taken cautiously because of the wide range of illness that the word "neurological disorders" comprise. Consequently, additional research is needed to determine specific characteristics of each and one of neurological illnesses and the individual effect in the swallowing process.</p> | | |
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1 Introduction

Dysphagia is most common in the elderly (60+ years) and is frequently considered the cause of malnutrition and dehydration (Barczi, Sullivan & Robbins 2000, 347-364; Bhattacharyya 2014, 765-769; Clavé & Shaker 2015, 259-270; Sura, Madhavan, Carnaby, & Crary 2012, 287-298; Baijens, Clavé, Cras, Ekberg, Forster, Kolb, Leners, Masi-ero, Mateos-Nozal, Ortega, Smithard, Speyer & Walshe 2016, 1403-1428; WHO 2002). Considered as a geriatric syndrome, the prevalence of dysphagia increases with age, due to which it is usually found among institutionalized people such in hospitals, nursing homes and geriatric acute cares.

Due to mass ageing of the population, dysphagia affects many people at a time. This in return leads to substantial morbidity and poor health outcomes. (Baijens et al. 2016, 1403-1428.) Dysphagia is usually a resultant symptom caused by a pre-existing incurable neurological illness/state (NHS, 2018). The treatment usually requires a life-long diet adaptation; a modification in the consistence of the meal. In consequence, it is important for the nurses to learn to modify meals for dysphagic patients. Having the knowledge of neurological disorders causing dysphagia in elderly, the nurse should be able to adapt the menu to meet elderly's nutritional needs. (García & Chambers 2010, 26-33.) The aim of this thesis is to summarize different methods that will maintain an optimal nutritional intake in elderly suffering from neurological dysphagia (ibid., 2010-26-33).

2 Neurological disorders and dysphagia in elderly

Because of the ageing of the population in western countries, the neurological disorders are highly prevalent in elderly, which have dysphagia as a side symptom (Riggs 1998, 556-560). Multitude adverse health conditions can affect the swallowing process in the elderly: neurological disorders, rheumatoid diseases, tumors involving the aerodigestive tract, metabolic deficits and respiratory compromises are some of the diseases that can lead into dysphagia (Sura et al. 2012, 287–298).

The world health organization (WHO) has defined neurological disorders as “diseases of the central and peripheral nervous system” in other words, diseases of the brain, spinal cord, cranial nerves, peripheral nerves, nerve roots, autonomic nervous system, neuromuscular junction and muscles. These disorders include “epilepsy, Alzheimer’s disease and other dementias, cerebrovascular diseases including stroke, migraine and other headache disorders, multiple sclerosis, Parkinson's disease, neuroinfectious, brain tumors, traumatic disorders of the nervous system due to head trauma, and malnutrition.” (WHO, 2016.)

2.1 Dysphagia

Dysphagia is defined as the difficulty to move the food and liquid from the mouth to the stomach. It can be caused by a wide range of structural and functional inadequacies of the oral cavity, pharynx, larynx and esophagus. To establish an optimal treatment, it has to be understood how the normal swallowing process is and how the movements differs between eating solid food and drinking liquid. (Matsuo & Palmer 2009, 691-707.)

Swallowing and eating process includes more than 30 nerves and muscles. The physiology of natural eating and swallowing is divided into; oral stage, that includes oral preparatory stage and oral propulsive stage, pharyngeal stage and esophageal stage. (ibid., 691-707.)

Oral stage takes place when a liquid and/or solid is led to the mouth. When ingesting liquid food, the tongue holds the bolus against the posterior palate creating a sealed tongue-palate cavity (figure 1). In contrast, when a solid food is taken into the mouth, the tongue, soft palate and jaw keeps the posterior oral cavity without sealing during eating (figure 2). Once the food is suitable for swallowing, it is placed on the tongue surface and propelled to the oropharynx. (ibid., 691-707.)

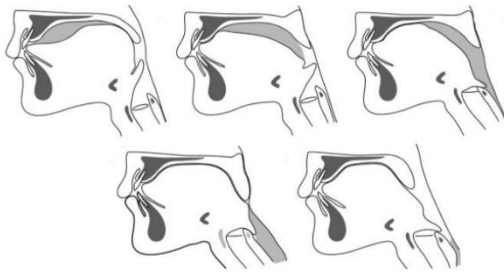


Figure 1. Swallowing process of solid

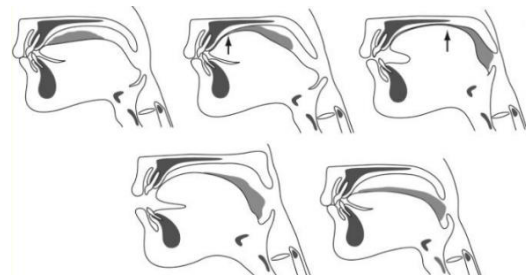


Figure 2. Swallowing process of liquid

Pharyngeal stage is referred to the bolus passage through the pharynx to the esophagus, while closing the nasopharynx protecting the food entering to the larynx and trachea with no aspiration. (ibid., 691-707.) Esophageal stage is the transition of the bolus to the stomach by peristaltic relaxation and contraction waves regulated by the autonomic system (ibid., 691-707).

Functional or structural deficits in the oral cavity, pharynx, larynx, esophagus, or esophageal can happen in dysphagia. While the severity can differ from abnormal difficulty, effort, pain, choking and aspiration to a total inability to swallow. This can cause severe complications such as malnutrition, dehydration, respiratory infections, pneumonia and increased remissions, institutionalization, and morbimortality. (ibid., 691-707.) Moreover, it is known that ageing produces physiologically muscle and nerve changes that retards muscles strength and swallowing coordination. However, it is uncertain what deterioration constitutes age-relating changes and what is specific consequence of neurological disorders. Some studies have shown that a normal

swallowing is very rare among elderly people, thus above illustrated as normal swallowing function may be abnormal for elderly population. (Nilsson, Ekberg, Olsson & Hindfelt 1996, 180-184; Ekberg & Feinberg 1991, 1181-1184.)

In conclusion, it seems that the aging decreases the capacity to modulate the swallowing process. Therefore, in order to establish which swallowing functions are affected by neurological dysphagia, the causes and etiology of neurological dysphagia has to be determined and analyzed individually.

2.2 Etiology of neurological disorders leading to dysphagia

There are many disorders of the central nervous system that causes dysphagia in elderly. Major neurological disorders that produce dysphagia are listed in the table 1. (González-Fernández & Daniels 2008, 867-888.)

| Type | Etiology | | Clinical presentation |
|------------------|-------------|------------------------------------|--|
| Non-degenerative | Vascular | | Stroke |
| | Trauma | | Traumatic brain injury |
| | Neoplastic | | Brain tumor |
| | Congenita | | Cerebral palsy |
| Degenerative | Progressive | Dementia | Alzheimer Different type of dementia |
| | | Movement disorder | Parkinson, progressive supra-nuclear palsy, olivopontocerebellar atrophy, Huntington's disease, Wilson's disease |
| | | Muscle disorder | Myopathies, myasthenia gravis |
| | Relapsing | Sclerosis: multiple sclerosis, ALS | |

Table 1. Major neurological disorders that produce dysphagia

Central nervous system disorders that cause neurological dysphagia in elderly are classified into non-degenerative or degenerative. Based on the etiology, the non-degenerative disorders are subclassified as vascular, traumatic, neoplastic or congenital and each one of them have a distinctive clinical presentation. The degenerative disorders can be subclassified based on the clinical progression into progressive or relapsing disorder. Progressive degenerative disorders can be then subclassified into dementias, movement disorders and muscle disorders; and again, each one of them have a distinctive clinical presentation. The sclerosis is the neurological degenerative disorder that has a relapsing-remitting course. (ibid., 867-888; Buchholz 1994, 245-255; Causes. Dysphagia 2018.)

Once reviewed the central nervous system disorders that cause neurological dysphagia, it is important to consider which one of those are the most common type of neurological disorders in elderly. In order to establish a general treatment, it is crucial to recognize what is the prevalence of neurological illnesses that cause dysphagia within the elderly population.

There is not a defined chronological age to refer to the older population, as seen in the *Table 4. Elderly population's DRI for macronutrients in Spain, Finland and US*. In Spain elderly population is considered 65 years and older, in Finland 75 years and older and in US 70 years and older. The UN has established the elderly population at 60+ years old (WHO 2002), and the same age level has been set for this thesis.

2.3 Prevalence of neurological disorders leading to dysphagia in elderly

Following the classification order of the *table 1. Major neurological disorders that produce dysphagia*, and selecting the most common illness that causes neurological dysphagia; table 2 shows the prevalence of neurological disorders. It has been established by comparing two articles; one based on European neurological elderly patients with dysphagia by Baijens et al. (2016, 1403-1428), and the other one based on American neurological patient with dysphagia by Daniels (2006).

| Type | Diseases | Prevalence | |
|------------------|--------------------------------|------------------|-------------------------------------|
| | | Baijens et al. | Daniels |
| Non-degenerative | Stroke | - | 65% |
| | Traumatic brain injury | - | 25-61% |
| | Progressive supranuclear palsy | - | Initially: 16% Later stages: 83% |
| Degenerative | Dementia | 19-30% 57-84% | - |
| | Alzheimer's disease | 57-84% | 32-84% |
| | Parkinson's disease | 35-82% | 50-63% |
| | Huntington's disease | - | 85% |
| | Multiple sclerosis | 24-34.3% | 34% |
| | ALS | 47-86% | 100% |

Table 2. Prevalence of dysphagia in neurological disorders

Most of the time dysphagia incidence varies depending on the method of ascertainment (ibid 2006). Because of that, most of the illnesses have a very wide range of prevalence. Daniels (2006) shows the prevalence of non-degenerative neurological disorders; Stroke has a mean of 65% (range between 20% and 90% [González-Fernández & Daniels 2008, 867-888]). Traumatic brain injury has a prevalence of 25-61% and progressive supranuclear palsy has initially a 16% but on a later stage it gets up to 83%. The degenerative neurological disorders such as dementia has been reported by caregivers on 19-30% and by instrumental exploration on 57-84%, same as dysphagia in Alzheimer's disease, where prevalence can be up to 84%. Parkinson's disease varies from one study to another, having the 35-82% or 50-63% of prevalence. Huntington's disease has an 85% and multiple sclerosis can be up to around 34%. Amyotrophic Lateral Sclerosis's prevalence is 47-86% measured by clinical and instrumental

exploration, but practically, everyone suffering from ALS has been reported to have swallowing difficulties. (Baijens et al. 2016, 1403-1428; Daniels 2006.)

3 Nursing intervention in neurological disorders with dysphagia in elderly

Management of dysphagia is multidisciplinary that involves doctors, nurses, dieticians, speech therapists, careers and family members. Some studies have reported the importance of the nurse's role to improve the outcomes of neurological elderly patients with dysphagia. (Koidou, Kollias, Sdravou, Sdravou, & Grouios 2013, 812-827; Dondorf, Fabus & Ghassemi 2015, 17-20; Michou 2014.) Because of that, it is crucial that the nurse have an adequate knowledge and training in the management of dysphagia (Ibid., 2015, 17-20; Ibid., 2014).

3.1 Management of dysphagia in elderly with neurological disorders

For the nurse it is important to know that in some cases dysphagia can be partially or totally corrected by altering the diet and using a non-invasive method. In other cases, when dysphagia causes aspiration, impedes proper nutrition and is accompanied by weight loss, more aggressive intervention such as a feeding tube may be needed. Moreover, in those patients who suffer from progressive degenerative neurological disorders, dysphagia will be just one of a large number of symptoms and disabilities that have to be intervened by the nurse. (Wirth, Dziewas, Beck, Clavé, Hamdy, Hepner, Langmore, Leischker, Martino, Pluschinski, Rösler, Shaker, Warnecke, Sieber, & Volkert 2016, 180-208.)

Neurologic elderly patients with dysphagia should have an adequate nutrient intake and a positive eating experience. To ensure that, nurses' role during mealtimes consist of: adapting the meals' texture, providing a relaxed environment and avoiding distractions such tv or radio. Ensuring a good eating position; keeping the neurologic elderly patients with dysphagia in an upright position by accommodating pillows or providing special chairs. To make the most of the meal, it is important that the patients like the food, sometimes to gather this information, family members might need to be involved. The changes in the patient's appetite and the difficulties experienced when eating should be monitored. When the patient is unable to, the nurse

should cut or shake the food into bite-size pieces and/or feed the patient. To keep the track there should be a record of the food intake and documentation of the weekly weight. The nurses should also monitor the effectiveness of the diet and modify it in those cases that is necessary. (Bridepoint staff 2000, 1-20.)

3.2 Nutrition of elderly with dysphagia caused by neurological disorders

It is very well known that neurological disorders with dysphagia are a risk factor for malnutrition and dehydration in elderly (Tagliaferria, Lauretani, Peláa, Meschia, & Maggioa 2019, 2684-2689). “Malnutrition is referred to the intake of persons energy and/or nutrients that can be deficient, exceed or imbalanced” (Malnutrition, 2018). And “dehydration is defined as the condition that results from excessive loss of body water.” Dehydration usually comes with malnutrition, but it can be difficult to identify because its typical signs, for example the skin elasticity, that are not reliable enough (Carmichael, 2011).

The term malnutrition covers 2 groups of conditions: undernutrition and obesity or overweight. In this case, when talking about dysphagia’s complications in elderly, it is referred to undernutrition. This can include stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (lack of vitamins and minerals). (Malnutrition, 2018.)

| Elderly settings | % (Range) of Malnutrition | | |
|------------------------------|---------------------------|-------------------------|-------------------------|
| | Suffers from malnutrition | At risk of malnutrition | Good nutritional status |
| Community- dwelling elderly | 2 (0-8) | 24 (8-76) | 74 (16-100) |
| Frail elderly | 9 (0-30) | 45 (8-65) | 50 (11-91) |
| Hospitalized elderly | 23 (1-74) | 46 (8-63) | 31.5 (6-68) |
| Institutionalized elderly | 21 (5-71) | 51 (27-70) | 29 (4-61) |
| Cognitively impaired elderly | 15 (0-62) | 44 (19-87) | 41 (0-80) |

Table 3. Prevalence of malnutrition of elderly people in nursing homes and hospitals

To establish the severity of malnutrition in elderly people, Table 3 (Guigoz, 2006, 466-468) gives an example of the prevalence of malnutrition in various elderly settings. It has been determined that among community-dwelling elderly, malnutrition is present on the 2% of the elderly and 9% in case of frail elderly. But in hospitalized and institutionalized elderly people, malnutrition has been on the 23% and 21% of the cases respectively. The risk of malnutrition has been higher and more widespread among elderly living in a community (24%) and among frail elderly (45%). In hospitalized and institutionalized elderly people, the risk of malnutrition has been 46% and 51% respectively. Moreover, 15% of cognitively impaired elderly people suffer from malnutrition and 44% are at risk. (ibid 466-468.)

To suffer from malnutrition and dehydration means that the optimal nutritional intake is not achieved. The optimal nutrition is quantified with dietary reference intakes (DRI). DRI are nutrient reference values developed to avoid deficiencies. They are based on the minimum nutrient intake level that will maintain a defined level of nutrition in a healthy individual. (Arbonés, Carbajal, Gonzalvo, González, Joyanes,

Marques, Martín, Martínez, Montero, Núñez, Puigdueta, Quer, Rivero, Roset, Sánchez & Vaquero 2003, 109-137.) Adequate intake (AI) is the average daily approximation of nutrient intake. It is based on observation or explanation of apparently healthy people that are assumed to be adequate. (Slaving 2004, 628-644.)

Knowing this, there has been established a comparison table about *elderly populations DRI for macronutrient in Spain, Finland and USA (table 4)* and a *comparison AI table of elderly's population water intake* from those same countries (table 5).

These countries have been chosen because of the following reason: the Mediterranean diet consumed in Spain has been demonstrated that delays the onset of neurodegenerative diseases (Farooqui & Farooqui 2018, 1-16). On the other hand, in the US, the western diet may be the cause of neurodegenerative conditions (Francis & Stevenson 2013, 119-128.) Moreover, the change on the Finnish diet gives an example of the healthier dietary approach that the country's recommendations has taken (Männistö, Laatikainen, Helakorpi & Valsta 2010, 907-914.)

| DRI, acceptable macronutrient distribution ranges in elderly (%) | | | |
|---|-------------------|--|--------------------|
| | Spain 2003 | Finland (Nordic recommendations) 2004 | US 2005 |
| | <65 years old | <75 years old | <70 years old |
| Protein | 12-17% | 15-20 | 10-35 |
| Carbohydrates | 55-75% | 45-60% | 45-65 |
| Simple carbohydrates | <10% | <10% | <25% |
| Fat | 25-35 | 25-35 | 20-35 |
| Cholesterol | <300mg/day | Reduce the consumption | As low as possible |

Table 4. Elderly population's DRI for macronutrients in Spain, Finland and US

As seen in the table, the US elderly's total daily protein intake recommendation (10-35% of the Total Calory Intake) is bigger than in Finland (12-17% TCI) and Spain (15-20% TCI). On contrary, the total daily carbohydrates intake recommendation is bigger in Spain (55-57% TCI) and smaller in Finland (45-60% TCI) and US (45-65%TCI). The biggest difference is the recommendation of simple carbohydrates; in the US is up to 25% of the total daily calory intake and in Spain and Finland is up to 10%. (Food and nutrition bord 2005; Arbonés et al. 2003, 109-137; Suominen 2007, 1-76.)

As an average daily approximation of water intake, Finnish recommendation has 1L less than Spain and US (Nordic Nutrition Recommendations 2012; Soterias 2018; Armstrong & Johnson 2018, 1928).

| Adequate water intake | | |
|------------------------------|----------------|-------------------------|
| Spain | Finland | USA |
| 2-2,5L | 1-1,5L | 2,7L women 3,7L male |

Table 5. Comparison of water AI in Spain, Finland and US

As a conclusion, it seems that the nutritional values of Spain, Finland and US are not significantly different, because of that, it cannot be established which values are the optimal. As a result, when stablishing an optimal nutritional intake for elderly people with neurological problems causing dysphagia, nurses should follow their own national nutritional recommendations.

4 Aim, purpose and research question

This study aims to review literature related to dysphagia and nutrition in elderly patients with neurological problems. The purpose of this thesis is to gather information about general nursing interventions to tackle the dysphagia challenges in elderly neurological patients, and thus, maintain an optimal nutritional intake.

The research question is: how can the nurse maintain an optimal nutritional intake in those elderly patients suffering from dysphagia generated by a neurological disorder?

5 Methods

The Research Method explains how the research has been developed, it is determined based on three factors: the type of phenomenon to be studied, the objectives of the research and the analytical perspective of the researcher. (Abreu, 2014, 195-204.) Based on those factors, the literature review is the research method that meets the requirements of this study.

5.1 Literature review

Literature review can be defined as a structured review of several primary studies to synthesize and summarize the existing knowledge. The aim of the appraisal and synthesize of the results in the literature review is to expose international evidence, verify ongoing practices, identify and notify fields for future research, confirm evidence to guide decision-making and analyze and describe areas for future research. (Munn, Peters, Stern, Tufanaru, McArthur, & Aromataris 2018, 143).

For conducting a literature review, a six-step process has been elaborated by Machi and McEvoy (2016). The research starts by selecting a topic that recognizes and defines the problem. This is followed by developing a process for solving the problem through building a case for literature review. The literature review is then conducted by assembling, organizing and analyzing appropriate data. After this phase and through a data analysis process, findings that are anchored on evidence are established. After this, a critique of the literature is executed where findings are drawn. Lastly the researcher presents in a proper scientific language their evaluation and draw conclusions of the review. (Ibid., 2016.) The six steps elaborated by Machi and Mcvov has been applied to this thesis in the following way: step 1 in the theoretical background, step 2 in the aim purpose and research question, step 3 and 4 in methods; in the subchapters *scientific article selection process* and *analysis and synthesis of data*, respectively, step 5 in results and step 6 in discussion and conclusion.

This bachelor thesis was built as a literature review because there was a visible need to gather several primary studies to organize and analyze findings around the topic of nursing interventions in order to maintain nutritional intake for neurological patients with dysphagia.

5.2 Scientific article selection process

In order to identify the best evidence articles that are significant for the topic and provide information that will be applicable to the conclusions, the following inclusion criteria was established.

| Inclusion criteria |
|--|
| Answers the research question Study is in English or Spanish Scientific publication Peer-reviewed Free full-text access for JAMK students Study of elderly patients with dysphagia Study is published in 2006 or later |

Table 6. Inclusion criteria

Afterwards, continuing the process of bibliographical search, keywords were stabilized to use in the research.

| Keywords |
|---|
| Neurological OR nervous system |
| Stroke OR Traumatic brain injury OR Progressive supranuclear palsy OR Dementia OR Alzheimer's disease OR Parkinson's disease OR Huntington's disease OR Multiple sclerosis OR ALS |
| Swallowing OR dysphagia OR esophageal diseas* OR pharyngeal diseas* OR esophageal motility disorder* OR dysphagia OR Swallowing Disorder* |
| Aged OR elder* |
| Nutrition OR diet OR food* OR nourishment OR food intake OR eat* OR nutrient* Or physiology OR metabolization |

Table 7. Keywords

5.3 Analysis and syntesis of data.

The structure of this review has adopted a descriptive approach based on inductive content analysis. Inductive reasoning is the process to establish a common conclusion from the selected articles by gathering new information into a theory. The researcher evaluates the articles considering all the possibilities, having an open mind and trying to find a common subject to answer the research question. (Bengtsson 2016, 8-14.)

To present the phases of the systematic research that has been developed during this review, a PRISMA flowchart has been created (Figure 3.)

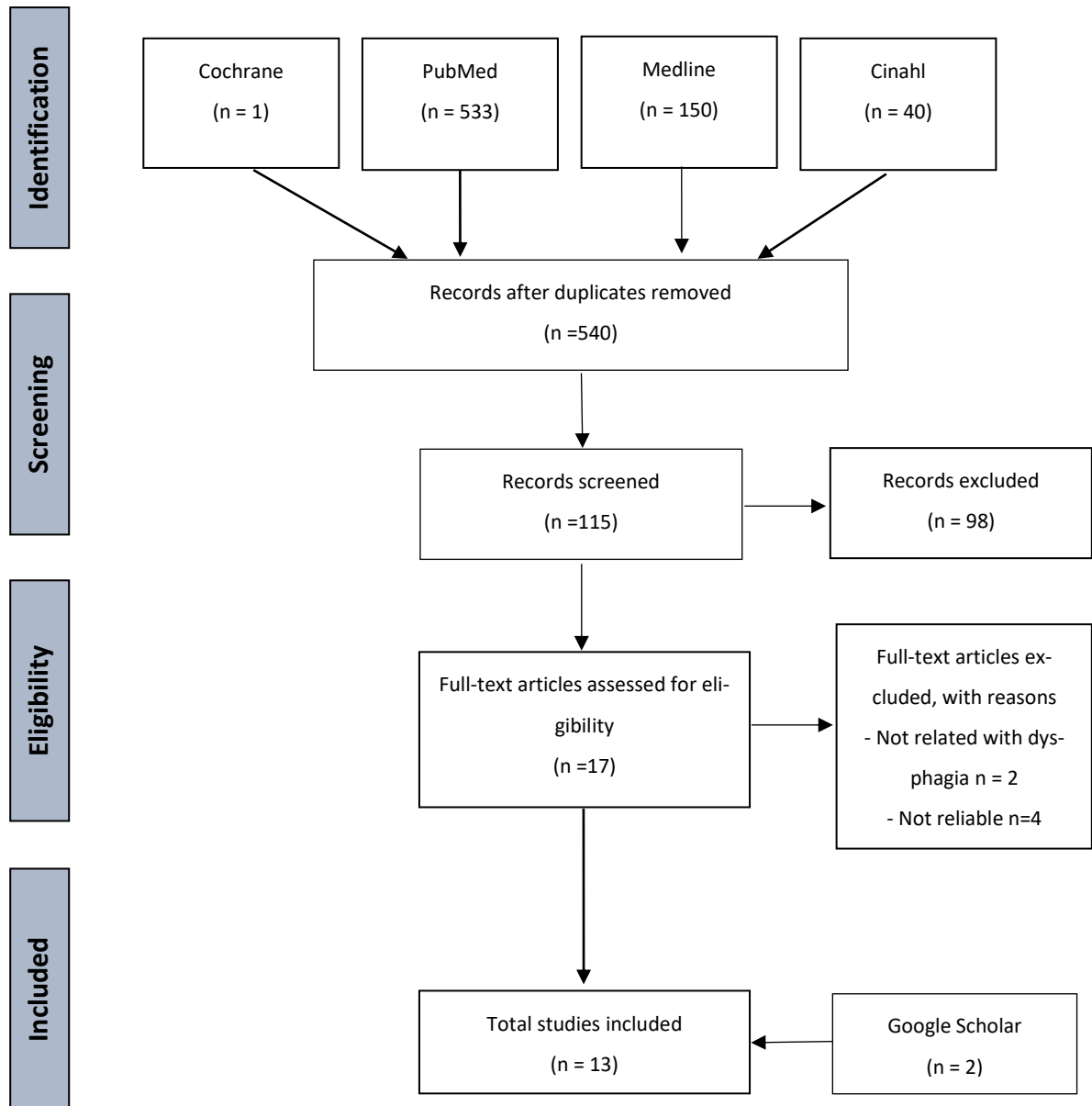


Figure 3. Prisma flow chart

Based on the keywords, the research was done in PubMed, Cinahl Plus full-text, Medline and Cochrane Library. Once the duplicated articles were excluded and the inclusion criteria screened, 115 articles were collected.

Preliminary selection was made following the title and the abstract of the articles; 98 articles were excluded and 17 were included. After reading through those possible eligible articles, 6 were excluded because they were not related with dysphagia or had no reliability for the research. Moreover, doing a research in Google Scholar open access database where the keyword “nutrition in dysphagia” was used, 2 articles were found to be eligible for the literature review. Open access databases have free, available research articles, where the reliability and quality are as valuable as the paid-journals. (What is Open Access, 2019; Reliability of open access journals, 2018.)

The final selection was made by taking notes for appraising the quality of each of those 13 articles; following the checklist of Hawken, Payne, Kerr, Hardey and Powell (2002, 1284-99), the articles were assessed following the criteria and scoring them by the notes: Good=4, Fair=3, Poor=2 or Very poor=1 (Appendix 1). It was concluded that all the articles had a good quality (total points between 32 and 36), because of that, the 13 articles were selected to be included for the review (Appendix 2).

6 Results

During the article analysis, lack of information was found among nursing interventions with focus on neurological problems with dysphagia. In order to carry forward, it was decided that the research was also going to be based in general medicine, and the findings were going to be adapted for nursing profession.

Another issue came across during the article analysis; even though the research is based on dysphagia generated by neurological disorders, there were three studies that include neurological and non-neurological illness with dysphagia in their investigations. Non-neurological illnesses were the following ones: cardiovascular surgery care, respiratory illness/condition, spinal injury, and head and neck cancer. Among these studies, distinction was made between degenerative and non-degenerative disorders where there was no significant difference on the results between the two groups, because of that, these three articles were included in the research.

After reading the selected articles several times, the main ideas were gathered and classified to create subcategories, at the same time these subcategories were organized to elaborate the main categories (Appendix 3). The data analysis based on the research question resulted in three main categories: facilitating swallowing of different food consistencies and diet, implementing various tube feeding methods and continuous evaluation of nutritional care needed for elderly with neurological dysphagia. Figure 4 illustrates the main categories and subcategories of the data analysis process, and the results are explained afterward in the next chapter.

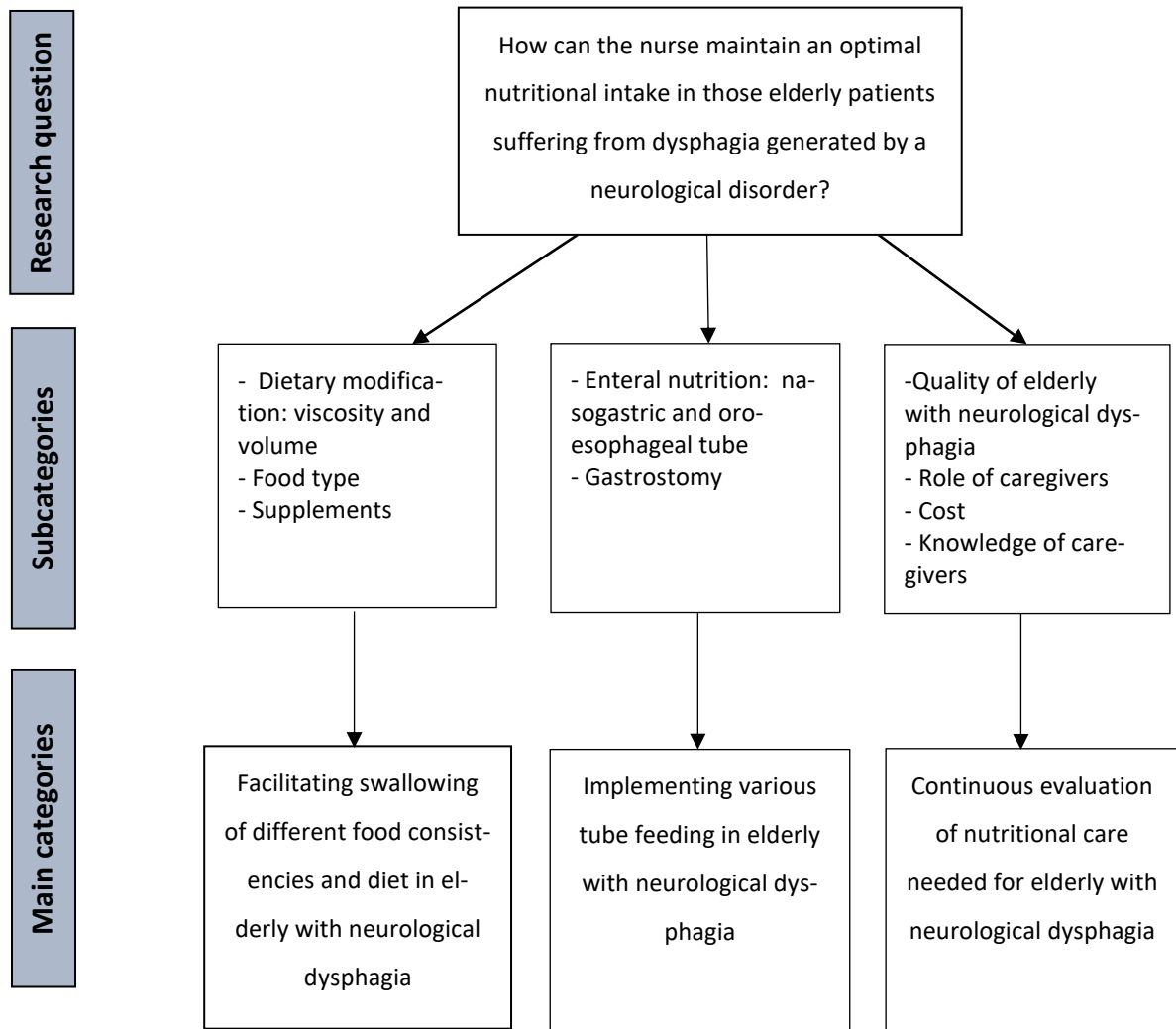


Figure 4. Results of data analysis

6.1 Facilitating swallowing of different food consistencies in elderly with neurological dysphagia

6.1.1 Dietary modification: viscosity and volume

During mealtimes, neurological patients with dysphagia are at risk of aspiration (aspiration with cough or silent aspiration) or having food residues in the pharynx. Dietary modification has been determined to be the most effective method to cope with neurological dysphagia; where viscosity and volume are the modifiable factors of a meal when dealing with aspiration with cough, silent aspiration and pharyngeal residue. (Matsushima, Matsushima, Matsumoto, Moriwaka, Honma, Itoh, Yamada, Shimohama, Ohnishi, & Mori 2016, 1-9.)

Fluid volume was analyzed administering 50ml versus 5ml of thin fluids to patients with Parkinson's disease; in the 91% of the cases smallest volumes improved swallowing or had lower risk for aspiration. Swallowing was improved by having lower risk of aspiration (aspiration and cough or silent aspiration). Aspiration and cough was more common when consuming higher volumes of thin fluids than small volumes. (Miles et al. 2018, 909-918.)

Fluid viscosity was analyzed in the study made by Miles, McFarlane, Scott and Hunting (2018, 909-918) "32% of cases had aspiration for thin fluids while 18% had aspiration for thick fluids". In this study they established an association between dysphagia and viscosity, meaning that higher scores of silent aspirations occur with thick fluid. Moreover, in the same study a significant association was seen between cough responsiveness and thin fluids. (ibid., 909-918.) When considering the pharyngeal residue in neurological dysphagia, studies have shown that pharyngeal residue is more common in increased food viscosities (Dias de Souza, Gonçalves da Silva, Cola, & Motonaga 2019, 1-6). In addition, it has been observed that pharyngeal residue is commonly associated with ALS patients. (Mendes, Cola, Motonaga, Novaes, & Gonçalves da Silva 2018, 1-5). Not only with ALS, but it is believed that other neurological disorders also have individual characteristics; because of that, some studies have rejected the idea of "one solution" for neurological dysphagia and suggested to have

different, individual criterions in order to identify the clinical features of different subgroups (Dias de Souza et al. 2019, 1-6; Mile et al. 2018, 909-918; Mendes et al. 2018, 1-5).

6.1.2 Food type

This subcategory described how the elements of food viscosity and volume can be adopted into practice. Food taken orally or by enteral nutrition can be home made, nutrient modules or a mixed of both (Stangherlin, Alves de Rezende, & Da Gama 2012, 691-697). Homemade diets are a frequent practice; softer alternatives can be cooked or processed in a blender (Matsushima et al. 2016, 1-9). For example, swallowing is easier when consuming ordinary rice and processed side dishes in contrast to consuming porridge rice only. Moreover, the IBM values are higher when consuming ordinary rice and processed side dishes in contrast to porridge rice only. Because of that, studies have suggested consumption of a variety of modified foods to avoid low BMI. (Ibid., 2016, 1-9.)

6.1.3 Supplements

It has been indicated that neurological patients suffering from more severe dysphagia prefer supplement intake in order to supply all the requirements. The supplements are classified in two groups; those for additional energy and nutrition, and herbal supplements, even though herbal supplement`s usefulness is controversial. (Matsushima et al. 2016, 1-9.)

Apart from the energy and nutritional addition, it has been suggested that the intake of L-dopa as a supplement could improve the swallowing function and so result in a better swallowing performance of the meals (Ibid., 1-9). L-dopa is an amino acid that intermediates in the dopamine synthesis pathway. The consumption of L-dopa as supplement leads to a dopaminergic stimulation, which will lead to an initiation and facilitation of spontaneous and reflex swallowing (Juri & Chaná 2006, 893-901; Giles & Hockman 1977, 245-252).

6.2 Implementing various tube feeding methods in elderly with neurological dysphagia

6.2.1 Enteral nutrition: nasogastric and oroesophageal tube

The oral nutrition of modified food is the preference for 60% of the neurological patients with dysphagia. But when the food is not modified, oral nutrition descends to the third place being the preference for the 15% of the elderly and the tubes and ostomies become the first feeding option. (Sánchez, García, Arráez, Hernández, Aranda, Rausell, & Ferrer 2019 1019-1026.)

Enteral nutrition by tube has been indicated for patients suffering from dysphagia that refuse the oral food and/or are at risk of aspiration (Stangherlin et al. 2012, 691-697). Even though in patients with neurological dysphagia it is recommended to start the tube feeding as soon as possible, the establishment of feeding tube takes a long time since its advantages and disadvantages has to be pondered. The advantages are that the tube feeding will maintain an adequate nutritional intake, moreover, it will prevent the apparition of secondary complications such as pneumonia and gastrointestinal reflux. As disadvantage, it has been demonstrated that neurological patients have less tolerance to the tube feeding, causing; abdominal distension, nausea, vomiting and gastric retention. (Su, Gao, Zeng, Sha, Niu, Wang, Zhou, Jiang, Cui, Yang, Pan, Zhang, Liu, Li, Tan, & Lv 2016, 521-528; Malmgren, Wärn, Karlsträm, Cederholm, Lundquist, Wirén, & Faxén-Irving 2011, 1-7.) The main inconvenience is the gastric secretion that causes gastroesophageal reflux with possible aspiration pneumonia. Some studies have shown that nasogastric tube may not be effective for elderly with neurological dysphagia and that the esophageal tube is more effective reducing the pH, thus, alleviating gastroesophageal reflux and reducing cases of aspiration pneumonia. (Jung, Ki, Tae, Jin, Oh, Ju & Cheol 2019, 1-7; Stangherlin et al. 2012, 691-697.)

In order to minimize the effect and/or the causes of the feeding tube in neurological elderly with dysphagia, it is suggested to follow a standardized feeding protocol and nutritional practices (Su et al. 2016, 521-528).

6.2.2 Gastrostomy (Percutaneous Endoscopic Gastrostomy)

In the study made by Malmgren et al. it was observed that among elderly people, neurological diseases are the main cause for PEG (2011, 1-7). Moreover, it was determined that for long term nutrition, PEG should be the preferred. However, different indications should be established for each diagnosis, clinical status and individual prospect. In this line, it is important to mention that some studies questioned the PEG in dementia patients because of ethical considerations. (Malmgren et al. 2011, 1-7.)

When it comes to PEG, an important consideration has to be done. It has been demonstrated that patients with PEG tube have low serum zinc level. Because of that, serum zinc levels assessment should be part of the nutritional evaluation and/or include systematic zinc supplements as part of therapy. (Santos, Fonseca, Brito, Fernandes, Gonçalves, & Sousa 2013, 359-464.)

6.3 Continuous evaluation of nutritional care needs of elderly with neurological dysphagia

6.3.1 Quality of elderly with neurological dysphagia

Those who suffer from neurological dysphagia and had an inadequate nutrition (malnutrition and albumin level lower than 3,5mg/dL), have significantly lower survival rate (Stangherlin et al. 2012, 691-697). And even though having an adequate nutritional intake, the increase time that a dysphagic patient spends eating makes a low rate of quality life related to swallowing (Pontes, Amaral, Rêgo, Azavedo, & Silva, 2016, 27-32).

6.3.2 Role of caregivers

To ensure a good care of neurological patients with dysphagia, caregivers are usually needed. It has been seen that the incidence of caregiver among patients suffering from dysphagia is high, moreover, dietary modifications are related to the presence

of caregivers. Because of that, caregivers are important towards preventing low BMI. Caregivers consist of sisters, children, non-relatives, spouses, spouse and child and enteral nutrition support team (physicians, nurses and clinical dietitian). (Su et al. 2016, 521-528; Matsushima et al. 2016, 1-9.)

Nurses were seen as crucial professionals when dealing with modified foods. Their role consists on the quality control of served food texture to the patients and responsible for training others (nurses or family members) on preparing appropriate texture meals. Moreover, the presence of nursing and family's involvement is important determining the texture-modified food. (Garcia, Chambers IV, Russell, & Katt, 2018, 1458-1473.)

6.3.3 Cost

When talking about modified foods, an important aspect is the cost and expenses of the products. According to neurological patients with dysphagia, "dietary modification is a very important and essential expense". Even that, the outlays for eating utensils, supplements, alternatives and care foods are higher than the mean outlays for dietary modification. Moreover, for the overall mean expenses, the cost of care food is the highest among the expenses. (Mendes et al. 2018, 1-5.)

The study of Mendes et al. (2018, 1-5) discusses that the dietary modification among dysphagic patients is done regardless of the patient's income level. In contrast, the study of Stangherlin et al. (2012, 691-697) has shown that patients start with modified industrialized diet, but 13.8% changes to homemade diet due to the high expenses of industrialized diets. The conclusion was the same in the study of Sánchez et al. (2019, 1019-1026) where the outlays of artificial nutrition were the main limitations at home environment.

6.3.4 Knowledge of caregivers

Information and guidance about the modified foods and malnutrition to caregivers and neurological patients should be given by dietitian or trained nurse. It has been

seen that malnutritional status in elderly people can be improved by dietary education. (Mendes et al. 2018, 1-5.)

The study of Garcia et al. (2018, 1458-1473) presents the nurses knowledge about modified foods; on one hand nurses had a high understanding on the topic, but on the other hand, they defined it as an unexperienced topic (majority had less than 2 years of experience). Even though food modification has been determined as a wide range of responsibility, the learning of the topic is done in an informal way “someone explained to me or showed me” or it was part of the initial orientation. Because of that, incorrect preparations and beliefs are found among nurses. (Garcia et al. 2018, 1458-1473.)

Previous research has also established the importance of nurse’s knowledge about evolution of neurological dysphagic patients and the understanding of their attitude in order to determine a good, sensitive and individualized care. (Clarke, Fistein, Holland, Tobin, Barclay, & Baclay 2018, 115; Stangherlin et al. 2012, 691-697.)

7 Discussion

7.1 Ethical consideration, validity and reliability

Ethical considerations in research are defined as standards and guidelines adhered when conducting research with human participants, they assure the respect, dignity and health of participants in studies. Justice requires protection of participants autonomy with the use of informed consents by fully informing the participants about the research project beforehand. (Katefian 2015, 164-172; Oliver 2010.) Disclosure, comprehension, competency and voluntariness are the main principles of a consent (Fouka & Mantzorou, 2011, 3-14). As this study was a literature review of patients with neurological disorders, the ethical issues of the analyzed data have been questioned. A careful consideration of the ethical principles was done before a study was accepted or rejected for this literature review; this is reflected in the *Appendix 1. Quality of the articles* where ethical issues, confidentiality, sensitivity, adequacy and bias has been addressed. All of the articles included had a high score in ethics and bias, meaning that all the fundamental matters concerning confidentiality, sensitivity, and consent were addressed and bias was reflected and/or considered. (Hawken et al. 2002, 1284-99.)

The elderly people with no known impairments or living outside institutionalized care, same as caregivers, were considered as non-vulnerable group; where no special considerations were needed when ethics were assessed. On the contrary, research with vulnerable groups should be carried out if the research question can only be answered by that specific group and if the risk is minimal. (Katefian 2015, 164-172.) In addition, a careful, sensitive and special approach has to be ensured during the whole research procedure (Fouka & Mantzorou, 2011, 3-14). Because of that, some informed consents included in this review has been made by university hospitals and/or are based on mental capacity acts. Moreover, when the consent could not be taken from the mentally ill participants and when indicated, the permission was taken from family or next of kin.

During the assessment of ethical considerations and informed consent an observation was made in the article of Su et al. (25, 521-528). This research was based on patients with neurological disorder in tertiary hospitals in China, and even though ethical considerations were mentioned, there was no reference or comment about the informed consents of patients. It is important to note that this article was published in the Asia Pacific Journal of Clinical Nutrition in 2016. This journal publishes *instructions for the authors* every year, having found access to the publishing instructions of the years between 2003 and 2017 (Instructions for Authors 2003, 1-2; Instructions for Authors 2017, 1-5). They both state that in order to publish an original article “all investigations on human subjects must include a statement that the subject gave informed consent and patient anonymity should be preserved.” As a result, it is possible to assume that the informed consent was done in order to publish the survey in the journal, but there is no statement of it in the article.

The extract and presentation of data has been done in an honest and careful manner, misrepresentations have been avoided and there was no intention to make up or manipulate the data; in this way, this study has avoided any kind of **falsification** and **fabrication**. In the same line, **plagiarism** has been avoided by following JAMK’s (Jyväskylän ammatikorkeakuolu) reference’s instructions and by using a proper paraphrasing author’s skill without any personal intentions to plagiarize.

Accuracy and truthfulness in research are referred to validity. With an initial hypothesis for this literature review, literature was researched and accurate documentation of data and results presented. This was achieved through a precise inquiry within the presented hypothesis, hence, the findings are a true reflection of the inquiry. (Golafshani 2003, 597-607).

Generalizability is defined as the ability to generalize the results to wider groups, settings and circumstances (ibid., 597-607). To determine the generalizability of this study; the countries, nursing settings, illnesses and population of the reviewed articles were analyzed.

The articles included in this review were from ten different countries: Brazil, China, Japan, New Zealand, Portugal, Republic of Korea, Spain, Sweden, The United States of America and United Kingdom. Taking into account that there are 195 countries in the world, the generalization of the results is restricted. Moreover, the research method of these articles is qualitative, avoiding the variation of the results between themselves. Looking more precisely, the settings that these articles have investigated are as follows: hospitals in general, tertiary hospitals, neurological hospitals, neurological medical care units of University Hospital, endoscopic units of University hospitals, department of rehabilitative medicines, neurological medical clinics, home medical services, rehabilitation centers, skilled nursing facilities, health areas. This variety allows to generalize and implement the results of this study in different nursing settings.

Following the research question and analyzing those patients who suffer from neurological dysphagia, different diagnosis came across: some of the articles examined neurological dysphagia in general, without distinction; others examined one or various neurological disorders such as: stroke, Parkinson's disease, Amyotrophic Lateral Sclerosis, Huntington's Disease, Progressive Supranuclear Palsy, Motor Neuron Disease and Multiple Sclerosis. As mentioned in chapter six (6. *Results*) of this study. There were three studies that included non-degenerative neurological disorders with dysphagia, this does not mean that the results of this article can be used with those diseases. In this research other possible complication and illness have not been taken into account, as a consequence the results could only be generalized very cautiously in those degenerative diseases that have been specifically mentioned.

Looking more precisely into the researched population of the articles, the sample size varies between 6 and 400 people; optimal sample sizes for each study are unknown, because of that, the reliability of the studies regarding the size sample is unclear and the results might not be generalizable (Shoukri, Asyali & Donner 2004, 13). The articles did not make any distinction between race and gender, but there is a distinction among the ages. To determine neurological dysphagia in elderly, it has been established that elderly people are those that are 60 or over years old. Among the participants in the raw studies there were two articles that included neurological patients with dysphagia with ages between 18 and 95, five studies with ages between

34-88 and five studies with ages between 60-94. All articles included people aged 60 and above, thus this study has only analyzed elderly people with neurological dysphagia, because of that, generalizability is only possible among the elderly group.

Reliability is defined by the replicability or repeatability of the article (Golafshani 2003, 597-607). To ensure that repetition of the thesis produces similar results, the following measures has been taken into account: the steps of the research has been clearly defined and developed, the inclusion criteria of the studies was precisely indicated and the included articles were uniformly cited.

7.2 Discussion of results

Ageing is a current and prevalent phenomenon within global populations. Neurological disorders compose a majority of geriatric syndromes and hence a high prevalence of dysphagia among aging adults (60+ years). Even though patients with neurological illnesses with dysphagia usually suffer of malnutrition and dehydration, still these consequences are underdiagnosed and often untreated (Project, 2002; Baijens et al. 2016, 1403-1428). In order to avoid malnutrition and dehydration, the results analyze possible nursing care for elderly with neurological dysphagia. From the authors point of view these general results have to be taken very cautiously because of the wide range of illness that the word "neurological disorders" comprise.

In relation to the physiology of the swallowing process in neurological dysphagia, a new observation has been made. When analyzing the risk of pharyngeal residue in increased food viscosities, it has been seen that during normal swallowing, food portions are accumulated in the oropharynx, but with the condition of aging, the control, retention and deliver of the bolus are altered. Because of that, uncontrolled risky retention of bolus could happen when food is not modified. In contrast, when the food has been liquid or pureed, the risk of accumulation in oropharynx will be reduced and so will be the retention of bolus. (Dias de Souza et a. 2019, 1-6.)

These statements bring some new nursing implications. On one hand, the importance of nurse's knowledge and education about physiology of swallowing in dysphagia and the understanding on how to prepare an appropriate food for patients with neurological dysphagia. On the other hand, the importance of nurses practical knowledge in preparing the optimal food/drink viscosity for each elderly suffering from dysphagia. Even though some studies have demonstrated that commercially available modified foods are less expensive and more effective to be used in nursing settings, other studies have determined the importance of nursing knowledge. The nurse is the professional that is in constant contact with the patient, because of that, it is the one that can best observe and identify swallowing difficulties in elderly with neurological dysphagia (Kotecki & Schmidt 2010, 106-109; Garcia et al. 2018, 1458-1473). With an appropriate knowledge and education, the nurse should be able to individualize the food viscosity to the elderly's swallowing requirements.

Not only the nurse's knowledge in modifying food volume and viscosity, but combining a high variety of foods is also important. The consumption of different foods will ensure the neurological patient's optimal ingestion of macro- and micronutrients. (Matsushima et al. 2016, 1-9; Stangherlin et al. 2012, 691-697.) It is to say that an optimal nutritional care is the base for the treatment of malnutrition and dehydration produced by the difficulty of swallowing in elderly. Moreover, an appropriate use of dietary supplements has seen to be beneficial. Although, supplements should be used only to supply the requirements. (Cameron & Rosenfeld 2002, 631-643; Matsushima et al. 2016, 1-9.)

The results have also shown the importance of the nurse's role to treat neurological elderly patients with dysphagia (Koidou et al. 2013, 812-827). The approach involves the treatment of the neurological disorders (if possible) and the tube feeding care (Buchholz D. 1994, 143-155). The treatment of neurological disorders in elderly is not always possible because of the illness's neurodegenerative progression. In this case, nursing treatment is symptomatic and the care individualized. One important aspect to consider is the patient's quality of life. As mentioned in the study of Pontes et al., elderly patients with neurological dysphagia feel that their quality of life is low because of the high amount of time that they spend eating (2016, 27-32). Because of

that, the dysphagia patient's quality of life should be a key consideration for the nurses. Meaning that the autonomous patients should receive the information about their care, prognosis and future treatment options. Moreover, when considering the feeding option, and especially when the patient goes against the recommendations of the beneficent treatment; the nurses have to consider patient holistically and empathize on patient's individual perception of their quality of life. Culturally related care is also an important aspect in the patient's quality of life, for example giving different kind of flavored food depending on the culture of the person is a very important aspect of the treatment. (Miles, Watt, Wong, McHutchison & Friary 2016, 1-7.)

As mentioned before, another nursing approach to treat neurological elderly patients is the tube feeding. To determine the right time to start the tube feeding, the inter-professional information sharing is crucial. The nurses are in constant contact with patients, because of that, they have an important role to detect, communicate, follow up and document swallowing difficulties in elderly with neurological dysphagia. (ibid., 2016, 1-7.) After determining the need to put a feeding tube, the nurse has different roles depending on the type of tube that has to be inserted. The nurse has the right to insert the nasogastric tube, in contrast, the PEG is going to be set in the operation theater, where the anesthesia nurse and scrubbing nurse have individualized roles. (Best, 2010, 1-39.)

Once the tube feeding is set, the nurse's role consists on the surveillance of the tube (blocks, displace, infections, pain, discomfort...) and checking gastric residual. Moreover, they are responsible to give continuous feeding and to accommodate the position to reduce the risk of airway aspiration. The nurses have also the responsibility to minimize contamination, and have a meticulous handling of the open systems. (Williams & Leslie 2004, 330-334.)

8 Conclusion

Dysphagia in neurological patients can be partially or totally corrected and the malnutrition and dehydration risk avoided by altering the diet (Wirth et al. 2016, 180-208; Tagliaferria et al. 2019, 2684-2689). In order to modify food for dysphagic patients, nurse's knowledge about the evolution of neurological dysphagic illnesses should be high as their experience and understanding on modified foods (Clarke et al. 2018, 115; Stangherlin et al. 2012, 691-697; Mendes et al. 2018, 1-5). Nurses not only take care of food but, they should have an understanding on dysphagic patient's quality of life in order to determine a good, sensitive and individualized care (Stangherlin et al. 2012, 691-697; Garcia et al. 2018, 1458-1473). Because of the importance of nurse's knowledge in this subject, the learning of the topic should be done in a formal way, as part of the nursing learning programs (Garcia et al. 2018, 1458-1473). This review could be used for educational purpose and could also apply in viable nursing settings.

The central purpose of nutrition care in elderly with neurological dysphagia is to maintain a good quality of life and prevent complications. This literature review finds that evolution of neurological dysphagia in elderly patients and the therapeutic effect of the oral-nutritional should be further researched. Moreover, to give an accurate individualized care, additional research is needed to determine specific characteristics of each neurological illnesses and the exact effect in the swallowing process.

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Appendices

Appendix 1. Quality of the articles

| Author | Abstract/title | Introduction and aims | Methods and data | Sampling | Data analysis | Ethics and bias | Results | Transferability or generalizability | Implications and usefulness | Total | Comments |
|---------------------------|----------------|-----------------------|------------------|----------|---------------|-----------------|---------|-------------------------------------|-----------------------------|-------|--|
| Clarke et al. 2018 | 4 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 4 | 33 | 4 |
| Dias de Souza et al. 2019 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 2* | 33 | *Not Contributes something new and/or different. Suggests implications for policy and/or practice. |
| Garcia et al. 2018 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 36 | |
| Jung et al. 2019 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 2* | 32 | *Not Contributes something new and/or different. |

| | | | | | | | | | | | |
|------------------------|---|---|---|---|---|---|---|---|----|----|--|
| | | | | | | | | | | | Suggests implications for policy and/or practice. |
| Malmgren et al. 2011 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 36 | |
| Matsushima et al. 2016 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3* | 35 | * No suggests ideas for further research |
| Mendes et al. 2018 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 36 | |
| Miles et al. 2018 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 36 | |
| Pontes et al. 2016 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 35 | |
| Santos et al. 2013 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3* | 35 | *No suggests ideas for further research |
| Sánchez et al. 2019 | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 4 | 2* | 35 | * No suggests ideas for further research. No suggests implications |

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|-------------------------|---|---|---|---|---|---|---|---|----|----|---|
| | | | | | | | | | | | for policy and/or practice. |
| Stangherlin et al. 2012 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 36 | |
| Su et al. 2016 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 3* | 33 | *No suggests ideas for further research |

Appendix 2. Reviewed articles

| Autor | Published year and country | Title | Research method | Main results |
|---|----------------------------|---|---|---|
| Clarke, Fistein, Holland, Tobin, Barclay, Baclay | 2018, UK | Planning for an uncertain future in progressive neurological disease: a qualitative study in patient and family decision-making with focus on eating and drinking | Longitudinal qualitative in-depth interviews. | Drinking and eating issues are often unnoticed. |
| Dias de Souza, Gonçalves da Silva, Cola, Motonaga | 2019, Brasil | Pharyngeal residue in neurogenic oropharyngeal dysphagia | Cross-sectional study | There was no statistically significant difference in pharyngeal residue between puree food and thickened liquid |
| Garcia, Chambers IV, Russell, Katt | 2018, USA | Modifying Food Textures: Practices and Beliefs of Staff Involved in Nutrition Care | Survey | Professional staff had a similar opinion and beliefs about modified food textures but not about experiences, roles and responsibilities |

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|--|-------------------------|---|------------------------------|--|
| Jung, Ki, Tae, Jin, Oh, Ju, Cheol | 2019, Republic of Korea | Comparison of tube feeding in stroke patients-A pilot study | Pilot study | Oroesophageal tube could be substitute for nasogastric tube in patients with dysphagia, gastroesophageal reflux and aspiration |
| Malmgren, Wörn, Karlström, Cederholm, Lundquist, Wirén, Faxén-Irving | 2011, Sweden | Indications for percutaneous endoscopic gastrostomy and survival in old adults | Retrospective analysis | To be old age was not a contraindication for percutaneous endoscopic gastrostomy (PEG). Although, better criteria for selection and timing of PEG insertion is needed. |
| Matsushima, Matsushima, Matsumoto, Moriwaka, Honma, Itoh, Yamada, Shimohama, Ohnishi, Mori | 2016, Japan | Analysis of resources assisting in coping with swallowing difficulties for patients with Parkinson's disease: a cross sectional study | Cross-sectional study | High cost was associated with coping with severe swallowing disorders. |
| Mendes, Cola, Motonaga, Novaes, Gonçalves da Silva | 2018, Brasil | Fiberoptic endoscopic findings of oropharyngeal swallowing of different food consistencies in Amyotrophic Lateral Sclerosis | Retrospective clinical study | There was a statistically significant difference in pharyngeal residue between thickened and pureed consistency liquid. |

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|---|-------------------|--|-------------------------------------|--|
| Miles, McFarlane, Scott, Hunting | 2018, New Zealand | Cough response to aspiration in thin and thick fluids during FEES in hospitalized inpatients | Prospective observational study | Cough response to aspiration differs between food volume and viscosity. |
| Pontes, Amaral, Rêgo, Azavedo, Silva | 2016, Brasil | Quality of life in swallowing of the elderly patients affected by stroke | Cross-sectional study | It was observed a low score in quality of life related to dysphagia. |
| Santos, Fonseca, Brito, Fernandes, Gonçalves, Sousa | 2013, Portugal | Serum Zn levels in dysphagic patients who underwent endoscopic gastrostomy for long term enteral nutrition | Case study | Patients with PEG had low serum ZN levels. |
| Sánchez, García, Arráez, Hernández, Aranda, Rausell, Ferrer | 2019, Spain | Home enteral nutrition in patients with neurological disease in a health area of the southeast of Spain | observational cross-sectional study | Achievement generating a standardized unified criterion of artificial nutrition. |
| Stangherlin, Alves de Rezende, Da Gama | 2012, Brasil | Occurrence of complications and survival rates in elderly with neurological disorders undergoing enteral nutrition therapy | Observational study | Enteral nutrition routes and its complications did not influence patient's survival rates, in contrast, it did the inadequate nutritional status and low albumin levels. |

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|---|-------------|--|---------------------------|---|
| Su, Gao, Zeng, Sha, Niu, Wang, Zhou, Jiang, Cui, Yang, Pan, Zhang, Liu, Li, Tan, Lv | 2016, China | A survey of the enteral nutrition practices in patients with neurological disorders in the tertiary hospitals of china | Prospective investigation | The understanding and training of the enteral nutrition configuration, practices and staffing needs to be understood and improved |
|---|-------------|--|---------------------------|---|

Appendix 3. Sample of content analysis process

| Raw database | Subcategory | Main category |
|---|--|---|
| Viscosity and volume are the modifiable factors of a meal (Matsushima et al. 2016). | Dietary modification: viscosity and volume | Facilitating swallowing of different food consistencies and diet in elderly with neurological dysphagia |
| Penetration and/or aspiration between liquid, thickened liquid and pureed sample (Mendes et al. 2018). | | |
| Pharyngeal residues of pureed food or thickened liquid (Dias de Souza et al. 2019). | | |
| Aspiration and cough response in thin and thick fluids (Miles et al. 2018). | | |
| Occurrence of complications and survival rate at patient's homes after hospital discharge with three types of EN; homemade diet, modular diet and mixed diet (Stangherlin et al. 2012). | Food type | |
| Homemade diets (Matsushima et al. 2016). | Supplements | |
| L-dopa dietary supplement (Matsushima et al. 2016). | | |

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|---|--|--|
| Comparison of tube feeding: nasogastric tube versus oroesophageal tube feeding in terms of aspiration pneumonia and gastroesophageal reflux (Jung et al. 2019). | Enteral nutrition | Implementing various tube feeding in elderly with neurological dysphagia |
| Enteral nutrition (infusion pump, PEG, oral feeding) practices, device configuration, staffing and patients support (Su et al. 2016). | | |
| Enteral nutrition indications (Stangherlin et al. 2012). | | |
| Comparison of tube feeding in home enteral nutrition (Sánchez et al. 2019). | Enteral nutrition and PEG | |
| Indications in elderly with neurological dysphagia of PEG (Malmgren et al. 2011). | PEG | |
| Serum Zn levels in PEG (Santos et al. 2013). | | |
| Quality of life in swallowing (Pontes et al. 2016). | Quality of elderly with neurological dysphagia | |
| Malnutrition and survival rate (Stangherlin et al. 2012). | | |

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|--|-------------------------|--|
| Roles, responsibilities, instruction and knowledge about modifying foods of staff involved in the service delivery of texture-modified foods (García et al. 2018). | Role of caregivers | Continuous evaluation of nutritional care needed for elderly with neurological dysphagia |
| Caregivers consist of sisters, children, non-relatives, spouses, spouse and child and enteral nutrition support team (physicians, nurses and clinical dietitian) (Su et al. 2016). | | |
| Resources coping with swallowing (Matsushima et al. 2016) | | |
| Dietary utensils and modification in patient's income level (Mendes et al. 2018). | Cost | |
| Patients start with modified industrialized diet, but 13.8% changes to homemade diet due to the high expenses of industrialized diets. (Stangherlin et al. 2012). | | |
| Outlays of artificial nutrition (Sánchez et al. 2019). | | |
| Dietary education and malnutrition status (Mendes et al. 2018). | Knowledge of caregivers | |
| Nurses knowledge about modified foods (García et al. 2018). | | |

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|---|--|--|
| Future in progressive neurological dysphagia, focusing on eating and drinking (Clarke et al. 2018). | | |
| Nurse's knowledge about evolution of neurological dysphagic patients (Stangherlin et al. 2012). | | |