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Methods of Nutrition-related Patient Education for Patients undergoing Haemodialysis. A Literature Review

Helsinki Metropolia University of Applied Sciences

Degree Programme in Nursing

Nurse (AMK), SXN14S1

Bachelor's Thesis

19.09.2017

Author(s) Title Number of Pages Date	Katharine Wilding Methods of Nutrition-related Patient Education for Patients undergoing Haemodialysis 23 pages + 3 appendices 19 September 2017
Degree	Bachelor of Health Care
Degree Programme	Degree Programme in Nursing
Specialisation option	Nursing
Instructor(s)	Liisa Montin, PhD, RN, Senior Lecturer
<p>Incidence of Chronic Kidney Disease (CKD) is increasing worldwide with corresponding rising levels of obesity and Diabetes Mellitus Type II. A specially formulated "renal diet" and healthy lifestyle habits can help to slow the progression of Chronic Kidney Disease into End Stage Renal Failure and Renal Replacement Therapy, such as dialysis, but it has been observed in research that many CKD patients needing haemodialysis are lacking the nutritional knowledge needed to maintain optimal health and remain well-nourished.</p> <p>The objective of this thesis was to determine what methods of teaching were used in Nutrition-Related Patient Education for patients undergoing haemodialysis. The ultimate aim is to develop appropriate Nutrition-Related Patient Education strategies for patients undergoing haemodialysis.</p> <p>Articles (n=11) were selected from CINAHL and Medline databases and from manual searches (n=2). Altogether 13 articles were selected, analysed and categorised in a systematic manner using principles of inductive content analysis. The findings were presented in a literature review.</p> <p>In this review, many different methods of patient education were exhibited which were represented by the VARK learning styles of visual, auditory, reading/writing and kinesthetic. Methods requiring sight, such as pictures, printed materials and video, were most common. Auditory methods, such as counselling, and technology, such as laptops and other computer devices were also represented. According to this review, most educational sessions were conducted by either nurse or dietician on an individual basis.</p> <p>From this review, the key message appears to be consideration for the patient as an individual in planning the best way of learning, taking into account patient's age, health status, abilities and health literacy, and adapt teaching styles to accommodate multimodal learning, as appropriate. Evaluation of the patient's retention of knowledge should be conducted.</p>	
Keywords	nutrition, patient education, methods, dialysis, nursing

Author(s) Title	Katharine Wilding Ravitsemusohjauksen menetelmiä hemodialyysihoitoa saaville potilaille
Number of Pages Date	23 sivua+ 3 liitettä 19 syyskuuta 2017
Degree	Bachelor of Health Care
Degree Programme	Degree Programme in Nursing
Specialisation option	Nursing
Instructor(s)	Liisa Montin, TtT, lehtori
<p>Kroonisen munuaistaudin esiintyvyys on maailmanlaajuisessa kasvussa, vastaten lihavuuden ja aikuistyyppin diabeteksen yleistymistä. Erityisruokavalio ja terveelliset elämäntavat voivat hidastaa kroonisen munuaistaudin etenemistä munuaisten vajaatoimintaan ja munuaisten toimintaa korvaavan hoidon, dialyysin, aloittamista. Tutkimukset ovat kuitenkin osoittaneet, että hemodialyysia tarvitsevilta potilailta puuttuu optimaalista terveyttä ylläpitävä ravitsemustieto.</p> <p>Tämän opinnäytetyön tarkoitus oli määrittää mitä menetelmiä käytetään hemodialyysissa käyvien potilaiden ravitsemukseen liittyvässä ohjauksessa. Tavoitteena oli kehittää tätä potilasohjausta.</p> <p>Artikkelit (n=11) valittiin CINAHL- ja Medline-tietokannoista sekä manuaalisilla hauilla (n=2). Kaikkiaan 13 artikkelia valittiin, analysoitiin ja kategorisoitiin systemaattisesti hyödyntäen induktiivista sisällönanalyysia. Tulokset esitettiin kirjallisuuskatsauksessa.</p> <p>Tässä katsauksessa on kuvailtu useita potilasohjauksen menetelmiä, jotka esitettiin visuaalisten, auditiivisten, lukemisen/kirjoittamisen sekä kinesteettisten oppimistapojen kautta. Näköaistia vaativat menetelmät, kuten kuvat, tulostettu materiaali sekä videot, olivat yleisimpiä. Auditiiviset menetelmät, kuten suullinen neuvonta ja teknologian käyttö, esimerkiksi tietokoneet ja muut apuvälineet olivat myös kuvattuina. Tämän katsauksen tulosten mukaan potilasohjausta annettiin yksilöllisesti, ja useimmiten sairaanhoitajan tai ravitsemusterapeutin toimesta.</p> <p>Tämän kirjallisuuskatsauksen keskeisin löytö näyttää olevan potilaan yksilöllistäminen ohjauksen suunnittelussa, ottaen huomioon potilaan iän, terveydentilan, kyvyt ja terveyslukutaidon, sekä ohjauksien soveltaminen mahdollistaen multimodaalisen oppimisen. Potilaan kykyä säilyttää tietoa tulisi arvioida.</p>	
Keywords	ravitsemus, potilasohjaus, menetelmät, dialyysi, hoitotyö

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1 Introduction

Chronic Kidney Disease (CKD) is a non-communicable condition which manifests as a structural or functional abnormality of the kidney. It can exist as a condition in its own right, but it is usually found in co-morbidities such as cardiovascular disease (CVD) or diabetes. (NICE 2015.) Obesity, a condition which has doubled in rates since 1980, is also a factor in the development of kidney disease. Obesity can increase the incidence of CKD indirectly by the development of hypertension, Type II Diabetes Mellitus and heart disease, or directly by damage caused to the kidney due to being overburdened. (WHO 2016.) It is believed that 26 million people in America suffer from CKD and millions more are at risk or undiagnosed (National Kidney Foundation 2016). Poorly managed Type II Diabetes Mellitus has remained the largest source of End Stage Renal Disease (ESRD) development in Finland since 1999 (Finnish Registry for Kidney Diseases 2015). The cost of treatment of all dialysis and kidney transplantation patients in Finland has been calculated at more than 100 million euros (estimation), of which 0.1% corresponds to 1-2 dialysis patients' annual costs (about 100 000 euros) (Finnish Registry for Kidney Diseases 2015).

To offset future rising costs of chronic care such as dialysis, emphasis should be placed on addressing the risk factors and causative issues of CKD (such as diabetes and hypertension) and promote healthy life habits such as patient nutritional education. Sutton, Hollingdale and Hart (2008) state that growing rates of obesity and diabetes give rise to increasing numbers of hypertension, heart disease and stroke, which leads to reciprocal increases of CKD incidence. One would assume that when a patient is diagnosed with hypertension, some form of heart disease or diabetes, they receive, as part of their treatment, nutritional advice and support to maintain their health at an optimal level. A "healthy" diet of lean proteins, plentiful amounts of fruit and vegetables and reduced sugar, fats and salt, along with a recommendation of 1.5-2 litres of fluid (preferably water) is the standard basic diet given to most patients, (The Eatwell Guide 2016.) but when kidney function is compromised, as in CKD, a different diet regime may be necessary (National Kidney Foundation 2016).

Patient Education is a term for a collection of scheduled activities that can help patients increase their current level of information about their health and improve their quality of life (Friedman, Cosby, Boyko, Hatton-Bauer & Turnbull 2010). Patient education can empower the patient and their loved ones/carers by helping to change the patient from a passive recipient of health care to a position of behaving with informed choices to affect their daily life. Such interventions to promote health knowledge and self-care can give a sense of purpose to a patient suffering from a chronic debilitating illness, and as Smeltzer, Bare, Hinkle and Cheever (2010) point out, health promotion and patient education can reduce health care costs such as preventing or delaying illness complications, prolonged hospital admissions and expensive and

intrusive medical procedures. The purpose of this thesis is to describe the methods used in nutrition-related patient education in haemodialysis.

2 Background

2.1 Chronic Kidney Disease (CKD) and End Stage Renal Disease (ESRD)

Kidney disease can affect approximately 15-25% of the population, often with no or minimal symptoms in the early stages. By the time the symptoms are noticed and acted upon, the kidney damage is already quite advanced. (Smart, Dieberg, Ladhani & Titus 2014.) Early kidney damage is diagnosed and monitored by urine and blood tests. Symptoms of later diagnosed Chronic Kidney Disease (CKD) include weight loss, poor appetite, oedema (which may manifest in the patient as swollen ankles, feet or hands or shortness of breath), itchy skin (pruritus), fatigue and increased urination. (NHS Choices 2016.)

There are 5 stages of Chronic Kidney Disease (CKD). Glomerular Filtration Rate is the measure of kidney function; a lower GFR indicates worsening kidney disease. A normal Glomerular Filtration Rate (GFR) is 90-115/min/1.73m², dependent on age and normal kidney function. (Renal Association 2013.) A young person aged between 20-30 years of age and without renal disease has a GFR of about 115, in comparison to an elderly person (65+ years and without renal disease) with a GFR of about 75. Risk factors for renal disease are diabetes, hypertension, family history, older age and ethnic group. Stages 1 and 2 show kidney damage with none or mild kidney dysfunction. Stage 3 and onwards (i.e. a GFR of 59-44) requires increasing nutrition support and culminating at Stage 5 (i.e. a GFR of less than 15). (Renal Association 2013.) Stage 5 is known as End Stage Renal Disease (ESRD) and a patient at this stage of illness requires Renal Replacement Therapy (RRT), in the form of either Haemodialysis (HD), Peritoneal Dialysis (PD) or kidney transplantation to survive (Smart et al, 2014). Not all patients with Chronic Kidney Disease will progress to ESRD, but those who do will face long and possibly intrusive healthcare treatments, which may be physically, psychologically and financially exhausting. (Smeltzer et al. 2010)

2.2 Definition of Dialysis Treatment

Haemodialysis (HD) is the process where the patient's blood is circulated through a special filtering machine known as a dialyser. The dialyser works like a healthy kidney, helping to maintain the correct ratios of fluid and electrolytes, preserve the acid-base balance and eliminating waste and toxins. (Smeltzer et al. 2010.) The patient's blood passes via a dialysis venous catheter through the dialyser's system of semi-permeable membranous tubing and specially formulated dialysis fluid. The blood is then filtered of excess fluid and waste products outside the body and returned to the patient. Buffers can be added to

retain essential compounds in the blood. HD is usually performed 3 times a week for 4-8 hours at a time. (Berman & Snyder 2012; Marieb 2012.) In Peritoneal Dialysis (PD), the patient's own body, i.e. the peritoneal (abdominal) cavity acts as the dialyser. The dialysis fluid is introduced to the peritoneal cavity via a catheter and filtration is carried out within the patient's body. The filtrate containing waste products and excess fluid is removed via the catheter. (Berman & Snyder 2012.) In this thesis, only HD patients will be considered.

2.3 Chronic Kidney Disease and Nutrition - "The Renal Diet"

Berman & Snyder (2012) describe nutrition as the dietary intake of a person and how the body uses that intake. Malnutrition, on the other hand, can be described as a diet in which the essential components of food are missing or inappropriate, which in healthcare terms equals under- or over-nutrition (Berman & Snyder 2012). A healthy diet, as previously described, can provide protection against malnutrition as well as common non-communicable diseases such as diabetes, cardiovascular disease and cancer (WHO 2016). It also can reduce the strain on the body already suffering with these diseases. For these patients especially, a nutritionally sound and appropriate diet is one aspect of care in which the patient should have timely intervention.

Sutton et al. (2008) point out that in the past, CKD had been seen more as a consequence of uncontrolled hypertension and congenital/hereditary diseases and therefore not warranting nutritional support or intervention in any way. Only patients with CKD resulting from long-term Diabetes Mellitus got more intensive nutritional support and guidance (Sutton et al. 2008). As described earlier, nowadays more and more patients are presenting with CKD with a history of heart disease and obesity, as well as more "traditional" diabetic and hypertensive patients. The obesity and heart disease patients may have had nutritional advice given which clearly contravenes the advice that a CKD diagnosed patient would receive. This may make choosing the appropriate diet difficult and confusing for the patient, and endangers their optimal nutritional status, especially if the patient requires dialysis. (Sutton et al. 2008.) The overload of conflicting knowledge can be too much for a patient and may lead the patient to not follow any guidelines at all (Meyer, Coveney and Ward 2014).

The "Renal Diet" is a set of nutritional guidelines to help the patient with CKD make appropriate food choices to optimise their health. It is said to be difficult for patients to follow as there may be restrictions on the amount of protein, sodium, potassium, phosphorus, and calcium allowed in the diet. Fluid intake may also be restricted depending on urinary output. These are quite individualized as limits are calculated on blood test results. Adhering to the diet may limit the amount of waste products and excess fluid in the bloodstream and reduces the filtering workload of the kidneys. (National Kidney Foundation 2016.)

Protein requirements in renal disease have to be monitored carefully; too much causes strain on the kidneys through built up waste products, too little causes malnutrition. Electrolytes, such as Sodium, Potassium and Calcium, are also carefully monitored as too little or too much of any of these can cause dangerous symptoms, such as cardiac arrhythmias, oedema and bone weaknesses (National Kidney Foundation 2016). Phosphorus, whilst not causing immediate damage to the body, will, at prolonged elevated levels, cause stiffening and hardening of blood vessels which raises the risk of cardiovascular blockages and death (Kalantar-Zadeh, 2013). Calorie intake is also important. Excessive intake of calories causes weight gain and further strain to both heart and kidneys. Too few calories results in weakness and a risk of malnutrition. (Berman & Snyder 2012.)

The restrictive diet and haemodialysis regime may negatively affect the renal patient's psychological state. Smith et al. (2010) show depression, lack of motivation and cravings are common in fluid-restricted renal patients and are factors in non-adherence to fluid and dietary restrictions. It has been concluded that renal patients would rather blame their medications for their renal disease than their diet, indicating a lack of knowledge and insight into their illness. Some patients believed they would have followed dietary restrictions more strictly had they known it could have slowed the progression of the CKD. (Hollingdale, Sutton and Hart 2008.)

2.4 Patient Education and Teaching Adults

In this thesis, the methods of patient education for adult patients undergoing haemodialysis is considered. Teaching to an adult differs to teaching to a child.

Adult learning was first considered by Malcolm Knowles in the 1970s. He formulated six ideas about adult learning that differ greatly from teaching to children. His theory is that an adult is an autonomous being and is able to study independently, needing the teacher only to guide and not to give facts as in a lecture. Adults are full of life experiences and knowledge, which should be used as a basis for new learning. Adults have goals and need to see the lessons fulfilling their own objectives. The education must show relevancy to an adult- i.e. there must be a point to the education and be practical so the adult can understand how and why the lessons are useful, especially in a work or health education situation. Finally, there should be a mutual respect between teacher and (adult) student to facilitate learning and that student and teacher are on an equal footing. (Knowles, cited by Russell 2006.)

An adult has different motivational needs to education than a child and that motivation may be affected by different factors. There are several sources of motivation for learning for adults but particular areas may

affect chronically ill patients such as those with End Stage Renal Disease. For example, an adult may learn best when the need is personalised, such as a better quality of life, but preconceived ideas from previous life experiences may hamper the need to learn ("I am too old to learn"). A patient may feel the need to learn as conforming to medical advice as set by health care professionals or as a form of complying with a figure of authority like a doctor. Some patients may find learning as something positive to manage their chronic illness, alleviating negativity, hopelessness and boredom and instilling a feeling of empowerment and self-management in their life. Motivation to learn may be hindered by more practical issues such as lack of time, lack of money, transportation problems and arranging childcare. If the mind is distracted in some way, it is not conducive to learning. (Lieb 1991.)

Adults, as any student, have different styles of learning. The VARK sensory modalities system (Visual, Auditory / Aural, Reading/Writing and Kinesthetic) was devised by Fleming and Mills in 1992 to highlight the different senses used in learning and which teaching methods suited particular students and their sensory learning style. Examples of visual learning, for example, would be graphs, charts and maps (but not videos). A VARK questionnaire can help determine which senses predominate in a student's learning, but many people have been found to be "multi-modal", i.e. where more than one sensory modality is highly ranked (VARK Learn Limited 2017). This kind of knowledge would be helpful to know when planning Patient Education so that many different patients could benefit using their own personal learning style.

It is important for the patient to access the information needed, but it is equally important the patient retains that information to make an informed choice / effect on their life. To ensure patients have gained and understood the knowledge taught, a method such as "Teach-Back" is employed. This involves the patient repeating back the knowledge in their own words to a health care professional, so the health care professional can assess the level of understanding and correct or add information as necessary. (Weiss, cited by Tamura-Lis, 2013.)

3 Purpose, aim and study question

The purpose of this thesis is to describe the methods of nutrition-related patient education for patients undergoing haemodialysis. The aim is to develop patient education for patients undergoing haemodialysis.

The study question is-

What are the methods of nutrition-related patient education for patients undergoing haemodialysis?

4 Data Collection Method, Data Collection and Data Analysis

4.1 Data Collection Method

Parahoo (2014) states that the main idea of research is to add one's own findings to a topic of study in order to create a deeper understanding of knowledge in that subject. A literature review is an objective assessment of evidence or research where researchers can critically summarise the most relevant information on a chosen topic that has been already researched and place it in context to create new insights or to form the framework for further study (LoBiondo-Wood and Haber 2010). Such studies can reveal aspects of the subject not already answered in the research and which may benefit from further investigation (Polit and Beck 2006).

The articles for this literature review were chosen using the electronic databases CINAHL and Ovid Medline. Further articles were manually searched after checking the reference lists of other articles. To narrow the search, a selection of inclusion and exclusion criteria were utilised (Table 1).

Table 1. Inclusion and Exclusion criteria used for this literature review.

Inclusion Criteria	Exclusion Criteria
Haemo/Hemodialysis Chronic Kidney Disease End Stage Renal Failure (ESRD) Adult Years 2009-2017	Peritoneal/CAPD dialysis Renal Transplantation Pre End Stage Renal Failure (ESRD) / Not on dialysis Diabetes Mellitus in title Parenteral Nutrition Acute Kidney Injury / Failure

The search terms were "nutrition", "patient education", "methods", "dialysis" and "nursing". The terms "haemo/hemodialysis" were later introduced to further limit the searches. Articles used in this thesis have been selected from the limits "years 2009-2017" (to use the latest research materials), English language academic journal sources (for ease of reading) and availability of Full Text. The hits from the searches were further reviewed by article title, availability of abstract and then finally by article context. Further relevant articles were found manually after checking the reference lists of other articles. After removal of duplications of articles, 13 articles were selected for the final analysis.

Table 2. Literature Search from Databases conducted 17.02-19.02.2017 showing search terms and limits used for this thesis.

Database	CINAHL	Ovid Medline
Search Terms	Nutrition AND Patient Education AND Methods AND Dialysis AND Nursing (Haemo/hemodialysis)	
Years 2009-2017 English Language Full Text (hits) Academic Articles	759	1018
Reviewed by Title and Abstract	127	102
Reviewed by Context	41	27
Duplicates Removed	3	1
Manual Search of Articles from Reference Lists		3
Articles used in final Analysis	5	8
Total Articles used in final Analysis	13	

Electronic databases provide a wider and more current selection of research articles than other sources such as books, which tend to date already after publication (Parahoo 2014). Using a range of academic sources from trusted research journals increases credibility and reliability, and promotes objectivity. Limits were set on the searches to produce the most current and relevant articles. Parahoo (2014) states that primary sources of information i.e. the original research have the most value in literature as those articles are unadulterated by second-hand reporting, and these, in the main part, have been used in this thesis.

4.2 Data Analysis

Once the articles have been chosen from the database searches, then the articles are carefully read and re-read to become familiar with the content and extract common themes. This is called content analysis. If there has been little previously researched knowledge on a subject available or the knowledge has not been comprehensively collected, then a method known as inductive content analysis is employed. This is a method of collecting themes from raw data in a consistent and systematic manner and then further classifying those themes into fewer but similar categories. The idea of this is that similar themed categories

have similar meanings, thus allowing greater understanding of the subject studied. (Elo & Kyngäs 2007.) The purpose of this is not just to group similar themes, but to bring together themes that "belong" and employ that information to compare and contrast data not belonging to that category (Elo & Kyngäs 2007). The categories in this thesis have been derived using the principles of inductive content analysis from the themes from the selected articles and are shown in Appendix 1.

5 Findings

5.1 General Findings

In this thesis, thirteen articles were analysed according to the data collection and inclusion / exclusion criteria as shown previously. The general findings of the data analysis are as follows:-

Of the thirteen articles, seven had a control group to support their findings (Ebrahimi et al. 2016; Karavetian and Ghaddar, 2012; Shi et al. 2013; Hernandez et al. 2014; Sevick et al. 2016; Ting-Yin Cheng et al. 2016 and Welch et al. 2013). Questionnaires were used in ten of the reviewed studies (Brogdon, 2013; Ebrahimi et al. 2016; Karavetian and Ghaddar, 2012; Shi et al. 2013; Chow and Dalton 2012; Hernandez et al.2014; Ting-Yin Cheng et al. 2016; Baldwin, 2013; Russell et al. 2011 and Welch et al. 2013) and appeared to be a popular method of collecting data pre- and post- intervention.

The subject of the Patient Education was Nutrition or Nutrition-related, but six of the articles focused specifically on Hyperphosphatemia and issues pertaining to Hyperphosphatemia, such as adherence to phosphate binder medication. (Brogdon, 2013; Karavetian and Ghaddar, 2012; Shi et al. 2013; Chow and Dalton 2012; Ting-Yin Cheng et al. 2016 and Baldwin, 2013). Eight of the studies had Patient Education sessions at least weekly (Ebrahimi et al. 2016; Karavetian and Ghaddar, 2012; Shi et al. 2013; Chow and Dalton 2012; Hernandez et al.2014; Sevick et al. 2016; Russell et al. 2011 and Welch et al. 2013) and five of those conducted educational intervention for patients twice or three times weekly. (Ebrahimi et al. 2016; Karavetian and Ghaddar, 2012; Shi et al. 2013; Sevick et al. 2016 and Russell et al. 2011). Length of educational intervention varied in the studies:- four articles (Baraz et al. 2009; Karavetian and Ghaddar, 2012; Shi et al. 2013 and Ting-Yin Cheng et al. 2016) had educational sessions of 20-30 minutes duration, three articles had teaching interventions of 40 minutes or longer (Ebrahimi et al. 2016; Baldwin, 2013 and Welch et al. 2013) and six did not state any length of time at all (Hegazy et al. 2012; Brogdon, 2013; Chow and Dalton 2012; Hernandez Morante et al.2014; Sevick et al. 2016 and Russell et al. 2011). Eight of the articles conducted the educational intervention for up to six months (Ebrahimi et al. 2016; Karavetian and Ghaddar, 2012; Shi et al. 2013; Chow and Dalton 2012; Hernandez et al. 2014; Sevick et al. 2016; Russell et al. 2011 and Welch et al. 2013).

The average age of the patient receiving the nutritional education in this thesis, as calculated from the articles' age demographics, is 52 years.

5.2 Findings from Categories

After categorising the findings of the thirteen articles, it was evident that there were five different aspects in the methods of nutrition related patient education in haemodialysis. These aspects are Auditory, Visual, Technology, Participatory / Active and Group / Individual, as shown in Figure 1. (Appendix 1). The method and instructor of nutritional education by author is shown in Table 3. (Appendix 2).

5.2.1 Auditory

According to the definition proposed by Fleming and Mills, auditory (or aural) reflects a wish to learn by listening or speaking. Of this group, as shown by Table 3, counselling is represented in seven of the chosen articles.

5.2.2 Nutritional Counselling

In this group of seven articles on the effects of nutritional counselling, five showed definite improvements, one showed slight improvement and one showed no improvement at all (Chow and Dalton 2012). The main improvements were shown in level of knowledge as tested by questionnaire post intervention and by clinical laboratory analysis.

One clinical laboratory test, Serum Phosphate, was used as a marker for evidence of adherence to the renal diet. As stated earlier, elevated levels of phosphate in the blood can cause long-term circulatory calcification. Staying within the normal range of this marker would indicate improved patient health and indicates good knowledge of food phosphate sources. Using this information, it was seen that three studies had significant improvements in Serum Phosphate levels after counselling, and one had a slight but not significantly improved result. One study continued with raised levels of Serum Phosphate despite the counselling intervention. The latter study somewhat goes against the trend of improvement after intervention as shown in other studies, but it was shown that the patients from this study (Chow and Dalton 2012) had only slightly raised phosphate levels pre-intervention and that changes were not likely to be very large, implying at least that their study group were more or less compliant with treatment pre-intervention.

Hernandez et al. (2014) and Hegazy et al. (2012) showed improvement in the severity of malnutrition in their intervention groups, which was attributed to improved knowledge in food types and fluid intake after counselling intervention. One article (Hernandez et al. 2014) determined that of the two groups in their study, the one receiving nutritional education showed greater improvements in malnutrition status.

Sevick et al. (2016) measured the success of their counselling intervention by inter-dialytic weight gain and dietary sodium intake, which showed that there was a significant reduction in sodium intake and improvement in Serum Sodium levels after 8 weeks, but this improvement was not sustained after 16 weeks.

5.2.3 Didactic Lectures

Didactic lectures were the method of choice in one article (Baraz et al. 2009), which appeared to have a positive outcome in learning for the patients involved. This particular article also combined an interactive support group after the lecture, which may have contributed to the overall improvement of the experimental group's laboratory statistics.

5.2.4 Interactive / Supportive

Two studies (Hernandez et al. 2014; Baraz et al. 2009) implemented interactive / supportive interventions in their research. A further article (Hernandez et al. 2014) used interactive sessions, both as individual and group settings, to produce a flow of feedback between healthcare professional and the patient.

5.2.5 Motivational Interviewing

One article (Russell et al. 2011) utilised Motivational Interviewing as an educational technique in this review. This study reported improvements to some clinical markers, such as phosphates but more significantly, improvement was seen in adherence to dialysis treatment. There appeared to be less occurrence of shortened dialysis treatments and dialysis attendance levels were higher.

5.3 Visual

Visual, as described previously, is the method of learning by seeing material by means of charts, maps, designs and pictures, but not videos or photography. Seven of the chosen articles used visual information in the form of pamphlets, educational brochures and "flashcard" reminders to increase knowledge.

5.3.1 Printed Materials

Brogdon (2013) chose an educational brochure on self-care and phosphate management which improved knowledge by up to 77% in some cases. Phosphate markers showed reduced (therefore better) levels after printed materials were distributed in three other studies (Karavetian & Ghaddar 2012; Shi et al. 2013 and Ting-Yin Cheng et al. 2016). In the latter study, patients in the experimental reported an improvement in pruritus, a sign of reduced phosphate levels in the blood. Ebrahimi et al. (2016) used an educational pamphlet as part of their intervention, which resulted in enhanced knowledge levels and an improved quality of life, according to questionnaires. Baraz et al. (2009) and Hegazy et al. (2012) distributed printed material after the main education sessions, so were not seen as the main focus of the intervention, but may have supported patients' learning at a later time.

5.3.2 Colourful Pictures

Colourful pictures were used by two studies in this thesis (Karavetian & Ghaddar 2012) and Ting-Yin Cheng et al. (2016). Again, Serum Phosphate was the marker of choice to determine the success of the intervention and both studies recorded lowered levels of phosphates in their experiment groups.

5.4 Technology

Technology includes the methods of teaching by laptop / computer, self-monitoring devices and video.

5.4.1 Laptops / Computers

Laptops were used in four studies (Hegazy et al. 2012; Shi et al. 2013; Hernandez et al. 2014 and Sevick et al. 2016) to impart nutrition related patient education. Powerpoint slideshows demonstrated nutritional messages and colourful graphics, while one study (Sevick et al. 2016) used Powerpoint for educational modules. Shi et al. (2013) maintained that their slideshow intervention contributed to improvements in the experimental group, such as 50% of that group achieved bloods values comparable to the International Renal Nutritional Standards (K/DOQI levels). Hernandez et al. (2014) also claimed success in their laptop slideshow intervention, as the malnutrition rate post intervention in the experiment group reduced by 25%. In their study, Hegazy et al. (2012) showed also improvement in rates of malnutrition, where incidence of moderately malnourished patients in the intervention group dropped from 7,3% to 0% post-intervention. Sevick et al. (2016) utilised laptops to educate their experimental group but found no lasting improvements

post-education.

5.4.2 Self-Monitoring Devices

Self-monitoring devices (handheld computers) were implemented in two studies in this review. In these studies, both monitoring systems show potential to contribute positively to patients' dietary habits, but

Sevick et al. (2016) found that initial gains in knowledge shown by patients (by the measurement of interdialytic weight gain) was soon lost after eight weeks. Welch et al. (2013) used two different handheld devices with their intervention and control group. The intervention group made use of a Dietary Intake Monitoring Application (DIMA) to record daily nutritional intake and the control group used a Daily Activity Monitor Application (DAMA) to record daily activity levels only. The DIMA group showed initial improvements through adhering to the renal diet, but did not perceive the benefits of the reduced sodium and fluid intake. The DIMA was considered to be better from the patients' perspective than the DAMA.

5.4.3 Video

Video has been included in technology although it is a visual aid. Two studies (Baraz et al. 2009; Baldwin 2013) included the use of video, the former to educate about dietary and fluid compliance, the latter to improve the phosphate control in haemodialysis patients. Baldwin reported reduced Serum Phosphate levels after one viewing of the educational video, but there was no improvement in knowledge or clinical statistics after two viewings. Baraz et al. (2009) indicated positive outcomes from their video intervention, but not as significant as their oral education.

5.5 Participatory / Active

These are interventions that encourage the participant to take a more active role and possibly interact more with others. These may be seen as more "informal" methods of education and would possibly appeal more to the kinaesthetic learner. Four studies were represented in this aspect.

5.5.1 Interactive Games

Karavetian and Ghaddar (2012) used interactive games to enhance learning in controlling Serum Phosphate levels. In their study, Group A had interactive games and were supplied with the correct answers, Group B had the games, but with the answers omitted and Group C had no intervention at all.

Of all these groups, Group A had the most striking positive results. Group B showed some improvements but not significantly, and there were not any changes in Group C at all.

5.5.2 Tally Score Board

Despite having a small prize for the “winner” (i.e. the patient with the best Serum Phosphate levels), Chow and Dalton (2012) noted in their study that their “Tally Scoreboard” intervention did not have any positive effects on Serum Phosphate clinical laboratory results, but adherence to Phosphate Binder medication was increased. After the intervention, Chow and Dalton (2012) found that 60% of patients asked had found the education “a good way to learn” but overall it was “fun”.

5.5.3 Other active methods

Hernandez et al. (2014) had cookery as part of the education package, but the details of that intervention were not expanded on in the text. Animations were used by Baraz et al. (2009) but it was not clear from the text how well it worked as an individual aspect of their education package.

5.6 Group / Individual

Ten of the selected articles favoured individual educational sessions with patients (Hegazy et al. 2012; Brogdon 2013; Ebrahimi et al. 2016; Karavetian & Ghaddar 2012; Shi et al. 2013; Chow & Dalton 2012; Hernandez et al. 2014; Sevick et al. 2016; Russell et al. 2011 and Welch et al. 2013), with one study reporting no improvement after their interventions (Chow & Dalton 2012). Three studies made use of group sessions (Baraz et al. 2009; Shi et al. 2013 and Hernandez et al. 2014), but Baraz et al. (2009) did not include individual sessions as well as group sessions.

6 Discussion

6.1 Discussion of the Findings

Counselling is arguably the most common form of patient education but does not necessarily mean it is the most effective. As individual sessions, counselling appears to have positive and measurable benefits to the patients, as shown in this thesis, but may not be practical on a long-term basis due to sheer numbers of patients needing dietary counselling. It needs planning by the educator, who ideally should be a person

well versed in renal nutrition. Ordinarily, this would be a specially trained dietician, but due to availability and financial restraints it is more likely a nurse will deliver this education. (Shi et al. 2013; Baraz et al. 2009; Hernandez et al. 2014.)

Didactic lecture is cost-effective as it educates many people at the same time, but does not allow for those whose learning strengths are not predominantly auditory based. This particular article also combined an interactive support group after the lecture, which may have contributed to the overall improvement of the experimental group's laboratory statistics. Support sessions can help the patient to feel they are not alone in their situation and by interacting with "peers", they can gain new knowledge and understanding of their condition. It may even boost positive feelings and reduce the risk of isolation and depression. (Smeltzer et al. 2010.)

Written/printed material was a popular method to impart knowledge to patients. This method may be more expensive and time consuming to produce in bulk, and may not be suitable for all patients. Some patients, as mentioned previously, have developed End Stage Renal Disease through suffering from Diabetes Mellitus, and it may be reasonable to assume these patients have problems with sight, as a progression of Diabetic Retinopathy. In these cases, it is imperative that the educator considers how the information is displayed. Appropriate colouring and large print may help. (Smeltzer et al. 2010.) On the other hand, something concrete that a patient can hold in their hands and refer to in their own home is useful and can help in memory. It is also helpful for relatives/ carers who can also benefit from nutritional education for End Stage Renal Disease. After all, it may be the patient's family members who are preparing the meals and supervising nutrition related medication. (Smeltzer et al. 2010.) Again, when the pictures are available at all times to the patients, the pictures can aid memory and knowledge may be acquired by colour association ("traffic light colours" for assessing increased sodium levels, for example) (NHS Choices 2015). Pictures are useful in cases where patients have lower literacy skills or require knowledge in a non-native language. Interestingly, in this review patients who received colourful picture education also got individualised attention from health care workers.

Both written/printed material have been included in the visual results, even though reading is seen as a separate learning style. Reading written material, however simply phrased, may prove a challenge to those with lower literacy or educational standard. It appears from this review that written/printed material is still prevalent in patient education, so it is important that educators check the level of understanding of the patient group before offering written educational material.

Computer education, such as laptop slide-shows and graphics, have their place in modern teaching methods. While these presentations are informative and educational, unless the patient can access the

information via emails or printed material, the information largely stays where it was taught- that is to say, the patient may still need follow up information at home.

The idea of an application available whenever needed to easily scan and calculate nutritional values would be highly valued by patients who need to monitor their diet closely, and indeed much research and technology is geared towards creating such an application. This type of monitoring device is beneficial if the patient themselves is able to use it correctly. The patients in both these studies were given training, but it still depends on how "computer-literate" and competent a patient feels handling such new technology. It may not be suitable for those with neuropathy in the hands (such as patients with advanced Diabetes Mellitus) or arthritic joints, for example elderly patients, but on the other hand, such a compact and mobile device may suit younger patients who are already experienced with mobile technology. Smartphones have already been used in reminding patients of appointment times and laboratory results, such as "MyKidneyCare App" (Nottage, Tibbles and Cox 2014), so diet-related applications will be a natural progression in technology.

Video is a cheap, easily available teaching option which can be used on a group or individual level. Attention again must be paid to the language level and visuals, so that those with poor eyesight can also benefit. It is also good that a video can be stopped and points explained or clarified whenever necessary.

6.2 Limitations of reviewed articles

Seven of the thirteen articles (Ebrahimi et al. 2016; Karavetian and Ghaddar, 2012; Shi et al. 2013; Hernandez Morante et al.2014; Sevick et al. 2016; Ting-Yin Cheng et al. 2016 and Welch et al. 2013) were controlled research trials, so six articles had no control group with which to compare. This also means that methods of patient education described in this literature review cannot be compared and contrasted for the most effective teaching method. Combinations of different methods of patient education may well be effective but it is difficult to ascertain which individual aspects of the methods were the most effective, especially as details of how the teaching was performed were lacking. Only the articles using one method of education can truly claim their research was successful within the parameters of their study. However, VARK learning shows that most students are multimodal, i.e. use different sensory aspects to learn and most of the reviewed articles use this concept to educate patients.

Seven of the articles (Hegazy et al. 2012; Brogdon, 2013; Ebrahimi et al. 2016; Karavetian and Ghaddar, 2012; Chow and Dalton 2012; Ting-Yin Cheng et al. 2016 and Russell et al. 2011) had used only one study area which could not be generalised to a greater population, especially if the sample size was already small, as stated earlier. Five of the selected articles (Hegazy et al. 2012; Brogdon, 2013; Chow

and Dalton 2012; Russell et al. 2011 and Welch et al. 2013) had a sample size of less than 50 participants, which is considered by research standards as quite small. In particular, Brogdon (2013) was aware of this limitation in her study, realising that a small number of participants can equate to an over-estimation of findings, whether they be positive or negative. Data contamination was mostly avoided in controlled groups, by keeping those participants away from each other as far as possible, but those researches involving family members may have had some external influence on the data and may have affected some results.

Questionnaires were used to collect data in ten of the chosen articles. (Brogdon, 2013; Ebrahimi et al. 2016; Karavetian and Ghaddar, 2012; Shi et al. 2013; Chow and Dalton 2012; Hernandez Morante et al. 2014; Ting-Yin Cheng et al. 2016; Baldwin, 2013; Russell et al. 2011 and Welch et al. 2013). There are distinct advantages and disadvantages in using this method. On the positive side, questionnaires can collect large amounts of information quite quickly at the respondents' convenience. It can be developed and improved by the researcher by trying out the questionnaire on a select sample group. Anonymity can be assured as the researcher can code the raw data produced. (Parahoo 2016). On the other hand, questionnaires can be limiting. Respondents may not be able to expand on the information required, and indeed may interpret the questions entirely differently to the researcher, especially if the respondent has certain life states such as chronic illness, depression or a different cultural background. Similarly, where data were collected by the self-reporting of patients, the information given by the patient may reflect what the patient thinks he/she should say, and not the entire truth. Family involvement, as mentioned previously, may also have had some bearing on the accuracy of the respondents' questionnaires.

High attrition rates (>20% drop-out) in the chosen articles were explained by patient death, renal transplantation or illness/condition unrelated to Chronic Kidney Disease. In a chronic illness such as CKD, the chance of deterioration in health is always a possibility and may not easily be predicted (Smeltzer et al. 2010). Other factors seen to limit the researches (as described by the authors themselves) were too few clinical parameters to measure success (Hernandez Morante et al. 2014), inconsistent educational methods (Chow and Dalton 2012), follow up not long enough or interrupted (Baraz et al. 2009; Karavetian and Ghaddar, 2012 and Shi et al. 2013) and not using a Smartphone in patient reporting (Ting-Yin Cheng et al. 2016 and Sevick et al. 2016).

6.3 Ethical Considerations of the Thesis

This thesis was a literature review and conformed to the ethical guidelines as set out by the Finnish Advisory Board on Research Integrity (TENK 2014). If this thesis was to be ethically acceptable and reliable, all aspects of the research had to display ethically sound scientific conduct in accordance to TENK

ethical guidelines. This also gave credibility to the findings. The thesis was presented accurately, paying meticulous attention to honesty and integrity. Data collection, analysis and evaluation conformed to the principles of specific scientific criteria, acknowledged and recognised in the field of research. All data used were openly communicated and responsibly published. Falsification, fabrication ("fixing results to suit") and plagiarism, all forms of research misconduct, were avoided as far as possible. Other researchers' work and achievements were credited appropriately and respectfully and accurately referenced. All sources of data were acknowledged. The literature review was written in a neutral and objective manner and was not subject to author interpretations. There were no conflicts of interest reported in this thesis.

As this was a literature review and no people were involved, there was no need to obtain informed consent. The consent had already been obtained via the literature studied. This study did not harm anyone, as the source of information was previously written research papers. As the research articles under review had already been approved by academic publications, there was no need to store sensitive data and no confidentiality had been breached. It can be assumed the permission to use the information was given via Metropolia University of Applied Sciences, as the academic articles were readily available online. Metropolia University of Applied Sciences is officially committed to ethical research conduct by the signing of the Commitment Document (Finnish Advisory Board on Research Integrity 2014).

6.4 Validity of the Thesis

This thesis addressed the issues of validity in the literature review by critically appraising the data and its analysis. Research is more likely to be acceptable as valid if the sources used are respected at least in the research community. Researchers should always critically appraise the source of the study material. Places of learning, such as universities, can assure some validity in resource material by subscribing to recognised research journals in paper, electronic or book form. The material must have author name(s) and their details and publication dates. The credibility of the research is more respected from recognised educational institutions. Web-sites are more trusted if the electronic address has ".edu" included. Search engines that produce unqualified websites should be avoided. (Study & Learning Centre, RMIT 2005)

Validity can also be respected if the researcher themselves acts in a responsible and ethical manner. In the whole thesis, from subject selection, planning and evolving a study question to collection of data and its analysis, the researcher can show the reader in a precise manner how the thesis progress evolves. In this thesis, the results were derived from the data and not from personal presuppositions or expectations.

This clarity of method gives the reader the chance to assess the reliability of the studies and thus its validity i.e. would another person get the same results by following to the letter the stages described in the thesis.

This is called external validation (LoBiondo-Wood and Haber 2006). Some of the data were difficult to categorise into themes as the details of the interventions were not described, which may have affected the findings of this thesis.

Internal validity refers to whether the study was affected by aspects such as bias and that interventions were done exactly the same way every time. Internal validity refers to whether the study was affected by aspects such as bias and that interventions were done exactly the same way every time. Research work undertaken as a pair, group or collaboration also validates findings and renders it more objective. This thesis was undertaken by one author, which, by previously mentioned criteria, could affect reliability. However, the thesis made use of two scientifically recognised databases, Medline and CINAHL, and the use of high quality academically sound articles to help counteract data shortcomings. Threats to internal validity are numerous but do not invalidate the study, as long as the threats are recorded appropriately in the results or as limitations to the study (LoBiondo-Wood and Haber 2006). This thesis was written within strict ethical guidelines and there were no conflicts of interest.

7 Conclusion and Implications for Nursing Practice

7.1 Conclusion

In this thesis, many different methods of patient education were seen, which were represented by the VARK learning styles of visual, auditory, reading/writing and kinaesthetic. Visual methods, such as pictures and printed materials, and auditory methods such as counselling, were most common. Educational sessions were mostly conducted on an individual basis by nurses or dieticians. This thesis is not an exhaustive list of educational methods, but it can be seen that a combination of educational methods is more effective than a single type. Further research is recommended.

7.2 Recommendations for Nursing Practice

As nurses, by the nature of their work, are in regular and close contact with dialysis patients, they make appropriate teachers of health education. Nurses often work one-to-one with dialysis patients, which builds a good rapport and close working relationship, ideal conditions for sharing knowledge and information. The nurse has the opportunity to assess the patient's ability to learn, by asking how the patient learns best (e.g. reading, listening, etc.) and adapting the teaching accordingly. The nurse should

be aware that even patients with minimal reading skills will report that they can read well, and those who are chronically ill will have the highest risk of poor health literacy (Smeltzer et al. 2010).

Renal disease patients will have a better understanding of their health if the principles of good nutrition and diet restrictions are taught and learned thoroughly. Both nutrition and fluid restriction are important aspects of care in End Stage Renal Disease- fluid overload can cause the patient to suffer from shortness of breath and fatigue, and patients who are poorly nourished may have symptoms of malnutrition, such as fatigue and headaches. Hyperphosphatemia can cause bone pain, pruritus and calcification of blood vessels. (Smeltzer et al. 2010; Kalantar-Zadeh, 2013.) By teaching patients how to maintain good nutritional health, the patient becomes empowered and can take control of their own health situation.

From the results of this thesis, nutritional education for patients undergoing haemodialysis should be regular (at least once weekly) and long-term (at least 2 months), and implement different sensory methods to maximise learning. Sensitive observation of the patient will determine whether the patient can tolerate educational sessions during a dialysis treatment. Teaching should be consistent and the information in line with other health care disciplines (e.g. doctors, dieticians) to reduce the risk of conflicting messages. (Hollingdale et al. 2008) The nurse should be empathetic and needs to remember that the patient may be depressed or struggling with their condition. The renal diet is hard to maintain for the patient so health care professionals should not scold or punish the patient for non-compliance to treatment. Making the teaching session fun can increase motivation to comply with treatment. Finally, the patient's new knowledge should be evaluated, for example by teach-back methods or on-site questionnaires (to avoid outside help/ influence/ contamination) to assess outcomes and correct knowledge if required.

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Appendix 1. Inductive Content Analysis Process.

Categorisation

Findings	Generic category	Main Category
Counselling	Auditory	Methods of Patient Education
Interactive / Supportive		
Motivational Interviewing		
Didactic Lecture		
Printed Material	Visual	
Colourful Pictures		
Video		
Laptop Computer	Technology	
Technology/Self-Monitoring Device		
Animations	Participatory / Active	
Games		
Tally Board		
Group / Individual Intervention		

Figure 1. Findings categorised into themes as part of inductive content analysis

Author(s), year and country where the study was conducted	Purpose	Participants (sample size)	Method of Nutrition related Patient Education	Data collection and analysis	Main results
Baldwin, D.M. 2013 USA 1	Viewing an educational video can improve phosphorus control in patients on haemodialysis: A pilot study	150	Educational video of 45 minutes duration made to positively impact on knowledge and behaviour connected to bone/mineral disorders in HD patients and issues pertaining to phosphorus in the body. 52% of participants were randomly selected to view the video twice	Single-arm interventional pilot study Questionnaire and food quiz Laboratory blood studies	Average phosphorus levels for patients were lower in the month after viewing the video compared to values of the previous 3 months. No significant difference of phosphorus levels between those who saw the video once or twice.
Baraz et al 2009 Iran 2	To determine the effect of an educational intervention on dietary and fluid compliance in patients having hemodialysis	63	2 types of education- a) oral education as a lecture and interactive support group. Take-home leaflet. b) 30 minute video.	Randomised trial Laboratory blood studies Inter-dialytic Weight Gain (IDWG) measurements.	After oral intervention- all laboratory results except Sodium and Potassium show significantly decreased levels. After video intervention- phosphate decreased, Calcium increased, all other laboratory results are insignificantly decreased. IDWG is decreased in both groups. No obvious differences in mean results between educational methods

<p>Brogdon, R. 2013 USA 3</p>	<p>A Self-Care Educational Intervention to improve knowledge of dietary Phosphorus Control in patients requiring Haemodialysis: a pilot study</p>	<p>10</p>	<p>Self-care educational brochure reviewed with each patient (1 to1). Brochure was given to patient to take home.</p>	<p>A pilot study using literature review and Patient Questionnaire (20 questions knowledge)</p>	<p>Identify strategies to improve dietary phosphorus content (pre-test 39%, post-test 77%), Identify signs & symptoms of increased phosphorus (pre-test 40%, post-test 72,5%), Identify foods high and low in phosphorus (pre-test 26,7%, post-test 85%).</p>
<p>Chow, J. & Dalton, B. 2012 Australia 4</p>	<p>To investigate the effect of a structured, 12 week education programme on serum phosphate levels and knowledge regarding phosphate management in haemodialysis (HD) patients</p>	<p>39</p>	<p>Education emphasizing the importance of phosphate binders and medication compliance was provided by nurses. Patient participation tracked by a score board.(1 point for bringing binder to session, 1 point for matching binder(s) to meal size and taking it correctly, 1 point for phosphate levels staying within acceptable levels). A small prize was given to the patient with most points.</p>	<p>Questionnaire Laboratory blood studies (Serum Phosphate, Serum Bicarbonate, Serum Calcium and Serum Chloride) Results were measured from comparisons of laboratory blood tests at baseline and after 3 months intervention</p>	<p>Serum bicarbonate was the only blood test that showed improvement. Calcium and Chloride remained stable, phosphate remained slightly above normal. 60% of patients expressed they were compliant with phosphate binder medication, 56% felt confidence in managing their phosphate levels on a daily basis.</p>

Ebrahimi, H. et al 2016 Iran 5	To determine the effects of educational instructions on haemodialysis patients' knowledge and quality of life.	99	One-to-one educational sessions (30-40 minutes and 10-15 minutes answering questions) twice a week for 12 weeks. Educational pamphlet given.	Questionnaires- Demographics, dietary status and quality of life	Statistically significant improvement in knowledge in intervention group. Quality of life score improved after intervention
Hegazy, I. S. et al 2012 Egypt 6	Study of the effect of dietary counselling on the improvement of end stage renal disease patients	41	Nutritional Counselling in one-to-one sessions. Laptop computer slides with nutritional messages and animations	Intervention Study Interview Nutritional status Laboratory blood studies	Improvements in knowledge observed (food items, fluid intake, how malnutrition worsens ESRD, high biological protein sources). Improvements in clinical laboratory parameters in all but phosphate and haemoglobin). Moderately malnourished patient amount reduced from 7,3% to 0%
Hernandez Morante, J. et al. 2014 Spain 7	Effectiveness of a Nutrition Education programme for Prevention and Treatment of Malnutrition in End Stage Renal Disease (ESRD)	120 (87 completed)	2 groups a) Nutritional Educational Programme (NEP) 12 sessions (8 over 2 months, then 4 over 2 months) on individual or small group basis. Interactive sessions including cooking, slideshow. b) Oral Supplement group (OS) only received a	Longitudinal 4 month prospective study Laboratory blood studies Questionnaire	NEP group - malnutrition prevalence decreased 25% (pre-intervention 31 patients had malnutrition, post intervention 17 patients had malnutrition) OS group- malnutrition prevalence reduced by 15%. Nutritional test showed NEP group had increased

			nutritional supplement for 3 times/week for 4 months.		knowledge post intervention, shown also by blood tests.
Karavetian, M. and Ghaddar, S. 2012 USA/Lebanon 8	To examine the effect of self- management dietary counselling (SMDC) on adherence to dietary management of hyperphosphatemia among haemodialysis patients	122	Group A- 2x20 minute sessions a week for 8 weeks. Counselling, games and positive reinforcement. Group B- Study educational games only with correct answers omitted. Group C- no intervention	Cluster based randomized control trial Questionnaires (Group A intervention Group B partial intervention Group C no intervention)	Knowledge increased in Group A. Only in Group A were phosphate levels improved after intervention. Calcium x Phosphate levels improved in both groups A+B but not C. Adherence scores improved in Group A but not Group C. Insignificant change in score in Group B. No improvement in binder intake for any group.
Russell et al 2011 USA 9	To examine the feasibility and efficacy of a staff-delivered motivational interviewing technique on treatment, diet, medication and fluid adherence in adult patients receiving outpatient haemodialysis	29	Dialysis staff, who were specially instructed in Motivational Interviewing, gave educational support using these techniques for 3 months to patients receiving HD treatment.	Pre-post design pilot study. Non-adherence was measured in patients 3 months prior to the intervention. (via patient records and laboratory blood studies) Questionnaire (the Health Care Climate Questionnaire, which can measure patient autonomy, a main issue in Motivational Interviewing)	Motivational interviewing seemed to have an effect on dialysis attendance, incidence of shortened treatments and also phosphorus and albumin serum levels. Inter-dialytic Weight Gain measurements were less influenced by Motivational Interviewing. Approach was acceptable to both staff and patients.

<p>Sevick M.A. et al 2016 USA 10</p>	<p>To evaluate the efficacy of behavioural counselling combined with technology-based self-monitoring for sodium restriction in haemodialysis patients</p>	<p>179 (160 completed)</p>	<p>2 groups -Intervention group and control group. Over 16 week period, both groups were shown 6 educational modules on HD diet. Intervention group also received social-cognitive theory-based behavioural counselling and monitored their diets daily with hand-held computers.</p>	<p>Randomised clinical trial Laboratory blood studies Inter-dialytic Weight Gain measurements. 3x 24 hour dietary recalls at baseline, 8 weeks and 16 weeks.</p>	<p>Inter-dialytic Weight Gain measurements did not differ significantly by treatment group at any time. A significant dietary sodium intake was observed at 8 weeks but not at 16 weeks. The intervention was acceptable to HD patients despite the results</p>
<p>Shi, Yue-Xian et al 2013 China 11</p>	<p>To evaluate the effects of a nurse-led educational intervention on the management of hyperphosphatemia and knowledge of phosphate binders among haemodialysis patients</p>	<p>80</p>	<p>Participants in experiment group received nurse-led intensive educational programme, individualised diet and medication sessions.</p>	<p>Prospective randomised controlled trial Questionnaire Laboratory blood studies</p>	<p>No improvements in Control group. Experiment group had improvements in phosphate levels. Knowledge was improved. No significant changes to serum calcium or parathyroid hormone levels. Over 50% of experiment group reached K/DOQI levels (internationally agreed recommended laboratory values in renal disease) during the intervention time, 30% of control.</p>

<p>Ting-Yin Cheng et al. 2016</p> <p>Taiwan 12</p>	<p>To investigate the effectiveness of systematic nursing instruction on a low-phosphorus diet, serum phosphorus level and pruritus of haemodialysis patients</p>	<p>94</p>	<p>2 groups-experiment and control. Experiment group received individual systematic instructions from nurses and an instruction pamphlet with pictures and reminder cards about a low phosphorus diet and phosphate binders. Patients were encouraged to self-monitor</p>	<p>Experimental study. Questionnaire (Patient self-assessment of pruritus, patient self-recorded diet diary for 5 days) Laboratory blood studies</p>	<p>Experiment group showed lower phosphorus diet intake, significant decrease in serum phosphate values and reduced incidence of pruritus.</p>
<p>Welch et al 2013 USA 13</p>	<p>To evaluate the use of a Mobile Application to Self-Monitor Diet and Fluid Intake among Adults Receiving Haemodialysis</p>	<p>44</p>	<p>2 groups-</p> <p>Group A used a Dietary Intake Monitoring Application (DIMA) scanning food items, selecting portion sizes, fluid intake.</p> <p>Group B used a Daily Activity Monitor Application (DAMA) to monitor an equivalent time as Group, but only inputting data about activity levels during 6 weeks intervention.</p>	<p>Feasibility Study</p> <p>Actual inter-dialytic weight gain pre and post dialysis.</p> <p>Patient self-monitoring diet and fluid intake</p> <p>Questionnaires:-</p> <p>Perceived Benefits of Sodium adherence</p> <p>Perceived Control (self-efficacy)</p> <p>DIMA Acceptability</p>	<p>Lower interdialytic weight gain was seen in the self-monitoring period of the DIMA group. More active DIMA users had a reduced sodium intake, but perceived benefits of sodium and fluid adherence were not affected by the study. Perceived control was higher in the intervention group than the DAMA group, but only immediately after self-monitoring ended. DIMA was deemed acceptable to patients.</p>

Table 4. Patient Education by Method and Instructor.

Author	Baldwin, D.M. 2013 USA	Baraz et al. 2009 Iran	Brogdon, R. 2013 USA	Chow, J. & Dalton, B. 2012 Australia	Ebrahimi, H. et al. 2016 Iran	Hegazy, I. S. et al. 2012 Egypt	Hernandez Morante, J. et al. 2014 Spain	Karavetian, M. & Ghaddar, S. 2012 USA/Lebanon	Russell et al. 2011 USA	Sevick M.A. et al. 2016 USA	Shi, Yue-Xian et al. 2013 China	Ting-Yin Cheng et al. 2016 Taiwan	Welch et al. 2013 USA
Method													
Motivational Interview									X				
Didactic Lecture		X											
Counselling				X	X	X	X	X		X	X		
Printed Material		X	X		X	X		X			X	X	
Laptop Computer						X	X			X	X		

Table 4. Patient Education by Method and Instructor.

Technology/ Self- Monitoring Device										X			X
Tally Board/ Point System				X									
Colourful Pictures								X			X	X	
Games								X					
Video	X	X											
Animations						X							
Interactive /Support		X					X						

Table 4. Patient Education by Method and Instructor.

Individual Intervention			X	X	X	X	X	X	X	X	X		X
Group Intervention		X					X				X		
Family Included					X						X		
Nurse		X	X	X	X		X		X		X	X	
Dietician							X	X	X	X			
Doctor							X						
Other Professional							X		X				
Not Specified						X							X