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Are Psycho-educational Strategies Effective in Promoting Fluid and Dietary Adherence in Haemodialysis and Peritoneal Dialysis Patients? A Systematic Review of Literature

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ABSTRACT

Objectives: *To identify studies involving educational interventions in promoting fluid and dietary adherence in haemodialysis and peritoneal dialysis patients; to critique the research methods, describe and summarise the effectiveness of the tested interventions.*

Background: *Adherence to fluid and dietary restrictions is a major integral part of the management regimen of end-stage kidney disease patients. However, no strategy has been reported in the literature as effective in achieving this.*

Methods: *The author searched the MEDLINE (Ovid), CINAHL (EBSCO), Psych Info and the Cochrane Library databases with no language restrictions. A total of 12 studies were reviewed based on the review question and the inclusion criteria. Each of the studies was critically appraised with respect to the sample size, study design, theoretical framework, intervention integrity and the outcomes.*

Findings: *Self-monitoring and self-management dietary counselling when combined with other strategies respectively offer some promise in promoting fluid and dietary compliance in dialysis patients. The calculation of IDWG was operationalized in various ways.*

Conclusions: *Further researches with more rigorous methodology and use of theoretical models are needed. The researches should consider reporting information on relevant variables such as co-morbidity, thirst intensity and type of sodium modelling used.*

Keywords: *Haemodialysis; Peritoneal dialysis; fluid; diet; adherence; patients*

Introduction

Chronic kidney disease (CKD) is an irreversible and progressive renal condition that could result in the loss of the normal functions of the kidneys over a period of time (Barnett, Li Yong, Pinikahana, & Si-Yen, 2008).For stage-5CKD patients, much of their normal kidney functions is lost and the treatment required to sustain their lives is renal replacement therapy(RRT), which include haemodialysis (HD), peritoneal dialysis (PD), and kidney transplantation along with a range of lifestyle modifications including fluid and dietary restrictions (Barnett et al., 2008).Inappropriate food intake and excessive fluid consumption by these patients could result in untoward effects that may impair their conditions. For instance, high serum potassium levels may cause patients to experience cardiac arrhythmias and can constitute about 2 to 5% of deaths in ESKD patients (Stevens &Dunlay, 2000; Muso, 2004; Preston et al., 2009; Korgaonka et al., 2010).Patients may also experience bone pain and itching of the body due to non-compliance with phosphate restrictions (Durose, Holdsworth, Watson &Przygrodzka, 2004). Excessive sodium consumption or drinking of excess amounts of fluid or foods that have a high water content like soup (broth-based soups), yoghurt, or gelatine, for example, may result in excessive weight gain between dialysis sessions (Welch, Perkins, Evans &Bajpai, 2003). Excessive intake of sodium may cause aggravated hypertension (Agarwal et al., 2000; Lindsay, Shulman, Prakash,&Kiaii, 2003), and peripheral oedema, mostly noticed around the ankles and pulmonary oedema resulting in breathlessness (Sacchetti, Harris, Patel,&Attewell, 1991; Sciarini&Dungan, 1996; Durose et al., 2004).

Despite the fact that fluid and dietary restrictions are crucial in maintaining the health and well-being of dialysis patients, findings from numerous researches on compliance indicate that compliance level is poor (Leggat et al., 1998; Lee &Molassiotis, 2002;Welch et al., 2003). Studies have also shown that compliance with the treatment regimen in dialysis patients is dependent on such factors as personal health beliefs, knowledge, satisfaction with treatment and support, and social and cultural mores of the patient and the ability of the patient to resist a strong physiological drive to drink (Cameron, 1996; Mok& Tam, 2001;Welch & Thomas-Hawkins, 2005).Various studies have examined the effectiveness of educational or psychological interventions in promoting fluid and dietary adherence in dialysis patients but none has proven any of such interventions to be relatively effective. Therefore this review seeks to identify studies involving educational and or psychological interventions in promoting fluid and dietary adherence in haemodialysis and peritoneal dialysis patients; to critique the research methods, describe and summarise the effectiveness of the tested interventions

Methodology

In order to ensure that a comprehensive set of studies relevant to this review were located for possible inclusion, an iterative process comprising six stages of literature search according to Brettle and Grant (2004) was adopted in searching several databases which included Cumulative Index to Nursing and Allied Health Literature (CINAHL) (1991 to 2013), PsychInfo (2002 to 2013), Cochrane Library (No time limit), and Ovid Medline (1946 to 2013), Science Direct and Google Scholar. The subject headings, text words and MESH terms used in the search included “haemodialysis patients”, “peritoneal dialysis patients“, “dialysis patients”, “psycho-educational strategies”, “psychological strategies”, “education”, “fluid adherence”, “dietary adherence”,and their various synonyms. The terms were combined in various orders using the Boolean operators “OR” and “AND” in order to yield broader and better results (Booth, Rees, &Beecroft, 2010). Other approaches such as citation tracking and search for grey literature, other than electronic database search were adopted (Brettle & Grant, 2004). This was necessary as limitations such as ineffective search strategies and availability or inadequate coverage of the searched databases have been reported to be associated with searching only electronic databases as sources of information retrieval (Pope, Mays, &Popay, 2007). A total of 12 studies which met the inclusion criteria

wereretrieved. The criteria for inclusion of studies into the review and data extraction were articles which : (a)involve adults chronic kidney disease patients receiving either peritoneal dialysis or haemodialysis for at least 3 months, (b) focused on the implementation of an educational or psychological intervention or both, (c) has outcomes as interdialytic weight gain (IDWG) or daily weight gain (DWG), serum calcium measurement, serum phosphorus measurement, serum potassium measurement or album measurement and (d) published in English Language.

Article appraisal and data extraction

A critical appraisal of the included studies was carried out using the evaluation tools for qualitative, quantitative and mixed method studies (Long et al., 2002). This was necessary to determine the strengths and limitations of the studies and to ensure they are relevant in answering the research question of the review as recommended by Khan et al. (2003). The studies were specifically reviewed for their research designs, samples, theoretical frameworks, and outcome measures, while the findings were also critically analysed.

Results

A total of 12 studies met the inclusion criteria and were therefore reviewed. One of the studies was published in 2001, two in 2002, two in 2003, one each in 2004, 2006, and 2008 respectively while two were published in 2010,one each in 2011 and 2012 respectively. Eleven of the studies involved HD patients while only one involved PD patients. Also, 7 of the studies examined compliance to fluid restrictions, 4 to dietary restrictions and 1 to both fluid and dietary restrictions. The list of the studies with their sample demographics are shown in Table1:

Table 1: Review study sample demographics

Lead author	Year	Mean age (Year)	Sex % (Male/Female)	Race (%white)	Education	Mean tenure on dialysis (months)
Chen, W.	2006	NA	NA	NA	Mean <HS	NA
Casey, J.	2002	54	52/48	NA	NA	NA
Molaison, E.F.	2003	54	52/48	18	Mean <HS	48
de Araujo, L.P.R.	2010	52	55/45	NA	NA	19.9
Baraz, S.	2010	34	52.4/47.6	NA	≥52.4% College graduates	54
Ford, J.C.	2004	NA	38/62	NA	NA	NA
Barnett, T.	2008	52	50/50	NA	84.2% HS graduates	29
Sagawa, M.	2001	47	70/30	NA	NA	101
Christensen, A.J.	2002	55	45/55	90	Mean HS	79.8
Lindberg, M.	2011	67	75/25	NA	NA	NA
Karavetian, M.	2012	57	48.5/51.5	NA	NA	60
Tsay, S.-L.	2003	58	41.9/58.1	NA	NA	38

N/B:HS = High school

NA= Not available

Research designs

The research studies selected for this review used quasi-experimental or single-group designs; experimental, longitudinal cohort designs. A randomised control design was used in three studies (Tsay, 2003; Baraz et al., 2010; Karavetian&Ghaddar, 2012). A quasi-experimental design was used in six studies (Lindberg et al., 2011; Christensen et al., 2002; Sagawa et al., 2001; Molaison&Yadrick, 2003; Ford et al., 2004; Barnett et al., 2008), and two studies (Casey et al., 2002de Araujo et al., 2010;) used a single-group, pre-test post-test design while one of the studies (Chen et al., 2006) used a longitudinal cohort design.

Samples

The studies included data from a total of 767 and 70 patients receiving haemodialysis and peritoneal dialysis respectively. In the HD category, six studies had sample sizes between 4 and 40, three studies had sample sizes between 62 and 70, one study had 122 as its sample size and another had the highest sample size of 316. However, the only study in the PD category had a sample size of 70. The sample sizes were generally small and the use of power estimates was scarcely reported. Only two studies (Barnett et al., 2008; Tsay, 2003) reported the use of power estimates to determine their sample sizes. This could therefore mean that some of the studies may have been underpowered. Using underpowered sample sizes in the testing of the various interventions tested could lead to poor results or effect *(Tsang, Colley, & Lynd, 2009; Ellis, 2010*; *Turner, Bird, & Higgins, 2013*; *).* The participants in the studies were usually included if they were non-adherent to either fluid or dietary, or both fluid and dietary restrictions, were adults, not cognitively-impaired, and have been on either HD or PD for at least three months. However, less frequently used criteria for inclusion in the studies were ability to produce up to 500ml of urine per day, medical stability and no previous educational intervention. Though the samples were not fully described in almost all the studies, the participants were mainly middle-aged and across all the studies, there were discrepancies in gender representations. Five of the studies reported the educational level of the participants; most were at least high school graduates. The ethnicity or race of the participants was reported in only two studies (Christensen, Moran, Wieber, & Lawton, 2002; Molaison&Yadrick, 2003). Subjects in twostudies were from the USA and one each from Iran, Brazil, China, Malaysia, England, Lebanon, Japan, and Taiwan respectively. However, the remaining two studies (Ford, Pope, Hunt, & Gerald, 2004; Lindberg, Wikstrom, & Lindberg, 2011) did not report the settings of their respective studies. In one of the 2 studies which reported race, a substantial percentage (80.1%) of the participants in the intervention group and 84% of those in the control group were African Americans (Molaison&Yadrick, 2003); while 90% of the participants in both the intervention and the control groups in the second study were Caucasians (Christensen et al., 2002).Participants across all the studies had been receiving RRT for varying length of time. In the 8 studies reporting tenure on dialysis, the participants had been on HD for 19.9 to 101 months; while in the only study involving PD (Chen et al., 2006); the tenure on dialysis was not reported.Sixstudiesreported attrition data (Ford et al. 2001; de Araujo et al. 2010; Sagawa et al. 2001; Christensen et al. 2002; Karavetian&Ghaddar, 2012; Tsay, 2003). The percentages of attrition ranged from 3% to 29%. Also, the reasons reported for various attritions included relocation to other dialysis centres, death, hospitalisation, transplant-tation, and perception of the study intervention as burdensome. However, reasons for attrition by some of the participants were not reported in some of the studies (de Araujo et al., 2010; Christensen et al., 2002).

Theoretical frameworks

There was variance in the use of theoretical frameworks to guide the interventions in the studies. Four of the studies (Christensen et al., 2002;Tsay, 2003; Molaison&Yadrick, 2003; Lindberg et al., 2011) explicitly used theoretical frameworks. Two of the four studies (Tsay, 2003; Lindberg et al., 2011;) used the social cognitive theory *(Bandura,*

2004); while Christensen et al. (2002) used the self-regulation theory *(Baumeister&Vohs, 2007)*, Molaison and Yadrick (2003) used the Transtheoretical model (TTM) *(Prochaska&Velicer, 1997; Prochaska et al., 2008;)*.In the study by Molaison and Yadrick (2003), the educational intervention implemented was guided by the transtheoretical model of behaviour change *(Prochaska&Velicer, 1997; Prochaska et al., 2008;)* which proposes that for individuals to change behaviour or act on new health behaviour, they must move through a series of stages. The model therefore specified five stages (pre-contemplation, contemplation, preparation, action and maintenance) which the individual must progress through; and the stages vary by intent. Considering decisional balance, a core construct in the TTM, the individual weighs up the advantages and the disadvantages of changing behaviour and adopting a new healthy one *(Prochaska et al., 2008)*. The balance between the advantages and the disadvantages that the individual may identify depends on the stage of change in which the person is in *(Prochaska&Velicer, 1997; Prochaska et al., 2008)*. Contingent on this theory, for people to move to the expected behaviour change, interventions must be stage-specific *(Welch & Thomas-Hawkins, 2005)*. However, when used by Molaison and Yadrick (2003) in their study, the interventions were not delivered according to the stages. Interdialytic weight gain did increase in the study (Table 2), though the authors reported a positive movement in the various stages. This therefore suggests that should the time of the study have been longer, there would have been decreases in the IDWG. On the other hand, this could also mean that the TTM did not support that sample in the study.

The social cognitive theory (SCT) was used in two studies (Tsay, 2003; Lindberg et al., 2011). Although the outcomes in the two studies offered more empirical support to the use of the theory, the reduction of fluid overload to the desired level was not achieved in Lindberg et al. (2011). The social cognitive theory proposes that individuals learn behaviours through observation, modelling and motivation *(Bandura, 1997; Bandura, 2001; Bandura, 2004)*. Knowledge of health risks and benefits of different health behaviours, a key construct in the SCT, is a pre-requisite for the desired change *(Bandura, 2004)*. It posits that if individuals are not aware of the consequences of their lifestyle or behaviour on their health, then they do not have any consequential reason to change to a new behaviour. However, marginal self-influences are necessary for most people to overcome potential obstacles to adopting the new lifestyle/behaviour and sustaining them *(Bandura, 2004)*. In one of the 2 studies (Tsay, 2003), there was a reduction in the IDWG and this was maintained over a period of 6 months. In the second study (Lindberg et al., 2011), IDWG was reduced but the reduction did not get to the desired level. These findings therefore lend more support to the suggestion by the authors (Tsay, 2003;Lindberg et al., 2011) that further researches involving the use of SCT be carried out.

In the study by Christensen et al. (2002), self-regulation theory was used in developing and testing the intervention. In self-regulation theory, an individual sets desired behavioural goals, establishes plans to achieve these goals and evaluates the outcomes *(Baumeister&Vohs, 2007; Hall & Fong, 2007)*. In the study by Christensen et al. (2002), there was no significant reduction in the IDWG just after the intervention. This may therefore suggest possibly that there is no empirical support for the theoretical framework used in this study. Additionally, the group samples used in this study were small (due to the high attrition rate as reported) and the findings may be conveniently said to be due to a lack of statistical power to detect change. However, IDWG decreased significantly 8 weeks after the intervention. This may therefore suggest that reductions in the IDWG could take longer to be effective when using this model.

Intervention integrity

The integrity of an intervention refers to the degree to which the intervention is delivered as designed *(Payton et al., 2000; Dusenbury, Brannigan, Falco, & Hansen, 2003)*. It shows the variances between what was originally planned and what is truly delivered. In many of the studies(Sagawa et al.,

2001; Casey et al., 2002; Tsay, 2003; Barnett et al., 2008; Ford et al., 2004; Lindberg et al., 2011), the interventions were delivered on an individual basis during dialysis treatment; in some other studies (Christensen et al., 2002; Molaison&Yadrick, 2003; Baraz et al., 2010; de Araujo et al., 2010;Karavetian&Ghaddar, 2012), the interventions were delivered in groups, while in Chen et al.(2006), the interventions were delivered both individually and as a group.

Across the studies, the healthcare professionals used to deliver the interventions varied and included renal nurses, medical doctors, dieticians, technicians and psychologists. In some of the studies (Baraz et al., 2010; Karavetian&Ghaddar, 2012), the interventions were delivered outside of the dialysis centres, and in another study (Molaison&Yadrick, 2003), the group intervention was delivered in the dialysis waiting room. The integrity of an intervention may be affected when multiple interventionists are used in a particular study*(Welch & Thomas-Hawkins, 2005)*; therefore, protocols have to be established, sustained and re-evaluated with consistency to maintain the integrity of an intervention delivery. However, most of the studies in this review did not report these procedures. Only two studies (Christensen et al., 2002; Karavetian&Ghaddar, 2012) reported clearly these procedures.

Intervention dosage refers to the duration and also the intensity of an intervention *(Welch & Thomas-Hawkins, 2005)*. The duration however, refers to the overall period of time the intervention is to be delivered *(Sidani& Braden, 1998; Sidani, Doran, & Mitchell, 2004)* .The duration of intervention varied across the different studies in this review; they generally ranged from 2 to 24 weeks (Table 2). The rationale for selecting the various intervention duration for each of the studies was not reported in any of the literatures. Additionally, there was no clear trend showing that prolonging the duration of the interventions was more effective than decreasing the duration. However, two of the studies (Christensen et al., 2002; Ford et al., 2004) showed more positive outcomes. This may suggest that increasing the length of the intervention duration could enhance the adherence of the patients.

The intensity of an intervention is the frequency with which the intervention is performed *(Sidani et al., 2004)*. The interventions were delivered over different intervals, ranging from a period of 20-30 minutes during each dialysis session monthly contacts with the participants. Most of the studies did report on the actual number of contacts with the participants, how long the contacts were and also if the intervention was delivered as planned. In one of the studies (Lindberg et al., 2011), the researchers reported that the intended number of sessions of the intervention was adjusted according to the requirements of each of the participants; but they did not state clearly if the frequency of the intervention was increased or decreased. None of the studies analysed the effect of intervention integrity in their study. However, Karavetian and Ghaddar (2012) reported that although the interventions were completely delivered, outbreaks in the Southern part of Lebanon prevented the completion of the planned follow-up of the participants in their study. The report of data relating to intervention integrity in most of the studies made it more convenient to assess the researchers` efforts in maintaining intervention integrity. Only Casey et al. (2002) reported that none of the participants missed any treatment during the study; none of the other studies in the review reported if lateness, hospitalisation of any participant or illness or shortened dialysis session affected any of the tested interventions in their respective studies. For instance, skipping or shortening any session of the dialysis treatment could be a major factor or problem which may adversely affect the intensity of many of the interventions tested in the various studies *(Bleyer et al., 1999; Saran et al., 2003).*

Seven studies used a control group (Christensen et al., 2002; Tsay, 2003; Ford et al., 2004; Chen et al., 2006;Baraz et al., 2010; de Araujo et al., 2010;Karavetian &Ghaddar, 2012), “usual care” or “routine care” was the description given to the various treatments in the control groups in two of these studies (Tsay, 2003; Ford et al., 2004;). Ford

et al.(2004), reported that the participants in the control group received routine care in addition to a monthly review of the laboratory reports by a dietician; although the dietician discussed abnormal phosphorus levels with the participants in the control group, participants were not provided with additional education materials. Complications could arise when some elements of the tested interventions are included in the usual care *(Welch & Thomas-Hawkins, 2005)*. However, considering the ethical principles, usual care cannot be restrained in intervention studies and it may include different aspects of the intended interventions such as the booklets on diet management, the counselling with the dieticians, or the nurse, and also education on fluid control *(Welch & Thomas-Hawkins, 2005)*.

Outcome measures

Seven of the studies(Molaison&Yadrick, 2003; Casey et al., 2002; Baraz et al., 2010; Lindberg et al., 2011; Barnett et al., 2008; Christensen et al., 2002; Tsay, 2003) examined interdialytic weight gain (IDWG) as their primary outcomes. Most of these studies(Casey et al., 2002; Christensen et al., 2002; Molaison&Yadrick, 2003; Tsay, 2003; Lindberg et al., 2011;) used IDWG as their only outcome. It is however pertinent to observe carefully that there could be variability in IDWG with respect to the number of days between the dialysis treatments, which may decrease the statistical power if the factor is not contained*(Welch & Thomas-Hawkins, 2005)*. According to *Welch and Thomas-Hawkins (2005)*, measuring the mean daily IDWG may be a more efficient method of assessing the effectiveness of fluid compliance interventions. Another IDWG measure used in one of the studies (Sagawa et al., 2001) is mean daily weight gain (IDWG). Two of the studies (Barnett et al., 2008; Baraz et al., 2010) tested the effectiveness of the respective interventions on both fluid and dietary adherence and have mean predialysis blood pressure, rate of fluid adherence, blood urea nitrogen (BUN), and other serum electrolytes (creatinine, sodium, potassium, calcium, phosphate, albumin, and uric acid) levels as their outcome measures in addition to IDWG. Conversely, three studies examined the effectiveness of their respective interventions on only dietary compliance in haemodialysis patients (Ford et al., 2004; de Araujo et al., 2010; Karavetian&Ghaddar, 2012) had serum electrolytes (phosphorus, creatinine, urea, calcium, calcium and phosphate products) and serum parathormone levels(PTH) as their primary outcome measures. Only one study (Chen et al., 2006) examined the effectiveness of menu suggestion in promoting dietary adherence in peritoneal dialysis; similar to other studies, serum albumin and serum phosphate were the outcome measures. Most of the studies reported means and standard deviations so effect sizes could be calculated and the group variability in IDWG could be assessed.

In the calculation of IDWG, there was a wide variation in the interdialytic periods used across the studies. For instance, Molaison and Yadrick (2003) calculated the mean IDWG using the weights of each participant for 3 weeks before the 6- and 12-week follow up periods. Christensen et al. (2002) calculated the mean IDWG using the measurements over the earlier 2 weeks. Baraz et al. (2010) calculated the mean IDWG using the bi-monthly calculations of IDWG and yet calculated the baseline IDWG using the average of weight gain during the dialysis sessions two months prior to the intervention administration. Also, while Barnett et al. (2008) calculated IDWG using weight values between dialysis sessions over a 2-month period of the intervention, Lindberg et al. (2011) reported IDWG as the difference between weight after previous dialysis session and the post dialytic weight for 6 to 8 weeks of the intervention but the researchers did not report clearly how the baseline IDWG was calculated. Furthermore, Tsay (2003) calculated the mean weight gain using 4 measures at 1 month, 8 measures at 3 months and 12 measures at 6 months. The reason for choosing a specific number of data points in the calculation of the IDWG was not explained in any of the studies.

Both pre- and post-dialysis weights of ESKD patients are very important and are used clinically in the planning and delivering of care to them *(Welch & Thomas-Hawkins, 2005)*. However, regardless of

this importance, most of the study reports did not address the clinical reliability of the weight measures. Of all the studies, only 2 (Sagawa et al., 2001; Tsay, 2003) reported the use of calibrated electronic scales. Possible random errors in measurement in the other studies may have resulted in increased variability in the IDWG and reduced statistical power *(Everitt& Pickles, 2004; Murphy, Myors, &Wolach, 2009; Melnyk& Morrison-Beedy, 2012)*. Also, missing weight values were not reported in any of the studies or how any apparently inaccurate values were handled in the data.

Effectiveness of the various interventions

Cognitive behavioural technique

The independent impacts of self-monitoring could not be ascertained since none of the treatment groups utilised this integral strategy alone. However, in all of the studies which combined self-monitoring with other intervention strategies (Sagawa et al., 2001; Christensen et al., 2002; Tsay, 2003; Lindberg et al., 2011), there were substantial reductions in the IDWG. Also, behavioural contracting when combined with other intervention strategies in Sagawa et al. (2001) showed no readily clear independent effect. In another study (Molaison&Yadrick, 2003), an educational intervention based on the TTM did result in increased IDWG while Casey et al. (2002) reported a non-significant reduction in the IDWG. In this study (Casey et al., 2002), the implementation of a self-efficacy training programme together with educational strategy resulted in reduced IDWG in the first month up to the sixth month after the delivery of the intervention.

Educational interventions

A short-duration diet education in one study (de Araujo et al., 2010), resulted in a transient reduction in the serum levels of phosphorus initially in both the intervention and the control group respectively; this reduction was more substantial in the control group. However, no significant differences in the serum phosphorus, calcium, creatinine, and urea or PTH levels were found at the end of the programme.

In Baraz et al. (2010), oral diet education when compared with a video education resulted in a statistically significant decrease in the serum creatinine, phosphate, BUN and uric levels after the programme. The serum sodium and potassium levels also decreased but these decreases were not statistically significant. In the video education group, it was reported that the mean serum sodium, potassium, creatinine, and BUN levels decreased after the programme; but these differences were not statistically significant. Although the mean serum calcium levels increased in both groups, however, the increase was statistically significant in the video education group but not in the oral education group. Also, there was a statistically significant serum phosphate and uric acid levels.

Ford et al.(2004), reported that additional diet education resulted in a significant decline in the serum phosphorus, calcium/phosphorus product levels of the participants after a 6-month period. There was also a significant improvement in knowledge. However, no statistically significant difference was found in the serum calcium and PTH levels between the intervention group and the control group.

Furthermore, in Barnett et al. (2008), after the implementation of the educational intervention, a significant reduction in the mean IDWG from 2.64kg to 2.21kg ($t=6.15$, 25, $P<0.05$) was reported and the number of participants with a mean IDWG greater than 2.5kg decreased from 18 to 6.

In the only study on peritoneal dialysis patients (Chen et al., 2006), the implementation of a menu suggestion plus patient education resulted in a significant compliance with the dietary restrictions as 57.1% (20 out of 35) of the participants in this intervention group met the compliance criteria post intervention.

Counselling

In the study of Karavetian and Ghaddar(2012), self-management dietary counselling when combined with interactive games which were related to the weekly educational topic on renal diseases , renal diet and phosphate binders with vitamin D, resulted in a significant improvement in the mean serum

phosphorus level (from 6.54 ± 2.05 - 5.4 ± 1.97 mg/dl), serum calcium phosphate product levels (from 58 ± 17 - 49 ± 12 mg/dl) and patient knowledge scores (from 50 ± 17 - 69 ± 25%).

For valid explanation of intervention effects to be made, the possible effects of the mediating variables must be thoroughly assessed *(Welch & Thomas-Hawkins, 2005)*. These mediating variables according to *Mackinnon (2008)* are those variables which must be modified to achieve the targeted outcomes. It determines the strength of the relationship between dependent and independent variables. The failure of an intervention being tested to alter a true mediating variable, will lead to the non-achievement of the intended outcomes like reduction in IDWG *(Sidani& Braden, 1998)*.

Molaison and Yadrick(2003) found that improvement in knowledge after the implementation of an educational intervention was reported. However, no decrease in IDWG was recorded; rather there was increase in IDWG. Subsequently Ford et al. (2004), found a significant improvement in knowledge, yetno statistically significant difference was found in the serum calcium and PTH levels between the intervention group and the control group. Additionally, de Araujo et al. (2010) stated there was an improvement in the knowledge of the participants, however no significant differences in the serum phosphorus, calcium, creatinine, and urea or PTH levels were found at the end of the programme.This may lead to a conclusion that knowledge may not be a relevant mediating variable in these studies. Conversely, in the study of Karavetian and Ghaddar (2012), there was significant improvement in knowledge and consequently significant improvements in the mean serum phosphorus, and calcium phosphate product levels.

Most of the studies included in this review did not measure pertinent demographic and contextual variables. In one study (Barnett et al., 2008) which analysed the demographic data in respect of IDWG, no statistical significance or relationship was found between IDWG and age, length of time on dialysis, educational level, employment, marital status and the presence of any concurrent disease. However, there was a statistical significance between IDWG and sex as more substantial decreases in IDWG was detected in the female participants than in the males. In contrast, another study (Baraz et al., 2010) reported a statistically significant relationship between age and diet or fluid compliance; younger patients showed greater compliance when compared with the older patients. Also, a statistically significant relationship was reported between the educational level of the participants and fluid or dietary compliance. Therefore, more educated patients were reported to have had better compliance than the less educated patients. Positive relationship between IDWG and occupation; dietary compliance and occupation were reported. However, just like in the study of Barnett et al. (2008), Baraz et al. (2010) reported no statistical relationship between IDWG and sex, marital status, and length of time on HD with the biochemical parameters.

Discussion

Compliance with fluid and dietary restrictions in both haemodialysis and peritoneal dialysis patients is a very crucial aspect of clinical management. However, this review shows that only a few intervention studies have been carried out in this respect especially on patients receiving peritoneal dialysis. Even though it is hard to compare the results across the studies in this review, considering the wide disparities in the samplings, designs, interventions, and outcome measures, the following generalisations could be made from the report of the studies: (a) self-monitoring and self-management dietary counselling in combination with other strategies offer some promise as intervention strategies in promoting fluid and dietary restrictions in ESKD patients receiving HD and PD, (b) theories were clearly used in some of the studies , (c) most of the study designs generally had control groups, (d) in most of the studies, the interventions were delivered individually, (e) the duration of the interventions varied across the studies, (f) mostly several interventions were tested using different individuals in the delivery, and (g) most of the studies have IDWG as their main outcome and this was operationalised in many ways. Also, serum

calcium, phosphorus, sodium, calcium/phosphate product, PTH levels were also used as primary outcomes in the various studies on dietary compliance.

In all of the studies reviewed, self-monitoring was used in combination with other strategies in most cases. None of the studies reported a separate degree of effect of self-monitoring or any single intervention. In each of these studies, there were significant reductions in the IDWG; however, the degree of the reduction and the duration of the effects were different across the studies. This is similar with the findings of another systematic review on the effectiveness of psycho-educational strategies in promoting fluid adherence in HD patients *(Welch & Thomas-Hawkins, 2005)*. Positive outcomes were also found with self-management dietary counselling when combined with educational interactive games (Karavetian&Ghaddar, 2012). These show that self-monitoring and self-management dietary counselling when used respectively with other strategies offer some promises as intervention strategies in promoting fluid and dietary adherence in haemodialysis and peritoneal dialysis patients. However, mixed results were found for the effectiveness of both oral and video diet education in the reducing IDWG and ensuring dietary adherence; whilst behavioural contracting showed no empirical effect in reducing IDWG.

A few of the studies reviewed used theoretical models in guiding the interventions tested. Using theories in guiding intervention studies not only helps in identifying variables which are susceptible to change but it also helps the researcher in the development and the evaluation of the intervention approaches *(Glanz& Oldenburg, 2001; Glanz, Rimmer, & Lewis, 2002; Garcia & Mann, 2003; Noar& Zimmerman, 2005)*. For example, behavioural capability, one of the major constructs of the social cognitive theory (SCT) indicates that knowledge is a pre-requisite for a health behaviour change *(Bandura, 2004)*. In this respect, knowledge pertaining to fluid and dietary management is necessary for people to adopt the positive lifestyle of adhering to fluid and dietary restrictions requisite in the management of HD and PD patients. However, the assessment of knowledge was obviously often lacking in most of the studies. In the studies where knowledge was assessed, the researchers-developed tools were utilised, while the reliability or validity of those tools were not reported. ESKD patients receiving either haemodialysis or peritoneal dialysis should be able to distinguish between their body and fluid weight, understand their fluid and dietary regimen, and know why and how it is to be followed. Also, self-monitoring and self-management require that the HD and PD patients should be able to measure their fluids, understand the writings on the labels, make necessary calculations and metric conversions, make the right choice of food combinations and maintain appropriate daily dietary intake *(Welch & Thomas-Hawkins, 2005)*. Conducting assessment of these capabilities will be vital in future researches using theoretical models to predict fluid and dietary compliance in ESKD patients. Although *Cooper, Booth, Fear, and Gill (2001, p.110)* stated that *"there is a threshold of knowledge beyond which other factors are more important to achieve the treatment goals"*; in one of the studies which reported knowledge (Karavetian&Ghaddar, 2012), self-management dietary counselling was tested and positive outcomes were reported with significant improvement in patients knowledge. In Ford et al. (2004), although there was a significant improvement in knowledge of the patients, the significant reduction in the serum phosphorus and calcium/phosphate products occurred only after a 6-month period. However, no statistical difference was reported in the serum levels of calcium and PTH in the participants. This may suggest that improvement in the knowledge of the participants could lead to increased adherence to fluid and dietary restrictions. Therefore, future researches should consider reporting knowledge as a mediating variable. In 2 other studies (Molaison&Yadrick, 2003; de Araujo et al., 2010), however, there were significant improvements in knowledge but no positive outcome was reported.

Most of the studies did not use randomised control trial. Due to the close and social nature of the

dialysis units, Christensen et al. (2002) stated that it may be difficult to assign the participants in the studies to various treatment conditions. However, it is argued that "if random assignment is not possible, threats to history, or the probability that some unknown event took place during the course of study, becomes of paramount concern" *(Welch & Thomas-Hawkins, 2005, p. 605*). Therefore, Christensen et al. (2002) recommends that an "attention control group" be used to ameliorate this threat. In two out of the three studies which used randomised control trial (Tsay, 2003; Karavetian&Ghaddar, 2012;), there were substantial reductions in the IDWG and significant improvements in the serum phosphorus, calcium/phosphate product levels and patient knowledge scores, indicating adherence to fluid and dietary restrictions in the HD patients. This is similar to the findings of two randomised controlled trials which tested the effectiveness of lifestyle interventions including dietary changes in reducing the incidence of diabetes *(Knowler et al., 2002; Lindstrom et al., 2003).*

Most of the interventions tested in the various studies were delivered individually. The effectiveness of a program however, may be based on its ability to meet the particular needs of an individual *(Patterson, 2001).* Even though tailored interventions have been implemented in other chronically-ill patients and did show favourable outcomes *(Bull et al., 1999; Bull, Kreuter, &Scharff, 1999; Champion et al., 2003; Lusk et al., 2003; Ishikawa et al., 2012),* the interventions tested in the various studies of this review were not certainly tailored to meet the specific needs of each participant. However, the findings of a systematic review to determine the effectiveness of tailored interventions to overcome barriers to change *(Fox & Khan, 2010)* showed no statistically significant outcomes. Using standardised materials or strategies in effecting behavioural change usually assumes that individuals will most likely go through the materials, choose to use part of the materials which they consider valuable to them and jettison the information that are not applicable to them *(Kreuter, Farrel, Olevitch, & Brenna, 2000).*

Many of the studies reviewed did not report important individual variables such as age, health literacy, thirst intensity, type of sodium modelling used, concurrent chronic conditions and vascular access. Studies have reported that age may have a positive correlation with better fluid and dietary adherence in ESKD population receiving HD and PD *(Kutner, Zhang, McClellan, & Cole, 2002; Kimmel et al., 2000; Kugler, Vlaminck, Haverich, &Maes, 2005).* More so, findings from other systematic reviews on health literacy and health outcomes have shown that health literacy is associated with positive health outcomes in people suffering from chronic conditions like diabetes mellitus and ESKD *(De Walt, Berkman, Sheridan, Lohr, &Pignone, 2004; Berkman et al., 2004; Taggart et al., 2012; Schillinger et al., 2002).* It may therefore be relevant to give consideration to health literacy in further studies to promote fluid and dietary adherence in ESKD patients receiving haemodialysis or peritoneal dialysis treatments. Furthermore, since intense thirst is a commonly reported symptom in ESKD patients receiving HD or PD *(Curtin, Bultman, Thomas-Hawkins, Walters, &Schatell, 2002; Welch, 2002; Welch, Perkins, Evans, &Bajpai, 2003;Said &Mohammed, 2013;) whilst* it has been reported to be associated with IDWG resulting from increased fluid consumption *(Welch et al., 2003; Akar, Akar, Carrerol, Stenvinkel, &Lindholm, 2011)*; it is therefore most likely that patients who experienced more thirst would respond in a different manner to the interventions such as self-monitoring and self-management in comparison with patients who experienced less intense thirst. The discrepancy in the approaches which was used in the calculation of IDWG and also in the determination of dietary compliance across the studies is questionable. Using various, non-standardised approaches in calculating the IDWG and in determining dietary non-adherence could increase variability and thus reduce statistical power *(Everitt& Pickles, 2004; Murphy et al., 2009; Melnyk& Morrison-Beedy, 2012).* Only one of the studies included in this review involved peritoneal dialysis patients.

Conclusion

Based on the findings of this review and the methodological qualities of the studies, it is difficult to make a categorical conclusion in the favour of or against the effectiveness of the various interventions tested in the studies. However, self-monitoring and self-management in combination with other strategies appeared to be effective in promoting fluid and dietary restrictions in HD and PD patients. However, more research involving peritoneal dialysis patients would be necessary to facilitate more substantive decisions on the effects of the interventions on this population. Further research with more rigorous methodology and use of theoretical models are needed. Researchers should consider reporting information on relevant variables such as co-morbidity, thirst intensity and type of sodium modelling used.

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