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Study on the Influences of Health Promotion Model Constructs on Salt Restriction Behaviour among Hypertensive Patients Using Structural Equation Model

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Abstract: Salt restriction in diet is an accepted health promoting behaviour in thecontrol of hypertension in patients. The practice needs lifelong adherence and overcoming of barriers and temptations. Pender's health promotion model [HPM] helps understanding the various factors influencing salt restriction along with theoretical approach to achieve it. This is a cross sectional study done among hypertensive patients attending the primary care centre in urban Chidambaram, Tamilnadu. The participants were assessed for their salt intake patternwith subjective estimation of sodium intake by 3 days dietary recall. The patients were assessed with the constructs of HPM to determine the indicators predicting the individual dietary intake of sodium and their influences using a pre-tested and structured interview schedule. Pearson's correlation was used to analyze the association between dietary sodium intake and constructs of HPM. The constructs were fitted into a structural equation model to study the direct and indirect effects of each construct on the dietary sodium intake which predicts the salt restriction behaviour of the individual. The results revealed that higher perceived self efficacy and perceived benefits among individuals were the predominant indicators which lead to salt restriction behaviour. Thus it was concluded that imparting knowledge about benefits of salt reduction in hypertension along with motivation of the patients' results in a higher self efficacy of patients which leads to better adherence to salt restriction as a control measure.
Keywords: hypertension, salt intake, salt restriction, health promotion model.

INTRODUCTION

Adult hypertension prevalence has risen dramatically over the past three decades from 5 per cent to between 20 to 40 per cent in urban areas[1] . An epidemiological shift in the prevalence of hypertension in developing countries has shifted the attention to control and prevention of non-communicable diseases at the national level in view of the rising trends [2].Hypertension results from a complex interaction of genetic, environmental, and demographic [3], dietary factors have a prominent role in BP homeostasis [4].Dietary modifications have been widely regarded as a lifestyle modification strategy with enormous potential for preventing hypertension [5]. Well established dietary modifications that lower BP is reduced salt intake [4].

Salt reduction has also been emphasized by the World Health Organization [WHO] and many countries' prevention and cure guideline of hypertension as a critical part of the prevention and treatment of hypertension [6]. A reduction in dietary salt to the recommended level of less than 5 – 6g/day will have major beneficial effects on cardiovascular health along with major healthcare cost savings around the world [7].

Despite strong evidence for a relationship between high salt intake and hypertension, plus the widespread recommendations for dietary salt restriction among hypertensive subjects, adherence is difficult to achieve [8]. Dietary adherence is a lifelong action, and internal desires and temptations play a major role as a barrier around this issue [9]. Social and cultural factors, along with population age, educational level and average income are primary determinants of dietary behaviours but can be difficult to modify in the short term [10,11].

Behavioural change through effective communication has been perceived and proven as a useful and the most cost effective tool for addressing public health problems [12]. A large number of behavioural intervention trials have tested the effects of dietary change on BP [5]. The use of a conceptual framework to guide this research and the interpretation of results can help us to understand the relative importance of different factors [13]. It is inferred that the health promotion model [HPM] can be useful in predicting the dietary behaviour. This model was first proposed by Pender. Health promoting behaviour is the desired behavioural outcome, which makes it the end point in the Health Promotion Model [14,9]. Considering the importance of perception as a likely influence on salt consumption and its importance for salt reduction, there is a need to clarify the role of beliefs according to HPM constructs in relation to sodium intake behaviour within the population [15].

Thus with very few studies about use of Health Promotion model in the assessment of salt restriction among Indian population. The present study has been carried out with the objectives to study the interrelationship between behavioural constructs of Health Promotion Model on salt restriction and to find the influences of these constructs on salt restriction among hypertensive patients.

METHODOLOGY

Study design and area

This is a cross sectional study carried out among out patients attending the primary urban health care centre functioning under Department of community medicine of RMMCH in Chidambaram. This study was carried out for a period of 4 months from2ndJanuary to 30th of April 2017. The study population consisted of individuals >30yrs of age diagnosed as hypertension at-least 3 months prior, irrespective of their treatment status. Patients having other co-morbidities, previously diagnosed cardiac conditions were excluded. Prior ethical clearance was obtained from the institute and informed written consent was also obtained from each participant after explaining the details of study.

Sample size and Sampling technique

Based on the results of a study by Kamran *et al*. [1], the correlation coefficient of the variables were taken into consideration to calculate sample sizes for each variable of the model. The aggregate of these calculated sample sizes was estimated to be 105, which was taken as the sample size for this study. With this sample size the study was conducted among the patients attending the urban health centre from 2ndJanuary, who fulfilled the inclusion criteria, were included in the study. Thereafter the consecutive patients attending the centre on daily basis were included till the sample size was reached.

Study tool

The study tool consisted of pre -validated, semi –structured interview schedule including details on the [1] socio demographic data, [2] 3 days dietary history by recall method [3], clinical details of hypertension and [4] questions on constructs of Health Promotion Model. Along with the participants' socio demographic details, 3 days dietary history was recorded by recall method of food items consumed. The sodium content of common food items, prelisted from validated reference of National health research institute, was used for the estimation of sodium intake. The average sodium intake for the three days was calculated to avoid bias. With the dietary sodium intake calculated, the salt intake of the participant was estimated in grams.

The HPM constructs included questions on prior behaviour, perceived benefits, perceived barriers, perceived self efficacy, interpersonal influences, situational influences, affect related behaviour and commitment to action. The prior behaviour included questions on the practices of participants prior to diagnosis as 5 closed type questions. Both perceived benefits and perceived barriers assessed the benefits and difficulties perceived by participants with 9 question each. The individual responses were recorded using 5 point Likert scale as strongly agree, agree neutral, disagree and strongly disagree. The perceived self efficacy of patients in following salt restriction was evaluated using 5 questions on ones acceptance and adaption of the practice. The patients self evaluated by giving scores in the form of 10 point score by participants themselves with least 1 to maximum 10 score according to their confidence level. The sections on interpersonal and situational influences included 5 questions each with individual responses recorded as never, rarely, occasionally, sometimes and always. The affect related behaviour and commitment to action included 5 closed type questions each to assess the effect on participants after following salt restriction and their future plan of action.

STATISTICAL ANALYSIS

The individual responses were recorded, compiled and entered into excel sheet for further analysis using SPSS version 21. The data was analysed in descriptive for socio demographic data, dietary sodium and components of Health Promotion Model. The association between the HPM components and dietary habits were analysed using Pearson's correlation. The components of the health promotion model were fit into a SEM model represented as modified health promotion model.

RESULTS

This study included 105 participants in total, with mean age of 57.09±10.7 yrs. Majority of participants were above 60yrs of age i.e. 43(41%). Among the study population 59% were female and 29.5% were illiterate and 40% were dependents. Among those of working group 24 (22.8%) were earning an annual income between 5000 and 20000 rupees. Majority of participants 40.9% (43) had duration of hypertension more than 5 yrs. and also among them 52.3% (55) were regular in their treatment.

Fig 1 represents the distribution of sodium intake among the participants in this study which states that 74.3% and 22.8%of participants had salt intake of 2grams to 4 grams and >5grams per day respectively which is higher than the recommended levels of <2grams of sodium per day (fig 1).

Table 1 represents the correlation between Constructs of HPM and dietary sodium intake. Prior behaviour of the participants is positively correlated with perceived benefits, self-efficacy, interpersonal and situational influences, affect related behaviour. It is negatively correlated with perceived barriers, commitment to action and dietary sodium intake. Perceived benefits are positively correlated with perceived self efficacy, interpersonal and situational influences, affect related behaviour and commitment to action. It is negatively correlated to perceived barriers and dietary sodium. Perceived barriers are negatively correlated to all components of HPM except dietary sodium intake.

Perceived self efficacy is positively correlated with prior behaviour, perceived benefits; affect related behaviour, interpersonal and situational influences and commitment to action. It is negatively correlated to perceived barrier and dietary sodium intake. Dietary sodium intake in this study is positively correlated with perceived barriers and is negatively correlated with rest of the components.

Table 2represents the total effects constructs and dietary sodium intake and table 3 and 4 represent the standardized direct and indirect effects of constructs on dietary sodium. Table 5 represents the fitness of modified health promotion model in SEM model.

Dietary sodium intake

The above table 2 shows that dietary sodium intake in the present model is strongly influenced by two constructs of HPM namely perceived self efficacy and perceived barriers similar to the regression analysis of the study. The total effect of perceived self efficacy according to the model is -0.694 on dietary sodium intake which is its direct effect.

The perceived barrier affects the dietary sodium intake directly as well as through perceived self efficacy. It also influences sodium intake through perceived barriers which influences through self efficacy. The total effect of perceived benefits on dietary sodium intake is -0.043. In accordance to the model the direct effect amounts to 0.533 and -0.577 indirectly through other factors indicating almost similar levels of direct and indirect effects.

Perceived self efficacy

The perceived self efficacy of the participants is influenced by other components of the model like prior behaviour, perceived barriers and behaviour after. The prior behaviour in the model has a higher 0.571 indirect and 0.128 direct effects on self-efficacy amounting to 0.699 of total effects on self efficacy (Table 2). Its influence through other factors such as perceived barriers and behaviour after factors are greater on self efficacy than its direct effect.

The perceived barriers have a total negative effect of -0.555 on self efficacy which acts directly as -0.470 and indirectly as -0.085 influence through other factors. (Table-3,4) This indicates higher self efficacy levels with decreased barriers perceiving by participants.

The behaviour after has a direct positive effect of 0.299 on perceived self efficacy inferring that persons with positive after behaviour have positive self efficacy in following salt restriction.

Perceived benefits

The perceived benefits of the study participants in turn are influenced by prior behaviour, interpersonal and situational influences with statistical significance. The prior behaviour and interpersonal factors influences the perceived benefits more indirectly by 0.413 and 0.308. They have a total effect of 0.657 and o.541 respectively as per the table 2, 3, 4. Whereas the situational factors has a direct effect of 0.443 on the perceived benefits with no indirect effect. Thus the benefits perceived by participants were positive if their prior behaviour which act directly as well as through interpersonal factors.

Behaviour after effect

It is influenced by prior behaviour, interpersonal factors and perceived barriers of participants. The prior behaviour has a total positive effect of 0.674 in which the majority is through indirect effect of 0.500 on behaviour after effect. Whereas interpersonal factors has major direct positive effect of 0.328 amounting to a total positive effect of 0.604 on behaviour after effect. Perceived barriers influences negatively with a direct effect of 0.285 on behaviour after with no indirect effect. (Table 3,4) More the

barrier perceived by participant's behaviour after effect is affected grossly.

Perceived barriers

Perceived barriers are significantly influenced by both perceived benefits and interpersonal factors of the participants. The influence of benefits perceived is direct and negative with estimate of 0.639. where as the interpersonal factors influences the barriers perceived more indirectly and has negative effect with estimate of 0.391.

Interpersonal influences

The interpersonal factors influenced by prior behaviour with a total effect of 0.65, which acts directly on the interpersonal factors positively.

Situational influences

The situational factors are affected by interpersonal factors of the study subjects significantly with a direct positive effect of 0.695.this indicates the positive effects of family, friends and peers on situational factors.

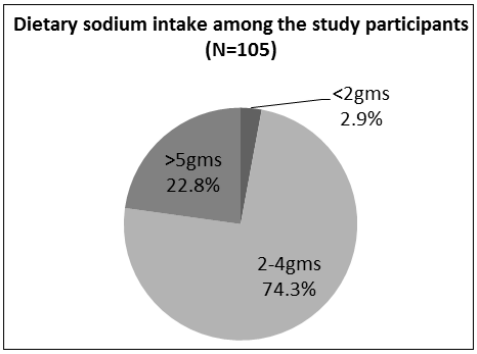

Fig-1: Distribution of study participants based on the dietary intake of sodium

Table-1: Correlations between HPM constructs and dietary sodium

Variables	Prior behaviour	Perceived benefits	Perceived barriers	Perceived self efficacy	Interpersonal influence	Situational influence	Affect related behaviour	Commitment to action	Sodium intake
Prior behaviour	1								
Perceived benefits	.657**	1							
Perceived barriers	-.648**	-.892**	1						
Perceived self efficacy	.703**	.821**	-.879**	1					
Interpersonal influence	.657**	.740**	-.798**	.788**	1				
Situational influence	.585**	.768**	-.770**	.723**	.780**	1			
Affect related behaviour	.676**	.767**	-.799**	.842**	.786**	.699**	1		
Commitment to action	-.022	.191	-.289**	.257**	.235*	.166	.269**	1	
Sodium intake	-.375**	-.387**	.524**	-.609**	-.462**	-.395**	-.529**	-.103	1

Table-2: Standardized total effects between constructs of HPM and dietary sodium intake

	Prior behaviour	Interpersonal	Situational	Benefits	Barriers	Behaviour after	Self efficacy
Interpersonal	0.657	---	---	---	---	---	---
situational	0.585	0.695	---	---	---	---	---
Benefits	0.657	0.541	0.443	---	---	---	---
Barriers	-0 .639	-0.666	-0.348	-0.639	---	---	---
Behaviour after	0.674	0.604	0.172	0.334	0.285	---	---
Self efficacy	0.699	0.580	0.225	0.446	0.555	0.299	---
Dietary Na	-0.368	-0.388	-0.068	-0.043	-0.765	-0.367	0.694

Table-3: Standardized direct effects of HPM constructs on dietary sodium

	Prior behaviour	Interpersonal	Situational	Benefits	Barriers	Behaviour after	Self-efficacy
Interpersonal	0.657	---	---	---	---	---	---
Situational	0.129	0.695	---	---	---	---	---
Benefits	0.245	0.234	0.443	---	---	---	---
Barriers	---	-0.274	-0.065	-0.639	---	---	---
Behaviour after	0.174	0.328	0.006	0.152	-0.285	---	---
Self-efficacy	0.128	0.069	-0.010	0.046	-0.470	0.299	---
Dietarians	0.059	0.047	-0.004	0.533	0.335	-0.159	-0.694

Table-4: Standardized indirect effects of HPM constructs on dietary sodium

	Prior behaviour	Interpersonal	Situational	Benefits	Barriers	Behaviour after	Self efficacy
Interpersonal	---	---	---	---	---	---	---
Situational	0.456	---	---	---	---	---	---
Benefits	0.413	0.308	---	---	---	---	---
Barriers	-0.639	-0.391	-0.283	---	---	---	---
Behaviour after	0.500	0.276	0.166	0.182	---	---	---
Self efficacy	0.571	0.511	0.235	0.400	-0.085	---	---
Dietary Na	-0.427	-0.435	-0.064	-0.577	0.430	-0.207	---

Table-5: Structural equation modelling fitness based on the HPM Constructs on sodium intake

Model fitness indexes	Recommended rate	Final model	Conclusion
Df/X²	<3.00	2.045	Fitted
GFI	>0.9	1.000	Fitted
AGFI	>0.8	0.991	Fitted
NFI	>0.9	1.000	Fitted
CFI	>0.9	1.000	Fitted
RMSEA	<0.1	000	Fitted

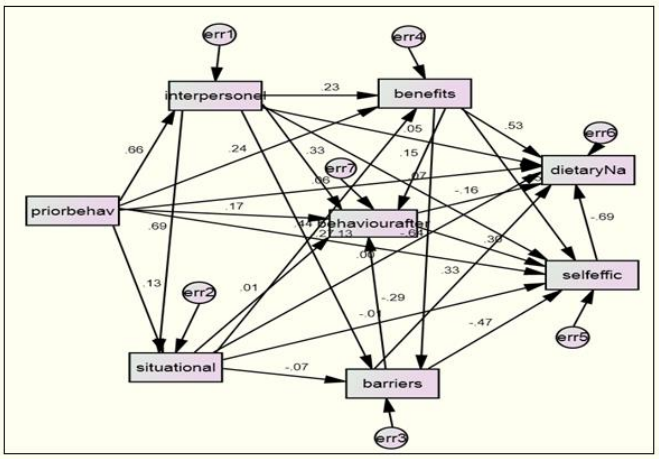

Fig-2: Modified health promotion model

DISCUSSION

Globally, a link between sodium intake and high blood pressure levels is well established [11].Although its benefits may be debatable, sodium restriction continues to be a mainstay in the management of Heart patients in the US and worldwide. Despite its prescription, the majority of even well informed, chronically followed HF patients remain non-adherent [15]. This has been attributed to social and cultural barriers including different body image ideals and food attitudes [16]. Those who perceived themselves at risk of consuming excess sodium were more likely to take action towards sodium reduction [11]. However practices towards sodium reduction were less likely to be taken by those who had unfavourable attitudes towards sodium reduction [11].

The present study done among the hypertension patients of urban Chidambaram has brought forth the behavioural influences of patients in their salt restriction habit. The study has highlighted the predominant factors influencing the perception by participants.

The amount of salt intake in this study was more than 8gms per day which is higher than the recommended daily intake of <5 gms of salt by hypertensives. Based on the dietary sodium intake calculated only 3 participants were following the recommended sodium intake of <2gms per day ie 5gms of salt, thus the rest being at high risk due to consumption of > 2gms of sodium or 5gms of salt per day. This has been supported by previous studies worldwide which states that the average consumption of salt is above 9g/day [16-20].

Perception refers to the way in which an individual regards, understands or interprets about things through experiences. Nutrition perception is one such factor which influences the dietary habits and beliefs of persons. This perception has been assessed by the constructs of HPM in the practice of salt restriction. The factors such as prior behaviour, perceived benefits, perceived barriers, and self-efficacy play major role in determining salt intake. Apart from these the interpersonal and situational influences along with behaviour after affect also influences the perception of individuals leading to their commitment to planned decision. In the present study the dietary sodium is negatively correlated to perceived self efficacy, perceived benefits, interpersonal and situational influences. The perceived barriers are positively correlated to the dietary sodium intake. This infers that persons perceiving barriers like tastelessness, weakness on consumption of low salt diet have higher dietary sodium intake. But perceiving a higher benefits and self-efficacy by patients in following salt reduction helps them to adapt to the practice despite the barriers. This finding is similar to the results of Kamran et al which also emphasises the role of self efficacy in salt restriction [9].

Similar to the study by Kamran, the Structural equation model has fitted in the constructs of prior behaviour, interpersonal and situational influences, with behaviour after affect, perceived benefits, barriers and self-efficacy influencing on the dietary sodium intake based on the results from the participants.

According to the model, the constructs of HPM namely perceived self efficacy and perceived benefits has been the predominant factors of the participants which determines their salt restriction behaviour than the others. The other factors though have effect on the dietary sodium intake yet their action is through influencing the factors of self efficacy, benefits and barriers. It is found that a favourable prior behaviour along with better interpersonal and situational influences has a positive effect in determining the behaviour after affect which in turn increases the perceived benefits and perceived self efficacy of the participants. Perception of higher self efficacy by patients in adaption of salt restriction helps them reduce their salt intake. The perception of beneficial aspects of salt restriction apart from reducing salt intake increases the beliefs and confidence of participants in accepting the practice as routine. These results in total reveal the importance of attention to perceptions and subjective norms in reducing sodium intake in hypertensive patients. Thus it is important to understand these contexts to motivate patients in behaviour modification.

CONCLUSION

Adherence to dietary lifestyle changes such as salt restriction is a lifelong process requiring motivation along with health education and knowledge. This infers that the health care provider should understand the various perceptions and barriers faced by patients to modify their approach from mere advising to motivation of patients in increasing their self efficacy and benefits of salt restriction. This in turn might help in better adherence to salt reduction in diet. Thus it needs both population strategy and individualized approach with health education and behavioural interventions to help hypertensive patients accept salt restriction as part of the treatment and thereby cultivate a favourable attitude towards salt reduction.

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