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Acupressure strategy to Deal with Consequences of Hemodialysis and Climatic Changes among Children Undergoing Hemodialysis

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Abstract:

Thirst, xerostomia and interdialytic weight gain are the most frequently occurring symptoms among children undergoing hemodialysis. These symptoms may lead to dehydration, frustration and affect their quality of life. Children experience significant impairment in everyday life functioning due to anxiety related to climatic changes.

Aim of the study: to investigate the effect of acupressure strategy to deal with consequences of hemodialysis and climatic changes (thirst, xerostomia, interdialytic weight gain and anxiety). **Subject and Methods: The Research design:** A Randomized controlled trial research design was used in the present study. **Setting:**

Hemodialysis unit at Assiut University Children's Hospital. **Subjects:** Purposive sample of fifty children were randomly allocated to study and control groups, 25 subjects for each. **Tools of data collection:** The following five tools were used to collect data 1- Data Collection Sheet to assess Personal and Medical Data. 2- Thirst Inventory Questionnaire to identify the occurrence of thirst. 3- Xerostomia Inventory (XI) to quantify the perceived xerostomia 4- Interdialytic Weight Gain (IWG) to measure the body weight during dialysis session. 5- Climate Change Anxiety Scale.

Results: revealed that 32 % of children in the studied group had chronic renal failure for three to less than five years, there is a decrease in thirst, xerostomia and interdialytic weight gain and anxiety from 24.04 ± 1.97 , 33.76 ± 3.55 , 1.5 and 26.52 ± 2.60 to 7.60 ± 0.87 , 11.92 ± 1.22 , 0.0 and 8.60 ± 1.66 (respectively). **Conclusion:** We concluded that the intervention of acupressure was effective in reducing thirsty and xerostomia, which significantly decreases intradialytic weight gain and anxiety in children undergoing hemodialysis. **Recommendation:** The study was highly recommended for using acupressure to children undergoing hemodialysis for its significance in decreasing thirst, xerostomia, interdialytic weight gain and anxiety.

Keywords: Acupressure, Climatic Changes, Xerostomia, Thirst, Interdialytic Weight Gain, Anxiety, Hemodialysis.

Intr

roduction:

Climatic changes are the biggest global health threat of the 21st century. Evidence of such change includes the instrumental temperature record, rising sea levels, and decreased snow cover in the Northern Hemisphere, water scarcity, and agriculture and food insufficiency. These environmental changes are likely to have an impact on all the natural ecosystems and socioeconomic systems (Rosenzweig et al., 2017).

Children are the first most vulnerable group to climatic change hazards. They have increased vulnerability compared with other groups because of their physical, physiologic, and cognitive immaturity. (Basu, 2019). (Etzel and Balk, 2013).

Anticipated direct health consequences of climatic changes include direct morbidity from heatwaves include heatstroke, electrolyte imbalance, kidney-associated diseases, and respiratory as well as infectious diseases, whereas increases in mean temperature are associated with a higher prevalence of pediatric kidney stones (Shea, 2014).

Children living with kidney disease are uniquely vulnerable to the effects of climate change, resulting in rising incidence of heat-related acute kidney injury and CKD, increased risk of nephrolithiasis, vector-borne kidney diseases, and disruption to kidney care delivery associated with extreme weather events (Barracough et al., 2017).

Worldwide, there are more than 30 in every 100,000 children are suffering from chronic renal failure (CRF) each year and the rate increased with age from 4 to 6 years (Naritata et al., 2017). In the United Kingdom (2016), the incidence of CRF in children less than 16 years was 9 per million age related populations (Plumb et al., 2018). In Egypt, according to the records of Out Patient Clinics and Dialysis Units of 11 universities, 1018 child patients were suffering from CRF and the age of 56.7% of them ranged from 1 to 19 years (Shaban, 2021).

Generally, hemodialysis (HD) is the most prevalent alternative therapy that is used in advanced and permanent kidney failure in pediatric patients. According to the International Pediatric Nephrology Association [IPNA] (2018), it was estimated that 12.9 per million of children less than 19 years were treated by hemodialysis. Hemodialysis is defined as a medical procedure that involves using a special machine to filter waste products from the blood and to restore normal constituents again to it (National Kidney Foundation [NKF], 2015).

Xerostomia caused by reduced salivary production is a major obstacle to the adherence to fluid-restriction of HD patients (**mina et al., 2019**). While the unstimulated salivary flow rate in healthy people ranges between 0.3 and 0.5 mL/min, about half of HD patients have a rate below 0.1 mL/min (**Yang et al., 2019**), and 60–77% of the patients experience severe thirst and xerostomia.

Thirst is a pervasive, intense and undertreated symptom for children undergoing HD. It is the craving for fluids that evokes the instinct of children to drink water and consume more amount of fluid than they required. It is an essential mechanism involved in fluid balance (**Said & Mohammed, 2013**).

Thirst result in excessive fluid intake and inter-dialytic weight gain in patients undergoing HD (**Bruzdazwiech et al., 2018**) that may lead to serious complications such as hypertension, congestive heart failure and death (**Dehghanmehr et al., 2017; Lewicki et al., 2013**).

Effective management of thirst can be accomplished using pharmacological and non-pharmacological techniques complementing each other. Non-pharmacological techniques include mechanical measures such as chewing gum and acupressure or hydrotherapy such as sucking ice, saliva substitutes, mouth washes, behavioral and psychological interventions (**Fan et al., 2013**).

Acupressure is non-invasive form of traditional Chinese medicine that is common throughout Chinese society as a way of maintaining general health (**Yang et al., 2010**). It involves gentle but firm pressure or massage with finger over certain acupoints by licensed practitioners. Stimulation of the residual secretory capacity of salivary glands through acupressure is well known to be effective in relieving thirst (**Yang et al., 2017**).

The success of HD depends on nursing care provided for children. The pediatric HD nurses play a pivotal role in providing information, care, support, and therapeutic counseling to the pediatric patients and their families throughout the entire illness (**Peimani&Pajouhi, 2010**). Being aware of the recent nursing guidelines for management of children undergoing HD will allow nurses to make an appropriate clinical decision (**James et al., 2014**).

Significance of the study:

The effects of climate change on global health are increasingly recognized. Global warming, extreme weather events, and many other threats are resulting in changing patterns of disease, with direct and indirect detrimental impact on human health worldwide (**Romanello et al., 2021**).

Thirst or dry mouth is one of the most frequently occurring symptoms in hemodialysis (HD) patients. Studies report that 60–77% of HD patients experience exaggerated thirst and dry mouth (**Sung et al., 2015**). Importantly, thirst is associated with a higher large interdialytic weight gain (IWG). A large IWG can result in a much greater risk for cardiovascular morbidity, the main cause of death in end-stage renal disease (ESRD) patients (**Kugler et al., 2015**).

Controlling the fluid intake for the patients undergoing HD reduce the detrimental effects of fluid overload on morbidity and mortality (**Ker & Gangadharan, 2019**). Managing and preventing children's thirst using non-pharmacologic techniques as acupressure in an effective and safe manner resulting in relieving children's thirst and prevent the serious complications that are associated with inter-dialytic weight gain.

Aim of the Study:

The aim of this study is to investigate the effect of acupressure strategy to deal with consequences of hemodialysis and climatic changes (thirst, xerostomia, inter-dialytic weight gain and anxiety)

Research Hypotheses:

- Children undergoing hemodialysis who receive acupressure exhibit less thirst, xerostomia, inter-dialytic weight gain and anxiety than those who don't receive acupressure interventions.
- There is significant relation between thirst, xerostomia, interdialytic weight gain and anxiety among children undergoing hemodialysis with their selected demographic variables.

Null hypotheses:

- Children undergoing hemodialysis who receive acupressure are just as likely as those who don't receive acupressure interventions related to exhibition of thirst, xerostomia, inter-dialytic weight gain and anxiety.
- There is no significant relation between thirst, xerostomia and inter-dialytic weight gain among children undergoing hemodialysis with their selected demographic variables

Subjects and Method:**Research design:**

A Randomized controlled trial research design was undertaken in this study.

Setting:

The study was conducted at pediatric hemodialysis unit in Assiut University Children's Hospital which is affiliated to Ministry of Higher Education and Scientific Research. It is the only unit in Assiut city that is dealing with children undergoing hemodialysis and serves children of all Upper Egypt. A pediatric hemodialysis unit contains two rooms, each room contains 12 beds, children examination room, room for nurse supervisor and room for resident doctor. The care for children is introduced by 20 nurses.

Subjects:

Purposive sample of fifty children undergoing hemodialysis who were admitted to the previously mentioned setting and they were selected and allocated randomly into two equal groups:

Group I: who received acupressure interventions (**study group**)

Group II: who received no interventions (**control group**)

Inclusion criteria:

- Children whose age ranged from 6-18 years.
- Both sexes
- Children undergoing hemodialysis for at least 3 months.
- Children who were free from diabetes mellitus, ischemic heart disease, and autoimmune disease.

Exclusion criteria:

- Children who had inflammation or neuropathic disorders in acupressure points.

Randomization

The randomization process was carried out through a web-based randomizer (<https://www.randomizer.org/>) to allocate 25 children to each group (control & study).

Data collection tools:

Five tools were used to collect the required data for this study:

Tool I: Interview Sheet: This tool was developed by the researcher after reviewing the literature to obtain personal and medical data of children undergoing hemodialysis. It included two parts:

Part one: It include personal data of children: as age, gender, residence and level of education.

Part two: It include medical data of children: as onset of disease, frequency and duration of hemodialysis.

Tool II: Thirst Inventory Questionnaire: This tool was adopted from (Bots et al., 2004) to assess the degree of thirst for patients undergoing hemodialysis. It comprised of 7 validated items; each item had 5-point Likert scale ranged from never which equals 1 to very often which equals 5. The responses to the seven items were categorized as follows: Never thirsty=7 points, almost never thirsty =14 points, occasionally thirsty= 21 points, fairly often thirsty= 28 points and very often thirsty =35 points.

Tool (III) Xerostomia Inventory Questionnaire:

It was adopted from Korean version of xerostomia inventory, (Lee et al., 2016) to assess the severity of xerostomia among patients. Xerostomia Questionnaire (XQ) was comprised of 11 validated items, each item had 5-point Likert scale is ranged from never which equal 1 to very often which equals 5 with the results from 11 points (no dry mouth) to a maximum 55 points (extremely dry mouth). The questions included items about dryness while eating or chewing and items about dryness while not eating or chewing. Cronbach's alpha for internal consistency is 0.868 and test-retest reliability ranged from 0.48 to 0.827. construct validity Spearman's rho, $\rho = -0.515$

Tool (IV) weight assessment sheet:

It was developed by the researcher to assess the children's weight between two sessions of hemodialysis.

Tool (V): Climate Change Anxiety Scale (CCAS):

The 13 – item climate change Anxiety Scale (CCAS) was adopted from (**Clayton and Karazsia, 2020**). the tool measured two subscales of climate change Anxiety (cognitive-emotional impairment) each item has 5-point Likert scale (1=never to 5 =almost always).

Methods:

- An official approval for conducting the study was obtained from the head of dialysis unit at Assiut University Children's Hospital after explaining the aim of the study.
- Tools were developed by the researcher after thorough review of literature and content validity was tested through a panel of five experts in the field of pediatric nursing from Faculty of Nursing, (Four from Faculty of Nursing, Assiut University and one from Faculty of Nursing, Sohage University) to ensure its validity for comprehensiveness, accuracy, clarity and relevance.
- A pilot study was carried out on five children who undergoing hemodialysis to test the feasibility of the tools and accordingly the necessary modifications were done. Those children were excluded from the study subjects.
- Internal consistency reliability was tested by using a Cronbach's Alpha (80%) for tool (II) regarding thirst inventory questionnaire, tool III was (86 %) regarding xerostomia inventory questionnaire and tool V was (71.1%) regarding climate change anxiety scaleafter modification to suit with age group subject, that means the tools were reliable
- Fidelity was achieved through receiving a special training in the field of acupressure at the Faculty of Physical therapy, sphinx University.

Interventions:

- Initially, the researcher determined the site of Lianquan (CV-23) acupoint which was located on the anterior midline of the neck in the depression above the hyoid bone. After that, the researcher determined the site of ChengJiang (CV- 24) acupoint which was located on the center of the mentolabial groove directly below the lower lip. For the Yifeng (TE17) acupoint, the

researcher determined its site which was located on the posterior to both ear lobes in the depression between the mandible and mastoid process. Finally, the researcher determined the site of Dicang (ST-4) acupoint which was located on the face directly below the pupil of the eye when the child focuses his / her eye forward and lateral to the corner of the mouth.

- The acupressure was performed by the researcher for three minutes during the hemodialysis session for each previously mentioned acupoints.

- Thirst was assessed weekly for four times at the end of the first, second, third and fourth week by using tool two.

- The researcher applied the acupressure for children for three times/ week for 4 weeks.

- The acupressure was performed in a circular movement, in clockwise direction for three minutes for each acupoints during hemodialysis session.

- For control group, the researcher used sham intervention.

- Children's thirst and xerostomia were assessed at the first day and then for four times at the end of the first, the second, the third and the fourth weeks using tool II and III, respectively.

- The inter-dialytic weight gain was calculated by subtracting the child's weight after the dialysis session (after –weight) from the beginning of dialysis session (before-weight) for four times at the end of the first, the second, the third and the fourth weeks by using tool IV.

- Anxiety level was assessed at the first day and then for four times at the end of the first, the second, the third and the fourth weeks using climate change anxiety Scale.

- Data for this study was collected for a period of 5 months from August 2023 to December 2023.

Analysis of data:

Collected data were revised and coded for computerized data entry using statistical package for social sciences (SPSS) version 19. Data were then verified prior to statistical analysis. Statistical methods were applied including descriptive statistics such as (frequency, percentages, mean and standard deviations). Statistical significance was considered at $p\text{-value} < 0.05$.

Ethical considerations:

The ethical research consideration in this study was included the following:

- Research proposal was approved from the Ethical Research Committee of the Faculty of Nursing, Assiut university.
- The research approval was obtained before research implementation from director of hemodialysis unit.
- A written informed consent was obtained from every child's parent after explaining the aim of the study.
- Parents were assured that the data of this research used only for the purpose of research.
- Privacy of children were maintained
- The research was maintained on anonymity and confidentiality of the subjects and Children's participation was voluntary, child's parent had the right to withdraw from the study at any time without penalty.

Results:

Table (1): shows the distribution of personal data of children. It was found that; the mean age of children in studied group was 13.24 ± 3.47 . The table also clarifies that, slightly more than half of children (52%) in studied group were females. The table reveals that 68% of children in the studied group were from rural areas. It was also observed that near half (48.0%) in studied group was in the primary schools. There were no statistically significant differences were revealed among the two groups in any of these characteristics.

Table (2): It was revealed from the table that 32 % of children in the studied group had chronic renal failure for three to less than five years. As regards the frequency of HD sessions, the table

clarifies that the majority of children (80%) received HD session three times per week. Concerning duration of hemodialysis session, the table revealed that 88% of children spent 4 hours on hemodialysis machine.

Figure (1): It was revealed from the figure that there were no statistically significant differences among comparison groups at baseline before acupressure application regarding thirst intensity scores (p-value= 0.149). After first week of intervention, there was no statistically significant difference and thirst intensity scores was (p-value = 0.147). After second and third weeks of acupressure application, there was improvement and thirst intensity scores were (p-value = 0.001 and 0.000) respectively. At the end of acupressure phase of the study, thirst intensity was lower when compared with the baseline and there were highly statistically significant differences in the comparison groups (p = 0.000).

Figure (2): It was revealed from the figure that there were no statistically significant differences among comparison groups at baseline before acupressure application and Xerostomia inventory score was (p-value = 0.484). After 1st and 2nd weeks of intervention, there was no statistically significant difference and Xerostomia inventory scores were (p value = 0.606 and 0.095) respectively. After 3rd week of acupressure application there was improvement and Xerostomia inventory score were (p value = 0.001). At the end of acupressure phase of the study, Xerostomia inventory score was lower when compared with the baseline and there were highly statistically significant differences in the comparison groups (p value = 0.000).

Figure (3): It was revealed from the figure that there were no statistically significant differences in the two groups at baseline before acupressure application. After first week of intervention, there was no statistically significant difference among the two groups. After second and third weeks of acupressure application, there was no statistically significant differences among the comparison groups. At the end of acupressure phase of the study, weight differences were lower when compared with the baseline of intervention and there were highly statistically significant differences in the comparison groups (p-value was 0.08).

Figure (4): It was revealed from the figure that there were no statistically significant differences among comparison groups at baseline before acupressure application and anxiety related climate change score was (p-value = 0.484). After 1st and 2nd weeks of intervention, there were no

statistically significant difference and climate change scores were (p- value = 0.606 and 0.095) respectively. After 3rd week of acupressure application, there were improvement and climate change score were (p value = 0.001). At the end of acupressure phase of the study, climate change score was lower when compared with the baseline and there were highly statistically significant differences in the comparison groups (p = 0.000).

Table (1): Distribution of personal data of children

Personal data	Study (n= 25)		Control (n= 25)		P-value
	No.	%	No.	%	
Gender:					
Male	12	48.0%	14	56.0%	0.571
Female	13	52.0%	11	44.0%	
Age: (years)					
Mean ± SD	13.24 ± 3.47		13.40 ± 3.19		0.866
Range	6.0-18.0		6.0-18.0		
Residence:					
Rural	17	68.0%	20	80.0%	0.333
Urban	8	32.0%	5	20.0%	
Educational level:					
Illiterate	3	12.0%	6	24.0%	0.526
Primary	12	48.0%	8	32.0%	
Preparatory	4	16.0%	3	12.0%	
Secondary	6	24.0%	8	32.0%	

Table (2): Distribution of medical data of children

Medical data	Study (n= 25)		Control (n= 25)		P-value
	No.	%	No.	%	
Onset of disease:					
3 - < 12 months	6	24.0%	5	20.0%	0.652
12 months - < 3 years	7	28.0%	6	24.0%	
3 - < 5 years	8	32.0%	12	48.0%	
> 5 years	4	16.0%	2	8.0%	
Frequency of hemodialysis:					
Twice a week	5	20.0%	6	24.0%	0.733
Three times a week	20	80.0%	19	76.0%	
Duration of hemodialysis session:					
3 hours	2	8.0%	0	0.0%	0.223
4 hours	22	88.0%	22	88.0%	
5 hours	1	4.0%	3	12.0%	

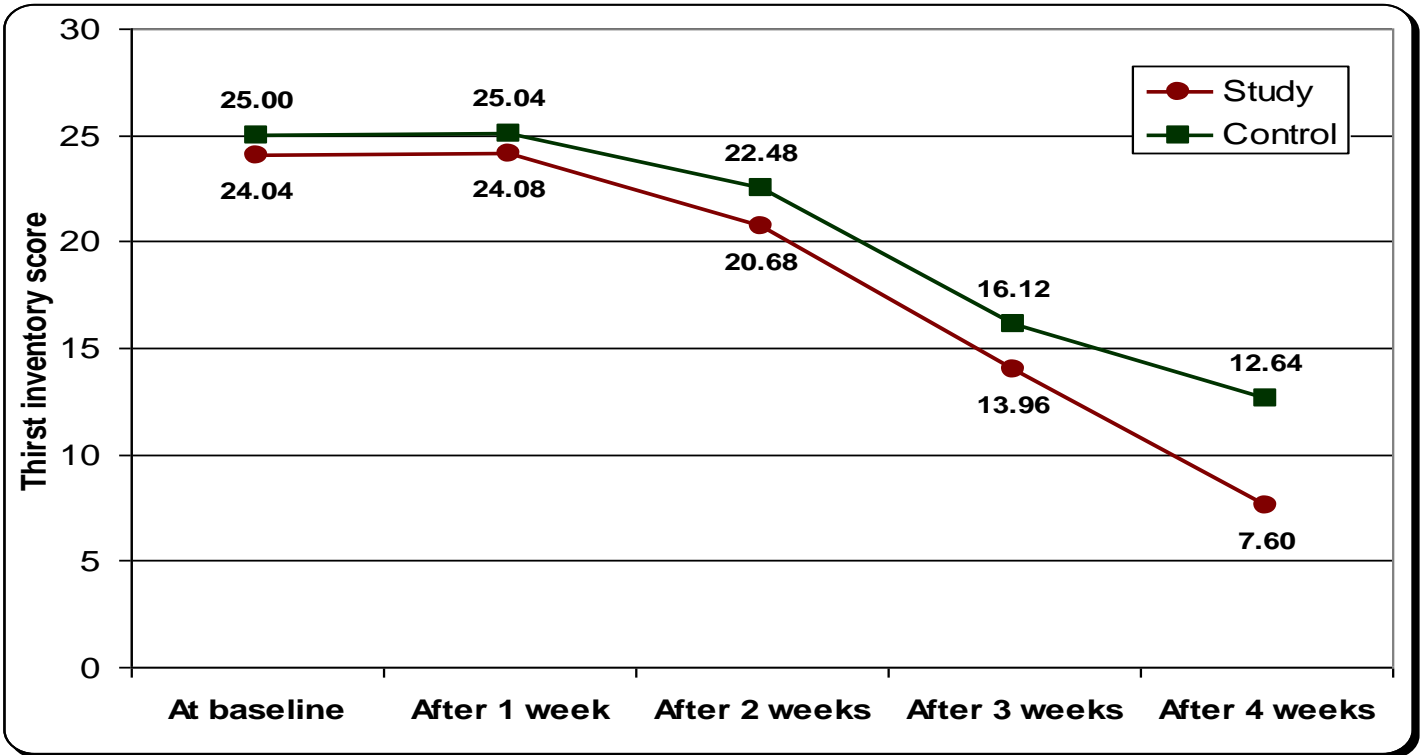


Figure (1): comparison between acupressure & control groups regarding thirst inventory mean score before and after acupressure intervention

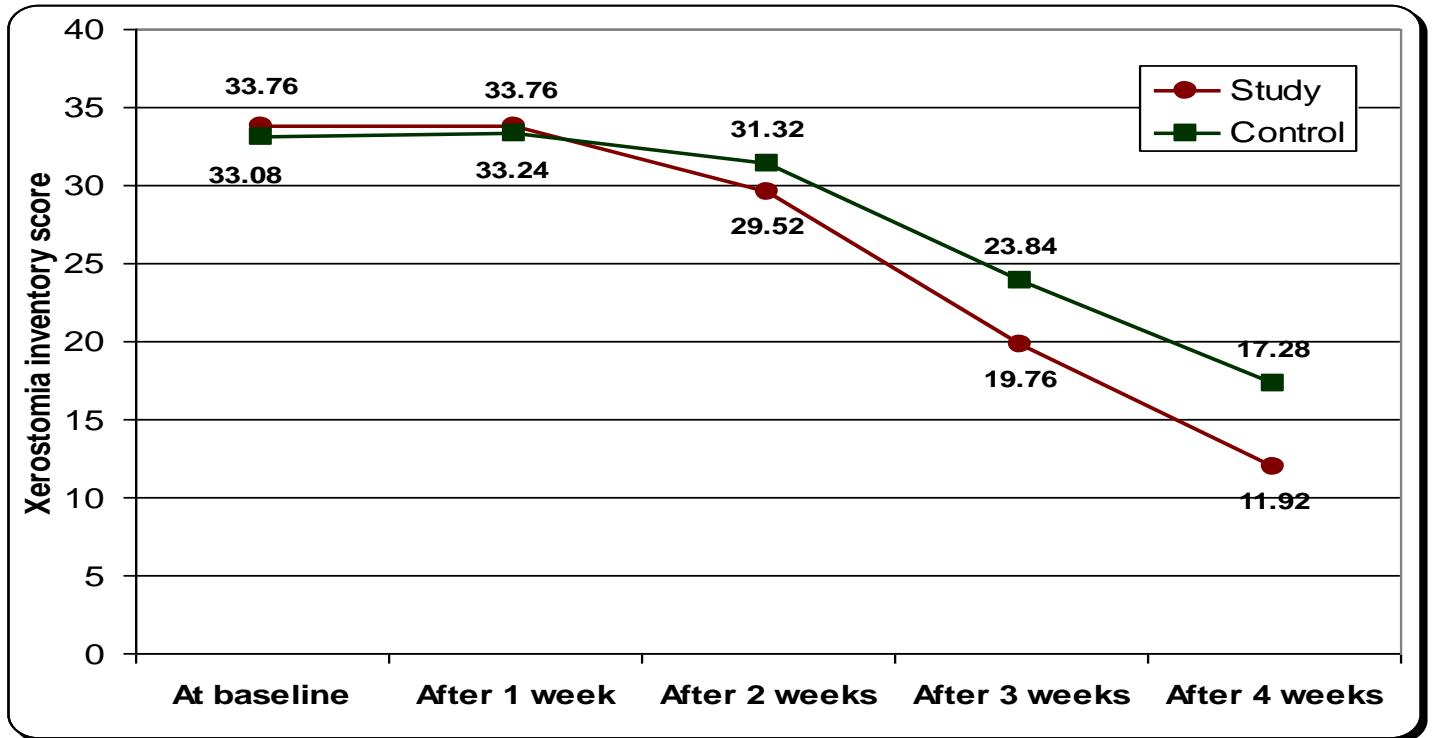


Figure (2): Comparison between acupressure & control groups regarding xerostomia inventory mean score before and after acupressure intervention

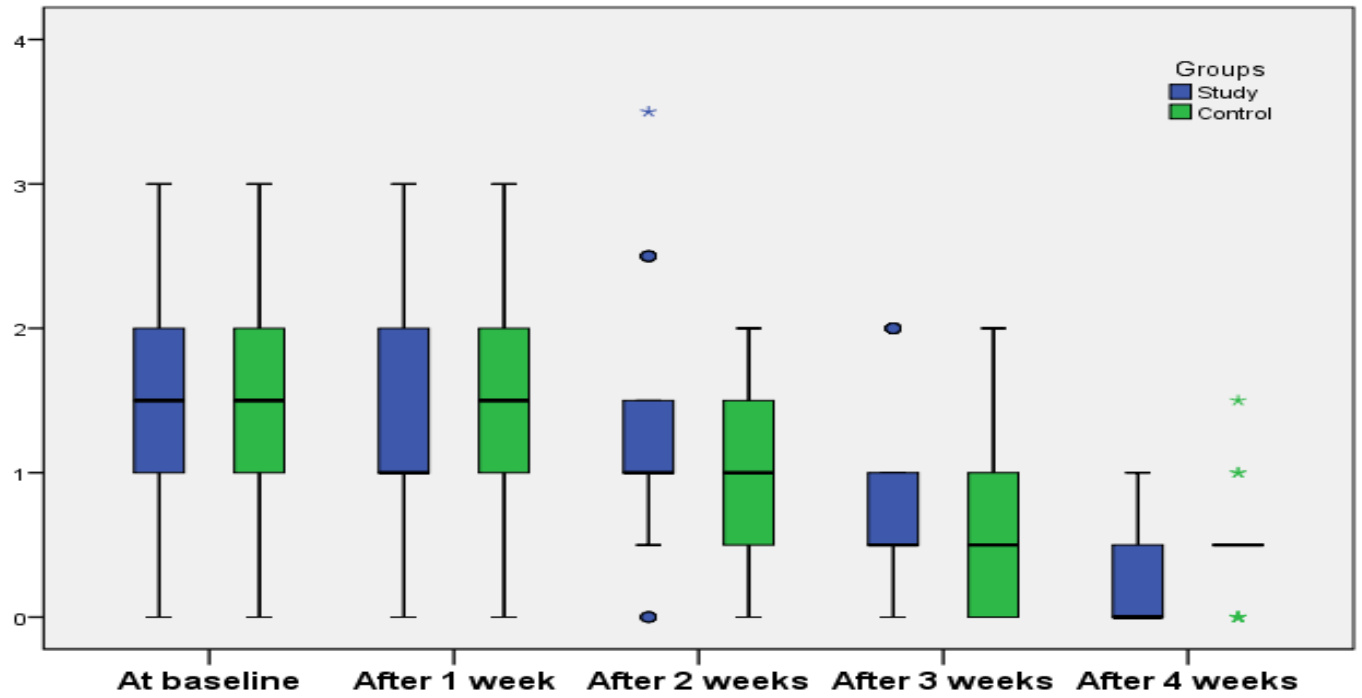


Figure (3): Differences between acupressure & control groups regarding weight differences before and after acupressure intervention

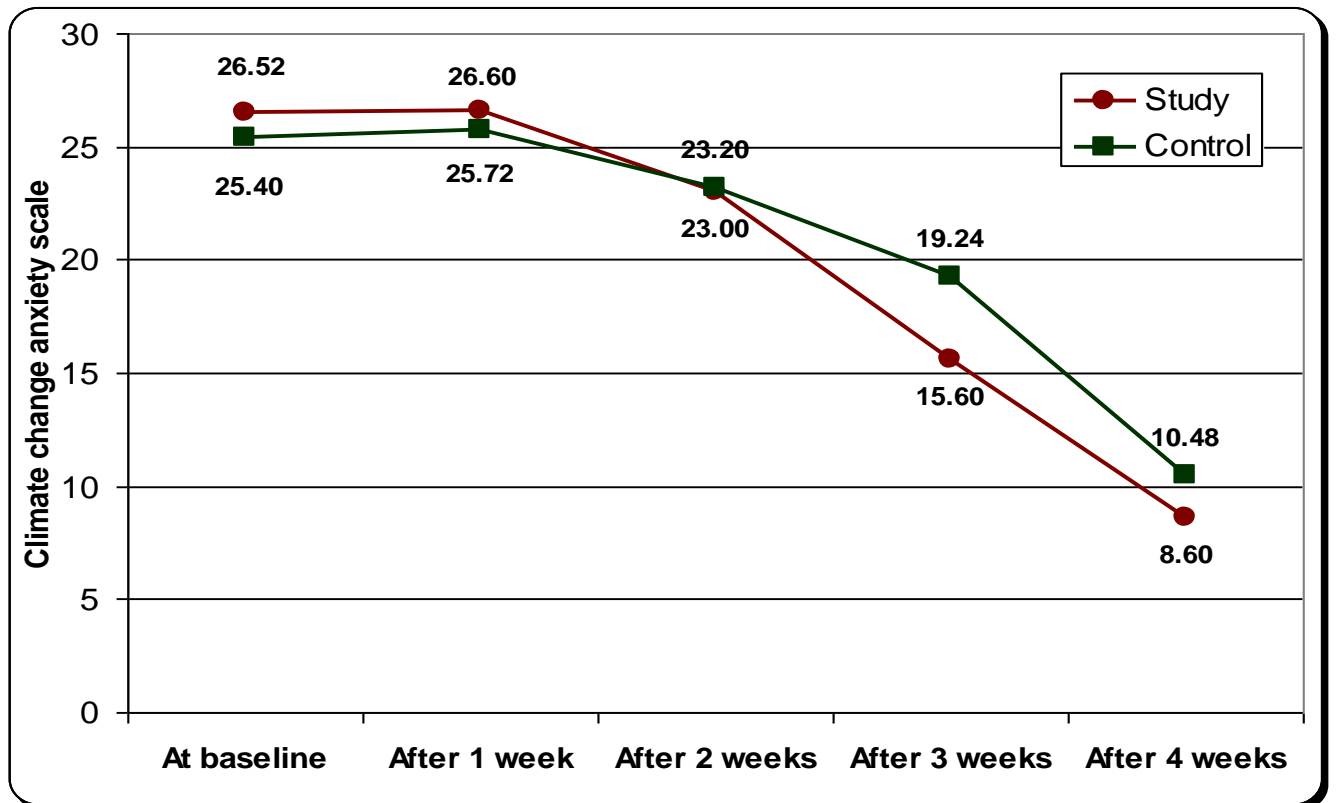


Figure (4): Comparison between acupressure & control groups regarding anxiety related to climatic change mean score before and after acupressure intervention**Discussion:**

Acupressure is noninvasive, safe and easy to implement. Therefore, it is well suited for application in clinical practice to alleviate thirst (**Li et al., 2014**). The finding of the current study revealed that there was a highly significant reduction in thirst intensity at the second, third and fourth weeks of study period (**table 3**). These findings could be interpreted by the fact that acupressure could restore the normal body functions by stimulating the autonomic nervous system to release neuropeptides (neuropeptide vasoactive intestinal polypeptide, neuropeptide Y, substance P, calcitonin gene-related peptide, neurokinin A), which increase saliva production to quench thirst (**Bossola et al., 2018**).

The findings of the current study were congruent with **Yildirim Keskin, et. al (2021)** Who conducted a study about the effect of acupressure applied among children patients receiving hemodialysis treatment on severity of thirst and quality of life. They reported that acupressure increased the amount of saliva and decreased the severity of thirst and affect positively on their quality of life. Moreover, **Yang et al., (2010)** concluded that acupressure may be effective in improving salivary flow rates and thirst intensity .

This study noticed that there was apparent decrease in the thirst among children in study group than in control group throughout the sessions, this result is in agreement with **Bayraktar et al. (2009)** who stated that acupressure appears to alleviate thirst, and consequently may attenuate the negative cognitive performance effects of thirst that doesn't appear in the control group.

The findings of the current study show that acupressure was effective in terms of significantly lowering xerostomia scores and increasing saliva secretion. These results are consistent with **Yang et al., (2017)** who conducted a pilot observational study that of a 4-week acupressure intervention for patients on hemodialysis, in which xerostomia and saliva secretion were significantly improved from baseline values. Xerostomia was likely to be improved because of the increase in saliva secretion, which was induced by the activation of the parasympathetic nervous system caused by the selective stimulus on the thirst acupoint (**Bossola and Tazza, 2012**).

This study reported that there is a statistically significant difference among children in the study group in relation to xerostomia, thirst, interdialytic weight gain and anxiety compared to control group. This result is in agreement with **Dirschnabel, (2011) and Murtagh, (2010)** related to xerostomia, they noticed that xerostomia is a frustrating symptom for patients on hemodialysis, mechanisms that contribute to its development include low saliva flow, mouth breathing and altered salivary composition. An increased intake of fluids secondary to xerostomia in patients on hemodialysis will result in excessive interdialytic weight gain.

It is apparent from this study that there is a decrease in xerostomia among children in study group than in control group throughout the sessions which consistent with **(Bossola et al. 2012)**. Furthermore, this result supports findings that acupressure is helpful for managing symptoms such as anxiety in patients on hemodialysis, resulting in enhanced health-related quality of life **(Arab et al., 2016)**.

The present study was planned as a preliminary trial on children to test the efficacy of acupressure in decreasing anxiety related to climatic changes, as there is a continuous need to explore guidance methods for children that are easy and cost effectiveness. Acupressure does not require extensive training and can also be taught easily to the child/parent, if used as a self-care measure. Simplicity, non-invasiveness, ease in performance, and lack of pain or major features that make this procedure well tolerated by children **(Viswanath et al., 2014)**. Likewise, application of acupressure on the anxiolytic points produced a beneficial effect, as there was a drastic decrease in the anxiety scores, irrespective of the treatment procedure considered. This can be attributed to the alteration in the emotional condition of the children, due to release of endorphins and serotonin **(Roberts et al., 2010)**.

Limitation of the study:

Limitations of this study is, the recruitment of participants was restricted to pediatric hemodialysis unit in Assiut University Children's Hospital, and thus the findings may not be generalizable to other populations.

Conclusion:

Based on the findings of the current study, it can be concluded that acupressure intervention was effective in reducing children's thirst and xerostomia, which significantly decreases intradialytic weight gain and anxiety in children undergoing hemodialysis.

Recommendations:

In line with the findings of the study, the following recommendations are suggested: -

1. Acupressure should be incorporated in the pediatric hemodialysis unit policy to decrease thirst among children undergoing hemodialysis.
2. Nurses in the hemodialysis unit should attend in-services training courses and workshops regarding acupressure intervention to practice it efficiently and easily.
3. Children undergoing hemodialysis and their mothers should be trained by specialists in acupressure to practice it at their homes.
4. Further researches on effect of acupressure on quality of life of Children undergoing hemodialysis
5. Further researches on application of acupressure for large sample group

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