A comparative study to assess nutritional games and modified hearth approach for adolescents

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ABSTRACT

Communication is the heart of human beings for exchanging information. Use of health communication principles in public health nutrition present various challenges and has contributed in gaining vast recognition by combing theory and practice in bringing desirable changes in nutritional knowledge and practice to overcome communicable and non-communicable diseases. An attempt was made to bring out a desirable knowledge change in school going children of 8th and 9th class by using nutritional games approach and modified hearth approach and to study the efficacy of the approaches by comparing. The study revealed a significant improvement in knowledge level of intervention groups of adolescents after exposure to experimental approaches-nutrition game and modified hearth approach compared to control group not exposed to any treatment ($p<0.01$). Significant decrease ($p<0.05$) in knowledge level was not observed after 4 to 5 weeks of intervention in experimental groups indicating retention of knowledge acquired through interventions. Modified hearth approach model was found more effective for imparting nutrition education compared to gaming approach.

Keywords: *Nutritional games, hearth approach, nutrition education, communication*

1. INTRODUCTION

Adolescents are a marginalized and disempowered group and lack access to resources, limited power to voice on societal stage, drop out of education due to socio economic factors and are highly vulnerable to violence and exploitation (Burman and McKay, 2007). The nutrient needs parallel the rate of growth with the greatest nutrient demand that occur during the peak velocity of growth. The nutritional requirements during peak velocity of growth were found as high as twice of the remaining period of adolescence (Forbes, 1992). Black et al (2013) observed that half of the adolescents were found stunted due to inadequate nutrition. Hence improving adolescents' nutrition is an investment for national progress in terms of productivity and economic progress. Adolescent age provides an opportunity to correct faulty dietary habits and set right nutritional deficiencies and to prevent chronic diseases later in life.

Nutrition intervention and education strategies are essential to promote the adoption of healthy eating habits. Games help in skill development and learning requires feedback to 'unfreeze' the individual's behavior and provide reinforcement of the change (Cunningham, 1984). Nutritional games helped to improve the dietary pattern of children (Patti Landers, 2003; Cullen et al, 2001, Tzufen Su (2014)) and provide the learners with instant information about the correctness of their efforts. Positive deviance/hearth approach was used to improve the health and nutritional status of children in different settings (Bolles et al, 2002, Seth et al, 2003) for newborn care, child nutrition, role of contraception and educational outcomes (Dear et al, 2002; March et al, 2002; Ahrari et al, 2002).

Therefore an attempt was made to develop and adopt new models of intervention to improve effectiveness and expand availability and access to nutritional care by exploiting the use of modified hearth approach and nutritional games approach for adolescents and the effectiveness of approaches were studied and compared by the investigator.

2. MATERIALS AND METHODS

2.1 Study design and data collection

A multi-factorial study design was used with repeated measures at three points in time, of dependant samples from control and experimental groups. A pretested questionnaire to assess the knowledge level of subjects consist of multiple choice questions on nutrition and health was administered to adolescents. All answers were coded and fed to computer and analysed using SPSS package version 20. Before intervention, base line data was collected from schools to find out homogeneity and the samples were found independent. Experimental groups were given intervention through nutritional games and modified health approach for a

period of 2 to 2 1/2 months. After a period of 4 to 5 weeks, intervention -2 (Retest) was implemented to know the retention of the concepts taught through interventions. Control group was not subjected to any treatment. One mark was assigned for correct answer and zero was given for wrong answer. The base line questionnaire was re-administered twice (post-test and re-test) to analyse the impact of two interventions separately for experimental and control groups.

2.2 Selection of schools and sample size
List of schools in Anantapur was procured from district education officer. Among the schools, six schools were selected by multistage random sampling technique and the principle/ correspondent of each school was explained about the purpose of study and consent was obtained. Purposive sampling method was adopt to select 8th and 9th class children as study subjects. Within the class disproportionate random sampling technique was used to select 30 students consist of both gender from each class apportioned on 50-50%. Consent was obtained from study samples. Two schools each were randomly assigned as control, experimental group-1 and experimental group- 11. Total of 360 school going adolescents formed the study sample.

2.2.1 Inclusion criteria: Adolescents studying in class 8th and 9th of 13 to 15 years of age, both gender who were present during the study period and willing to participate were taken for study.

2.2.2 Exclusion criteria: Students of 8th and 9th class who were ill or absent during the study period were excluded from the study.

2.2.3 Statistical analysis: Data obtained from nutrition knowledge questionnaire was entered and analysed with SPSS, version 20. Post hoc analysis was conducted using RM Anova (repeated measure anova) to compare the effect size of actual difference in nutritional knowledge between and within control and intervention group at initial, intervention -1(post-test) and intervention -2(retest) levels.

3. RESULTS AND DISCUSSIONS
Nutritional knowledge is one of the factors that affect the nutritional status and nutritional habits of individual, family, and community at large. The declarative knowledge deals with nutritional awareness about facts, processes and practices that helps in knowing about things in selecting the nutrient – rich foods for obtaining a balanced diet for health and well-being. The procedural knowledge deals with how to do things like how to select low-fat foods, low salt soup packets etc. However, nutritional knowledge is widely considered as declarative knowledge (Worsley, 2002). For any successful nutrition intervention programmes of targeted audience, current nutrition level of the participants is taken into consideration. Setting a reliable and valid definition for nutritional knowledge is difficult. True/false or multiple choice tests made up of items concerned with concepts of nutrients, promotions of nutritious food, food safety and nutrition and its relation to health, micronutrient deficiencies were used to study for the baseline knowledge level. Saegert and Young (1982) use the similar pattern to observe the baseline knowledge levels. Nutritional awareness was found correlated with quality of food and information transferred from parents to child (Ankiler *et al.*, 1990). Nutrition education programmes with theoretical knowledge and real food and snack experiences helps to teach children what to eat and avoid (Contento, 1981).This helps the children to instil better dietary habits and develop life long healthy eating habits.

Nutrition intervention programmes should be multifaceted and on-going (Contento, 2008) and found effective when behaviourally focussed on appropriate theory and prior research rather than knowledge alone. Sound understanding of nutrition and healthy life style, help people to make better food selection, overcome myths about food and protect from malnutrition. Therefore nutrition intervention was given to 8th and 9th class students through nutritional games and modified hearth approach model for a period of 2 to 2 ½ months.

The baseline mean score of nutrition knowledge levels of 360 children of all six schools was found to be 15.58 ± 4.824. The results of the nutrition knowledge test was given in table-1.

Table 1: Mean Scores of nutrition knowledge of adolescents based on groups

Group	N	Pre-test Mean ± SD	Post-test Mean ± SD	Retest Mean ± SD
Control	120	13.12 ± 3.293	13.19 ± 3.197	13.64 ± 3.604
E-1	120	18.55 ± 3.749	38.44 ± 5.882	38.48 ± 5.732
E-2	120	15.07 ± 3.320	44.90 ± 3.190	45.25 ± 2.518

Key: C- Control group; Values are expressed as mean ± SD.
E-1 - Experimental Group-1 exposed to games
E-2 - Experimental Group-2 exposed to modified hearth approach
Maximum Scores: 54

The base line data on the concepts of lessons planned for adolescents in control, experimental group-1 and experimental group-2 were 13.12 ± 3.29, 18.55 ± 5.74 and 15.07 ± 3.320 respectively. At base line, significant difference (P<0.05) was observed in the nutrition knowledge levels of school children between control, experimental group-1 and experimental group-2 (table-) indicating heterogeneity of the groups. The groups are independent. Post intervention results after a period of 2 – 2½ months indicated a significant improvement in knowledge levels of experimental groups. However, significant improvement was not observed in the knowledge levels of control group due to no treatment / intervention given for control group.

Post intervention results of experimental group-1 indicated improvement in knowledge levels from 18.55 ± 3.749 to 38.44 ± 5.82 and for experimental group-2 indicated the improvement in knowledge level from 15.07 ± 3.320 to 44.90 ± 3.190 revealing the effect of treatment in acquiring knowledge in experimental groups. When comparisons were made between the mean improvement in the knowledge levels of control (0.08 ± 0.251 SE), experimental group-1 (19.89 ± 0.671 SE) and experimental group-2 (29.83 ± 0.419 SE) it was found that there was a significant increment in the experimental groups compared to control group indicating the efficacy of the intervention (Fig.1).
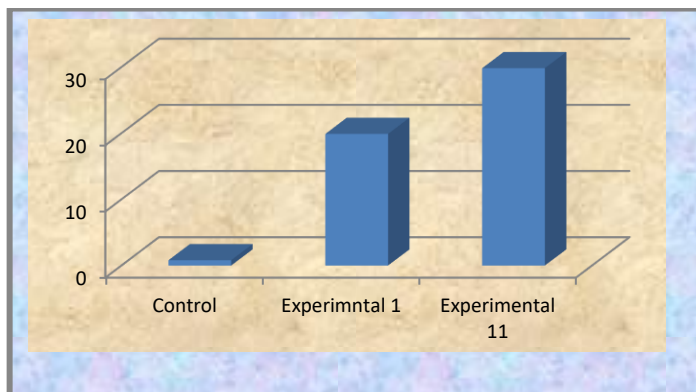

Fig. 1: Gain in knowledge level among experimental group

The improvement in knowledge mean scores of experimental groups was significant compared to control groups ($P< 0.01$).

Regarding the retention of knowledge gained through intervention, no significant difference was observed between the mean scores of school children in the experimental groups of post-intervention-1 and post-intervention-2 ($P=0.530$) indicating the retention of knowledge gained during intervention (table 2).

Table 2: Retention of knowledge in the students of experimental groups

Group	N	Post-Intervention-1	Post-Intervention-2	Significance
E-1	120	38.44 ± 5.882	38.48 ± 5.732	$P>0.05$
E-2	120	44.90 ± 3.190	45.25 ± 2.518	$P>0.05$
C	120	13.19 ± 3.197	13.64 ± 3.604	$P>0.05$

Values are expressed as mean $\pm$ SD.

From the study it was evident that experimental group-2 exposed to modified hearth was found more effective than experimental group-1 subjected to games (table 3). This could be due to the application of traditional methods of teaching along with nutritional games for teaching in modified hearth approach which include a combination of methods.

Table 3: Comparison of mean knowledge scores among the groups

Group	N	Mean	Std error	95% confidence level	
				Lower Bound	Upper Bound
C	120	13.317[a]	0.305	12.717	13.917
E-1	120	31.825[b]	0.305	31.225	32.425
E-2	120	35.072[c]	0.305	34.472	35.692

Means having different superscripts differ significantly at $p=0.05$.

Duncan multiple range test for school going adolescents revealed the mean scores among the three groups varied significantly ($P<0.05$). The mean score of experimental group-1 subjected to games approach showed 31.825 ± 0.305 (SE), experimental group-2 subjected to modified hearth approach showed 35.072 ± 0.305 (SE) and control group 13.317 ± 0.305 (SE). Among the groups, experimental group-2 subjected to modified hearth approach indicated a high mean knowledge score of 35.072 followed by the experimental group subjected to games indicated a score of 31.821 ± 0.305 and control group not exposed to any treatment indicated 13.317 ± 0.305. The study revealed both the approaches to be effective in imparting nutrition education among the treatments and modified hearth approach was found more effective. The pair mean difference among pre, post and retention scores of adolescents are given in table 4.

Table 4:The pair mean difference among pre, post, retention scores of adolescents

Knowledge	N	Mean	Std error	95% confidence level	
				Lower Bound	Upper Bound
Pre	120	15.578[a]	0.226	15.134	16.021
Post	120	32.178[b]	0.226	31.734	32.622
Retest	120	32.458[b]	0.226	32.026	32.891

Means having different superscripts differ significantly at $P=0.05$.

The pair mean differences among pre, post and retention scores are compared by using LSD test and the results revealed significant difference was not found among post, retest scores indicating the effective learning by the adolescents through treatments.

Educational based nutrition games were found interesting, flexible, and easily modifiable to suit the target audience (Steinman and Blastos, 2002) to be used as a teaching and learning aid. Nutritional games can also be used for after-school indoor or outdoor learning activities. Learning through playing nutritional games require students to collaborate and discuss with their partners to figure out appropriate moves and strategies to conquer their opponents (Davis, 2003). The current study observed the effectiveness on students learning was significant for different groups and class (8th and 9th).

Campbell *et al.,* (1995) observed the increased self-efficacy in 'stamp start program' as a result of using SCT concepts in a computer tailored nutrition intervention program to teach low-income woman how to lower dietary fat intake. An effective learner involves in a learning activity and use strategies to actively facilitate their self-learning. Therefore a challenge is to develop a suitable educational material that will enable students to become effective learners. Hence the study reveals that nutritional games has the potential to be used as an efficient tool alone (gaming approach) or in combination with traditional material (modified hearth approach) and can be applied to school going adolescence in the field of nutrition.

Nutritional knowledge in general to different scale items concerns with popular health beliefs and those deal with realistic nutritional information unrelated to health food beliefs (Seagert and Young, 1982). Sapp & Jenson (1997), Parmenter *et al.,* (2000) designed and developed reliable and valid questionnaires that distinguish and measure health-related nutrition knowledge and impact on guided behaviour and diet – health awareness and also to measure nutritional knowledge in different cultures, age or group of people or to know the nutritional knowledge effect (Parmenter *et al.,* 2000). Fitzgerald *et al.,* (2008) observed that food label use was positively associated with knowledge leading to healthier food choice pattern and increase the intake of vegetables and meat and helped in adopting new habits to take functional foods to improve and overcome the incidence of obesity, diabetes and cardio-vascular diseases. Lin and Lee (2005) indicated that nutritional knowledge within diabetic individuals is greater among those who get counselled by the dietician although significant difference was not found when compared with normal individuals. ParisaKeshani *et al* (2016) observed a significant increase in nutrition knowledge of 9.5 to 10.5 years in experimental group than control group which was in accordance to current study.

3.2 Nutritional Knowledge of adolescents based on class
Comparing the efficacy of nutritional games with modified hearth approach based on class according to knowledge is given in the following table 5.

Table 5: Mean scores of Nutritional Knowledge relating to class.

Class	Group	N	Pre-test	Post-test	Retest
8th Class	Control	60	12.68 ± 2.954	12.78 ± 3.405	13.02 ± 3.615
	E-1	60	15.88 ± 4.961	37.90 ± 5.993	38.45 ± 5.953
	E-2	60	15.13 ± 2.861	44.13 ± 3.014	44.67 ± 2.419
9th Class	Control	60	13.55 ± 3.572	13.60 ± 2.947	14.27 ± 3.512
	E-1	60	21.22 ± 5.258	38.98 ±5.768	38.52 ± 5.550
	E-2	60	15.00 ± 3.746	45.67 ± 3.182	45.83 ± 2.499

Values are expressed as mean ± SD.
C- Control group; E-1 - Experimental Group-1; E-2 - Experimental Group-2
Maximum Scores: 54

The mean pre-test or base line knowledge score of 8th class indicated 12.68 ± 2.954 and 9th class scored 13.55 ± 3.572. The 9th class students' base line score was found higher than 8th class. This could be due to more exposure to the science subjects. Among the 8th class, control group was found to deviate from the groups exposed to treatments at base line scores. The 9th class base line scores showed each group as an independent entity.

A significant increment in mean scores was found in 8th and 9th class students, subjected to treatments (fig-2). Exposure to gaming approach for 8th class students revealed an increment in mean scores from 15.88 ± 4.961 to 37.90 ± 5.993 and 9th class students showed an increment in mean score from 21.22 ± 5.253 to 38.98 ± 5.768. Increment in the knowledge levels was found higher in experimental group of 8th class adolescents than 9th class adolescents.
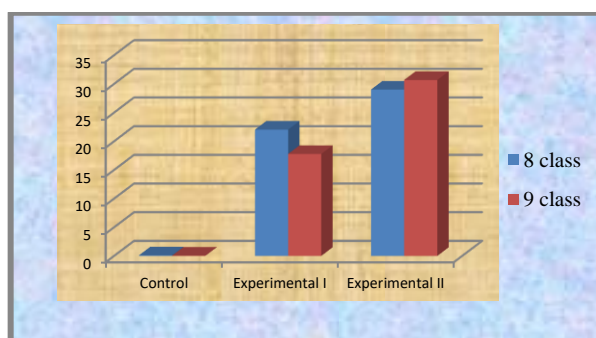

Fig. 2: Mean improvement in knowledge scores

However, significant difference was not observed in retention scores among 8th and 9th class students indicating effective learning by both the classes. The experimental group-2 of 8th class students exposed to modified hearth approach revealed an increment scores from 15.13 ± 2.861 to 44.13 ± 3.014 and 9th class students revealed an increment in mean scores from 15.0 ± 3.746 to 45.67 ± 3.182. Increment in knowledge level was found higher in 9th class experimental group-2 than 8th class. However, significant difference was not observed in retention scores among 8th and 9th class students indicating effective learning by both classes.The Duncan multiple range test for 8th and 9th class adolescents mean scores among groups varied significantly ($P<0.05$). The mean scores of experimental group-1 subjected to games approach showed 30.744 for 8th class and 32.906 for 9th class. The mean knowledge score for 9th class was found higher than 8th class and could be due to better initial learning by older children.

The experimental group-2 subjected to modified hearth approach showed a mean score of 34.64 for 8th class and 35.50 for 9th class. The 9th class students scored higher than 8th class. The control group showed higher baseline score for 9th class 9.138 followed by 4.828 for 8th class.

Positive impact of the educational games found in the study was in accordance with Cohen *et al.,* (1989); Lazarowitz *et al.,* (1994); Candido (2000); Burrowes (2003);EcKert *et al.,* (2004); Marasigan (2006); Rivera (2006); Tuzun *et al.,* (2009); Barclay *et al.,* (2011); Gutierrez (2014).Shaaban *et al.,* (2014) indicated a significant increase in KAP scores after attending nutrition education sessions by preschool teachers ($P<0.001$).Wormley (2013) reported a pre-test mean score of 51.76 ± 16.74 and post-test mean score of 60.48 ± 19.02, indicating knowledge increase for students ($P<0.002$) due to intervention which was in accordance to current study.

4. CONCLUSION
The nutritional games approach and modified hearth approach was found suitable for school going adolescents of 8th and 9th class of both gender. Nutritional games provide an opportunity for students to actively participate and improve their knowledge level. The potential of educational games and positive/hearth model in improving students learning should not be overlooked and could be further explored. Overall, the study revealed that modified hearth approach model was found more effective for imparting nutrition education for adolescents compared to gaming approach.

5. ACKNOWLEDGEMENT

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