NUTRITION KNOWLEDGE OF GRADE R LEARNERS IN DURBAN SUBURBAN SCHOOLS: AN INTERVENTION STUDY

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ABSTRACT

The aim was to determine the effect of a nutrition education programme (NEP) on the nutrition knowledge of Grade R learners. The study was conducted in four phases.

Grade R educators (n=20) from randomly selected urban government and private schools

in Durban completed a nutrition education questionnaire (NEQ) to identify activities and visuals suitable for this age group (Phase 1). Consequently, a classroom-based NEP was developed by the researcher in consultation with the foundation phase teacher recruited to teach the NEP. The participating schools were randomly selected from the 20 that had participated in the NEQ. A nutrition knowledge questionnaire (NKQ) was developed and tested. Fieldworkers and educators were sourced and trained (Phase 2). The intervention involved 120 Grade R learners in three schools: a government school (Experimental group – EGG) (n=37), a private school (Experimental group – EPG) (n=40) and one Control group (CG) (n=43), a private school. The same foundation phase teacher implemented the eight-hour (eight-week) NEP to Grade R learners in each experimental group (EG); the CG did not receive any nutrition education (NE) (Phase 3). Pre- and post-test knowledge was

assessed using a validated NKQ (Phase 4).

The educators‟ NEQ results confirmed the need for NE with suitable activities. For the NKQ the Cronbach Alpha score at 0.532 was achieved and the questionnaire was accepted as valid and reliable. For the intervention, One-way ANOVA was used to determine the total group‟s correct answers between pre-and post-test between the three schools. Statistical significant differences between two schools were observed using Independent t-test. The NEP pre-implementation test score indicated similar correct answers and not statistically significant between the three groups (EGG 72.43%, EPG 70.83% and CG 69.15%), with the EGG boys most knowledgeable (73.32%). For the whole test, it was the EGG (88.30%) that achieved a marginally higher percentage of correct answers significant (p=0.035) post-test difference between EGG (83.30) and CG (71.47). The NEP post-test results indicated that the EG girls (EGG 89.62% and EPG 87.50%) were more knowledgeable than the boys (EGG 87.00%), an insignificant difference. The study concludes that a resource-dense NEP with children actively involved in a non-threatening environment will increase nutrition knowledge.

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post-test than the EPG (87.50%) with a

ARTICLE INFO

Article history
Received 29 July 2016
Revision received 25 October 2016

Keywords
grade R, pre-primary, nutrition knowledge, nutrition education, nutrition education tools

INTRODUCTION

In April 2016, an alliance formed by the World Bank and the United Nations Children‟s Fund (UNICEF) prioritized early childhood development (ECD) both globally and nationally. The aim was to assist countries to achieve

various sustainable development goals (SDGs): to end malnutrition by 2030 (SDG 2 target 2.2); SDG 3 to ensure healthy lives and promote well-being; and SDG 4, particularly target 4.4, for both genders to have access to quality ECD and pre-primary education (UNICEF, 2016). Nutrition, health and early learning strategies are therefore advocated to promote early child development (Black and Hurley, 2016).

The South African (SA) government has prioritized ECD and this is incorporated into the National Development Plan (NDP). In 2015, the National Integrated ECD policy and programme was approved to accelerate quality ECD until formal school-going age. One of the essential ECD components required is nutrition support for children through formal early learning interventions (Hall et al., 2016). In SA, Grade R is in the foundation phase (Grade R-3) at school with formal schooling only commencing in Grade One. Entrance to Grade R is possible when a child is four years old turning five before midyear (Department of Basic Education, 2016). A wide range of ages (from four to seven years old) can be found in Grade R. Some parents delay the start of this phase of education due to financial constraints which affects children from disadvantaged socio-economic families (Hall, 2013). In 2014, in KwaZulu Natal (KZN) 75% of children under six years old lived below the upper poverty line (R923 per month) (Hall et al., 2016). The number of children attending Grade R has increased dramatically; however, KZN still has the lowest percentage (52%) of 3-5 year olds enrolled in early learning group programmes, which includes Grade R (Hall et al., 2016).

The Food and Nutrition Division of the Food and Agriculture Organization (FAO) affirms the importance of good nutrition during childhood with nutrition education (NE) in schools making a vital contribution to the long-term economic development of society (FAO, 2005). Worldwide research has highlighted the negative influence of undernutrition on school-going children in respect of school performance, attendance and intelligence (Grantham-McGregor et al., 2007). Malnutrition is the main contributor to the double burden of disease as overweight and undernutrition often coexist in one household (Rossouw et al., 2012) and is a common occurrence in schools in low-income areas (Draper et al., 2010). The double burden of disease warrants NE as one of the educational strategies to address these conditions as overnutrition is attributed to unhealthy eating habits (Provo, 2013).

Common barriers to pre-school healthy eating include: the food likes and dislikes of a child, the cost and availability of food, food advertising and allergies (Walton, 2012). At home and at school, pre-primary school children must eat what is served with limited food choice. Urban school children purchasing food of poor nutritional value from street vendors for consumption during school hours is increasing (FAO, 2007). An increasing number of young children (57%) in SA live in urban areas (Hall et al., 2016).

Nutrition knowledge gained from effective NE will result in a general understanding of food and nutrition with the individual realizing the need for behavioural and attitudinal changes (Contento, 2011). A study conducted by Matvienko (2007) established that six and seven year olds receiving nutrition and food education can result in these children selecting healthier food options. Nutrition education is considered an important aspect to improve the health status of school children and for the prevention of disease (Shariff et al., 2008). Keller and Lang (2007) reviewed Food Based Dietary Guideline (FBDG) implementation in four countries (New Zealand, Chile, SA and Germany) and observed success when children, through the education sector, became familiar with the guidelines. South African dietary guidelines were similarly used as the goals for the “HealthKick” programme in the Western Cape (Draper et al., 2010). In SA, the need for NE is evident as 71.70% of children between 10 and 14 years old obtained a low score in nutrition knowledge results in the South African Health and Nutrition Examination Survey -1 (SANHANES) and only 0.90% of the children were considered knowledgeable, obtaining a high score (HSRC, 2013).

Every child is an individual with many influences affecting learning. There are generic gender-specific learning differences with girls doing better academically than boys who need varied activities to stimulate the brain as they lose interest quicker than girls (Gurian, 2011). The FAO (2005) advocates that learning activities must be fun, age-appropriate and stimulating. In addition, active participation must be encouraged when teaching nutrition concepts to pre-schoolers. The play approach through experimentation, exploration and discovery is advocated and was used in this study to promote learning and the adoption of

appropriate nutrition and hygiene habits. Play evokes joy and self-satisfaction whilst learning, a shielding environment for learning with no risk of failure (Rickard et al., 1995).

A qualified educator is advocated by Sharma (2011) as being the logical person for implementing a NEP in a school. However, it is advised by Contento et al. (1995) that the educator should, as occurred in the current study, undergo in-service preparation regarding the nutrition content and delivery of the programme. The educator should also be a positive social role model.

The aim of the educator"s NEQ was to establish the need for NE in Grade R and to identify effective nutrition education tools (NETs) in two categories of schools: government and private in the suburbs of Durban, in the eThekwini municipality, situated on the east coast of South Africa. The results of the NEQ informed the intervention study. A nutrition knowledge questionnaire (NKQ) was developed to assess existing knowledge and the impact of a classroom-based Grade R NEP in the experimental (EG) and control groups (CG). To improve nutrition knowledge and reduce malnutrition the NEP developed for Grade R incorporated the 2003 FBDGs (Vorster, 2001) and the 2007 SA Paediatric Food-Based Dietary Guidelines (PFBDGs) (Bourne, 2007). Besides the FBDGs the nutrient-based food groups were included in the NEP to help prevent the occurrence of nutrition-related diseases, as advocated by Hendricks at al. (2007). When

FIGURE 1: NUTRITION EDUCATION TOOLS USED IN THE PROGRAMME

looking for appropriate NETs for inclusion in the NEP, the researcher selected NETs developed by Oldewage-Theron and Napier (2011) that had been used in two studies in the Vaal region. These NETs were based on the 2003 SA FBDGs and the 2007 PFBDG and were considered suitable for inclusion in the NEP. Studies conducted using the 2003 FBDGs and 2007 PFBDGs still apply as the same methodologies were used to develop all the guidelines in SA. Therefore the researchers feel this study is an important contribution to the knowledge in regards to NE in children.

METHODS

Permission

The Durban University of Technology (DUT) Faculty Research Committee and Higher Degrees Committee approved the ethics and the study as part of the proposal approval process. Permission from the school principals allowed the researcher to approach the Grade R educators to voluntarily participate in a self-administered nutrition needs survey. In 2010, the randomly selected school principals gave permission for the study to be rolled out as part of the daily classroom activities for the Life Orientation (LO) curriculum with the class educator present. Besides obtaining the age and gender of the participating children from the educator for statistical purposes, no other private information was obtained. Professors Oldewage-Theron and Napier (2011) granted permission for the researcher to use a NEQ, NEP validated art work, the pre-school Healthy Eating Activity Book (HEAB) and NETs (Figure 1).

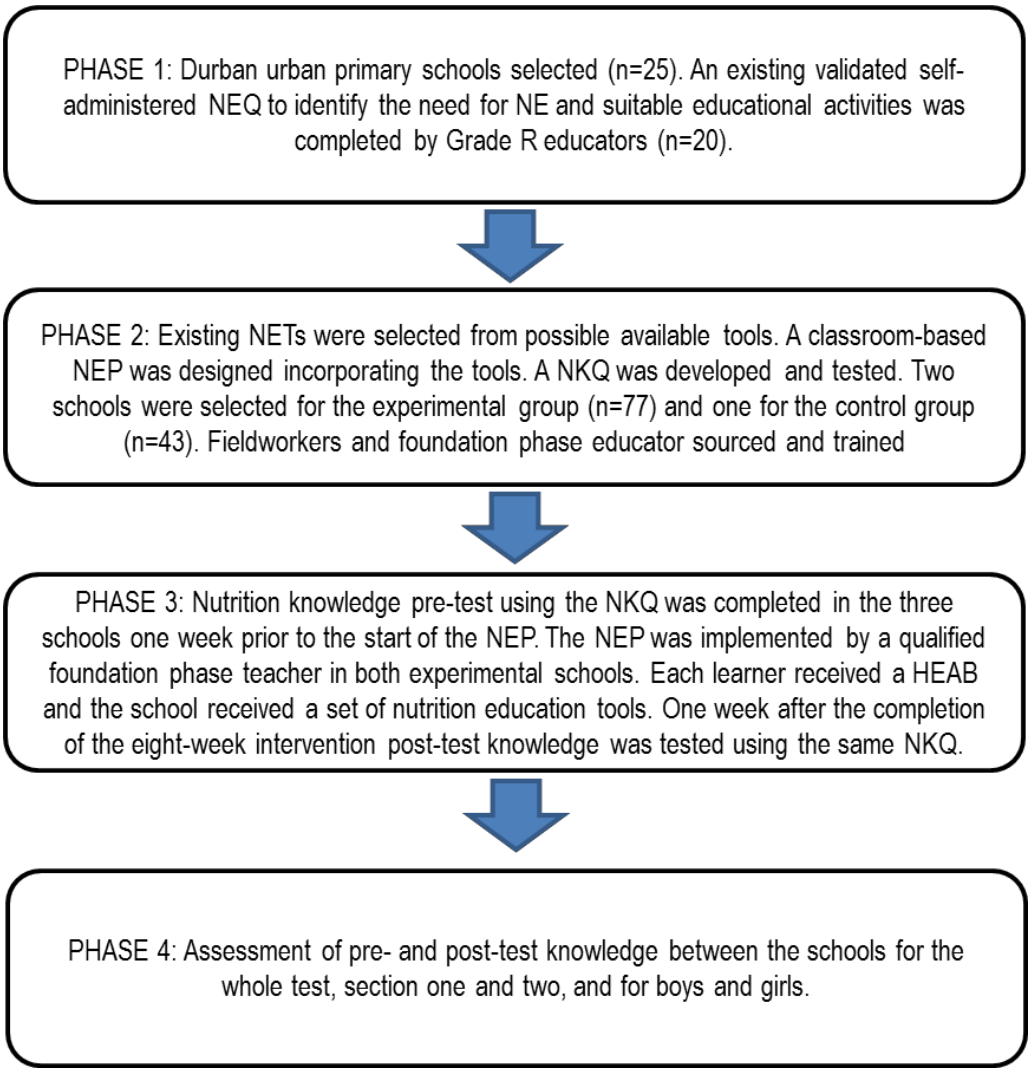

FIGURE 2: PHASES OF THE STUDY

Phases of the study

The four phases of the study are illustrated in the flowchart in Figure 2:

Phase 1: Grade R educators from randomly selected urban government and private schools in Durban completed an existing validated NEQ to establish the need for NE in Grade R and to identify activities and visuals suitable for this age group for a NEP. The questionnaire comprised of a total of 10 questions with a mixture of open-ended and closed questions. Certain closed questions had an „other" category where the respondent could provide their own response. The questions covered the following aspects of NE: its presence in the school syllabi, NETs currently used, time allocated in Grade R, the need for NE, effective NETs, what NETs would children enjoy, colours that would appeal for NETs, food pictorial presentation suitability, language on educational material, nutrition games to enhance learning and NETS that children don"t enjoy.

Phase 2: The NEP was developed. An eight-hour, eight-week Grade R NEP was created by the researcher in consultation with the foundation phase educator recruited to conduct the NEP. The content of the programme was aligned to the 2003 FBDGs (Vorster, 2001) and the 2007 PFBDGs (Bourne, 2007): enjoy a variety of foods; be active every day; make starchy foods the basis of a child"s main meal; eat plenty of fruit and vegetables every day; drink milk every day; eat chicken, fish, meat, eggs, soya or peanut butter every day; drink clean safe water regularly; eat fats sparingly; the use of salt; if children have sweets or drinks, offer small amounts with meals; feed children regular meals (Vorster et al., 2013) and the five nutrient-based food groups. The NETs consisted of a food group plate puzzle, NEP „My Little Books", NEP card games and the „Good for you, not good for you" board game and the HEAB (Oldewage-Theron and Napier, 2011).

The NKQ was developed by the researcher and based on the 2003 FBDGs and 2007 PFBDGs to assess the children"s knowledge of the guidelines and hygiene practices (NKQ section one) as well as the nutrient-based food groups (NKQ section two) pre-and post the intervention. To check the content validity of the NKQ a dietician was consulted. For face validity, the foundation phase educator reviewed the suitability of the knowledge level of the questionnaire. The questionnaire was assessed for internal consistency by a random sample of Grade R learners in an urban school in Durban. As the NKQ was found to be unreliable (Cronbach"s Alpha coefficient 0.296) the questionnaire was refined in consultation with four Grade R teachers. The refined NKQ was then tested by Grade R learners in a different Durban school and achieved a Cronbach"s Alpha coefficient of 0.532. Neither of these schools participated in the research study. In section one of the questionnaire, a happy or sad mouth drawn in by the child created a face which indicated a yes or no response to the following questions: is 10 hours of sleep required at night; must five fruit and vegetables be eaten every day; should a child play outside every day; must a child eat different types of foods; must fruit be washed before eating; must hands be washed before eating; will meat and fish give strong muscles; is it healthy to eat lots of sweets, cakes, biscuits; is milk and yoghurt, cheese needed for healthy bones and teeth; and must a child drink six glasses of water daily? For section two the children drew a line to connect the appropriate matches between pictures of food items to a food group name.

Suitable fieldworkers and a qualified foundation phase educator were sourced and trained. From the schools that participated in the NEQ, two schools for the EG, one government and one private, and one school for the CG were randomly selected to participate in the study.

Phase 3: Children in the EGs each received eight one hour NE lessons over an eight-week period; the CG did not receive any NE. Raman et al., (2010) postulates that structuring a NEP in this manner of spaced delivery and learning is beneficial for the enhancement of knowledge as cognitive load and fatigue is minimized. In addition, long-term retention of knowledge is improved. The children were taught about the FBDGs and the classification of foods according to nutrient-based food groups. Each lesson was one hour in duration; the theoretical part of the lesson was approximately fifteen minutes long. Thereafter the children completed one relevant exercise in the HEAB and were involved in the various fun nutrition educational activities (the puzzle, card games, board game and little books) for 45 minutes. During this time the educator engaged with the students and this allowed for reinforcement of the nutrition concepts learnt. The objective of the food group plate puzzle was to teach learners how to create balanced meal plates for breakfast, lunch or dinner with the food puzzle pieces representing

the different food groups. The children could learn to exchange food items within a food group. The objective of the card game was to introduce learners to „good for you" and „not so good for you" foods and activities. The two packs of cards enabled different games to be played and assist in the introduction of a variety of foods into the diet by matching the picture card to the correct alphabet card. The children made up stories for each other relating to the content of the six different My Little Books: Protein; Carbohydrates; Fruit; Vegetables; Good Habits and Things that are not so good for me. The purpose of the board game was to show the learners that it is good for them to practice healthy eating and hygienic habits and to be active. Players were rewarded and progress on the board when they land on a square of a „good habit" and must move back when they land on a
„bad habit" (Oldewage-Theron and Napier, 2011).

Phase 4: Pre- and post-test knowledge was assessed using the validated NKQ.

Study population and sampling

For Phase 1 of the study purposive random sampling was used to select 25 primary schools: government or private, boys" or girls" or co-educational, from the urban district of the Coastal Cluster of KZN for participation in the NEQ. All primary school names in this cluster were put in a container and randomly selected by the researcher. Twenty Grade R educators from 12 government and eight private schools completed the self-administered NEQ.

For Phase 2 purposive random sampling was used to select three schools from the 20 schools that had participated in the NEQ survey in phase 1 of the study. The names of the government and private schools were put in separate containers and one from each randomly selected by the researcher. One government and one private school were selected for the intervention and from the remaining schools one was selected as the CG. The study sample originally comprised of 130 Grade R learners from five to seven years old in three suburban Durban schools. There were two Grade R classes in each school with a similar number of children in each. Attendance and participation was not compulsory and it was acceptable for children to be absent and not complete the programme. One hundred and twenty children fully participated in the study and completed the pre- and post-test, EGG (n=37), EPG (n=40), and CG a private school (n=43), and 35% (n=42) boys and 65% (n=78) girls.

DATA COLLECTION AND ANALYSIS

Data enumerator"s pre- and post-test questionnaires

For fieldworkers, the researcher trained five educators as well as the Grade R educators from the schools where the intervention took place to ensure consistency in the administration of the NKQ. The same fieldworkers were used during the testing phase of the questionnaire and the pre-and post-intervention testing. On the cover page of the questionnaire the guidelines for completion were stated and these were explained to the fieldworkers who were proficient in English, which was the medium of instruction at the schools where the study was conducted.

Data collection

In Phase 1 the validated existing NEQ (Oldewage-Theron and Napier, 2011) was used to measure the need for NE and suitable NE materials in pre-primary Durban schools. There was no interviewer as it was a voluntary self-administrated questionnaire completed by Grade R educators in their own time.

For Phase 2 the pre-intervention data was collected in October 2010 with a minimum nine-week interval (intervention period) before the post data collection in November or December. Each fieldworker had a group of between five to six learners whom they guided through the process of completing the NKQ at a pace suitable for their group. Section one comprised of 10 questions to ascertain nutrition knowledge and hygiene practices. The learner created a smiley face for the „Yes" answer or a sad face for the „No" answer. For the five questions in section two to determine food group knowledge the child drew a line to join pictures of food items to the corresponding food group name. The children took no longer than half an hour to complete the questionnaire during LO class time, with one Grade R group in a school immediately followed by the next.

Data analysis

Phase 1: the NEQ data was captured on a Microsoft Excel® spreadsheet after twenty educators (government n=12 and private n=8)

participated in the survey. The data for open-ended questions in the NEQ were grouped per theme to obtain the most commonly selected themes as expressed by the educators.

Phase 2: the NKQ pre-intervention data was captured on a Microsoft Excel® spreadsheet after the 130 questionnaires were received and checked for completion. The post-test NKQ data (n=120) was captured in the same way once it was checked that the child had completed the pre-intervention questionnaire.

Statistical analyses

The NEQ and the NKQ were coded to analyse the data using the Statistical Package for Social Science (SPSS), version 17.0 for descriptive statistics. The results from the NEQ were used to guide the selection of the NETs for the intervention study. The Grade R learners‟ pre- and post-test nutrition knowledge was analysed for the whole test, as section one and two, as well as for each individual question:

- within each of the three participating schools
- for the total group between the three schools, and
- for the group of boys and girls in the study.

To compare the results between the three schools for the pre-and post-test, one-way analysis of variance (ANOVA) was used. Independent t-test was used when comparisons were made between two schools. The data from the NKQ were based on the percentage of children selecting the correct answers and therefore significant differences could not be determined as no means were presented. Significant differences were, however, presented between the means of the various schools with $p<0.05$ as an indicator of significance.

RESULTS

Phase 1: Educator's Nutrition Education Questionnaire results

Educators (95%) confirmed the need for NE in Grade R and 90% advocated using nutrition games to enhance learning at school. All the educators (100%) agreed that bright colours appeal to children and should be used in educational material. Forty two percent of the educators preferred that the home language be used when developing educational material, with 37% selecting English and home language. A variety of age appropriate educational tools was recommended: activity books (n=17); puzzles (n=17); card games (n=13) and board games (n=12). The results of this questionnaire enabled the researcher to develop an appropriate Grade R NEP for suburban schools in Durban.

Phase 2: Development of the Nutrition Education Programme and Nutrition Knowledge Questionnaire

The NEP comprised of eight one-hour lessons each with a different theme or topic. Lesson 1: Five different food groups. Importance of regular meals. Eat a variety of foods. Drink sufficient water. The use of salt. Lesson 2: Fruit and vegetables and the daily serving amount. Lesson 3: Carbohydrates and the daily serving amount. Lesson 4: Protein and the daily serving amount. Lesson 5: Milk and the daily serving amount. Lesson 6: Fats and the daily serving amount. Dangers of too many sweet foods and drinks. Lesson 7: Being active. Recap different functions of food. Lesson 8: Good hygiene practices. Various cognitive levels of thinking (knowledge, application, synthesis, evaluation) were engaged through the children‟s involvement in the NEP and activities (Contento, 2011).

For the NKQ the Cronbach Alpha score at 0.532 was achieved and the questionnaire was accepted as valid and reliable.

Phase 3: Implementation of the NEP

The NEP was conducted over an eight-week period. The sequence of events in the one hour lesson used Gagne‟s theory of instruction recommended for theory-based NE by Contento (2011). They are: gaining attention (A), present stimulus and new material (S), provide guidance and practice (G), apply and close (C). The first 15 minutes was used to address the topics for that lesson. The children then worked on relevant activities in their own HEAB and after that engaged in individual or group educational activities to apply and reinforce what had been learnt; the educator provided guidance.

Phase 4: Nutrition Education Programme Intervention Results

The differences and similarities of nutrition knowledge gained after the implementation of the NEP were compared between the children in a government school and those in a private school, between the boys and girls, and between pre-and post-test knowledge in the control and experimental schools. The results of

the study between the schools will be presented in Table 1 for the whole questionnaire as well as for section 1 (FBDGs) and section 2 (food groups) separately.

Comparison of the pre-and post-test results within each school group: Government (EGG), Private (EPG) and Control (CG)

The EGG (n=37) percentage for all the children with correct answers for the whole test are illustrated in Figure 3. At baseline, the majority of children in the EGG (72.43%) answered correctly and the NEP resulted in 15.87% more children providing the correct answers at post-test (88.30%). The girls (n=18) increased from 71.47% in the pre-test to 89.62% in the post-test when compared to the boys (n=19) with 73.32% in the pre-test to 87.00% in the post-test for the whole test.

As observed in Figure 4, most of the children in the EGG (n=37) (87.58%) answered all the questions correctly before the intervention for section 1. There was a similar trend between boys (n=19) (88.94%) and girls (n=18) (86.10%). In the post-test 94.33% of the children obtained the correct answers resulting in a 6.75% increase in knowledge for the whole group. Boys

TABLE 1: COMPARISON OF THE PERCENTAGE OF CHILDREN WITH CORRECT PRE- AND POST-TEST ANSWERS IN THE WHOLE TEST, SECTIONS ONE AND TWO BETWEEN THE THREE SCHOOLS WITH STATISTICAL SIGNIFICANCE

TEST	Experimental group		Control group (CG) (n=43)	Statistically significant difference $p<0.05$
	Government school (EGG) (n=37)	Private school (EPG) (n=40)		
Whole test pre-test	72.43	70.83	69.15	
Whole test post-test	88.30	87.50	71.47	$p=0.035$ between CG and EGG
Section 1 pre-test	87.58	84.00	84.19	
Section 1 post-test	94.33	98.75	86.03	$p=0.000$ between CG and EPG $p=0.002$ between CG and EGG
Section 2 pre-test	42.34	44.50	39.08	
Section 2 post-test	76.24	65.00	42.34	$p=0.037$ between CG and EGG

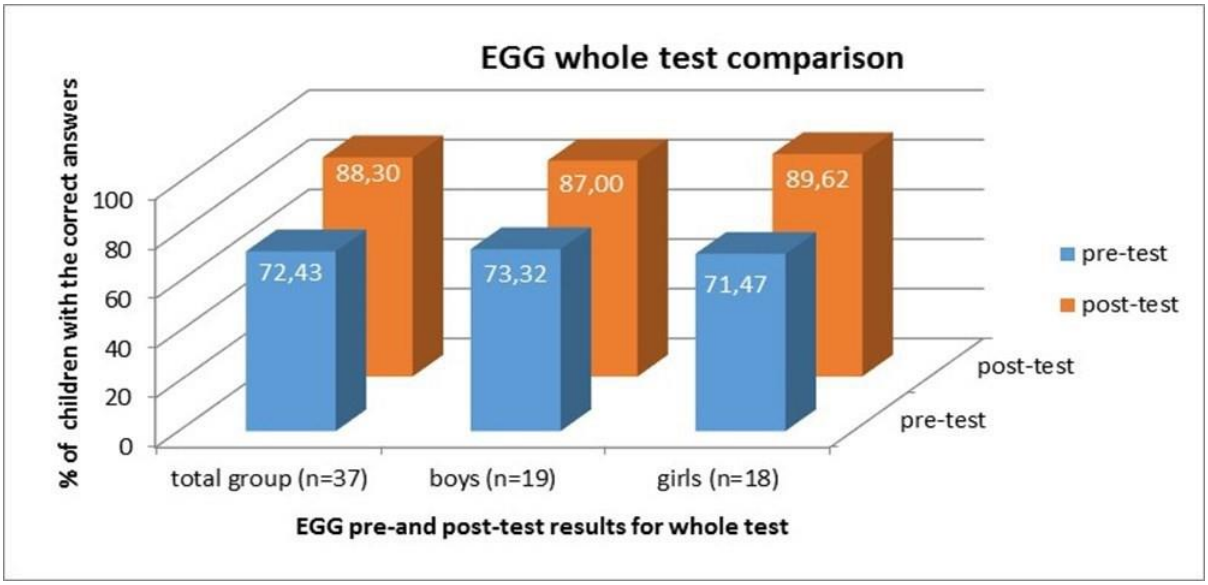

FIGURE 3: COMPARISON OF PERCENTAGE OF CHILDREN WITH CORRECT PRE-AND POST-TEST ANSWERS FOR THE WHOLE TEST FOR THE EXPERIMENTAL GOVERNMENT SCHOOL TOTAL GROUP, BOYS AND GIRLS

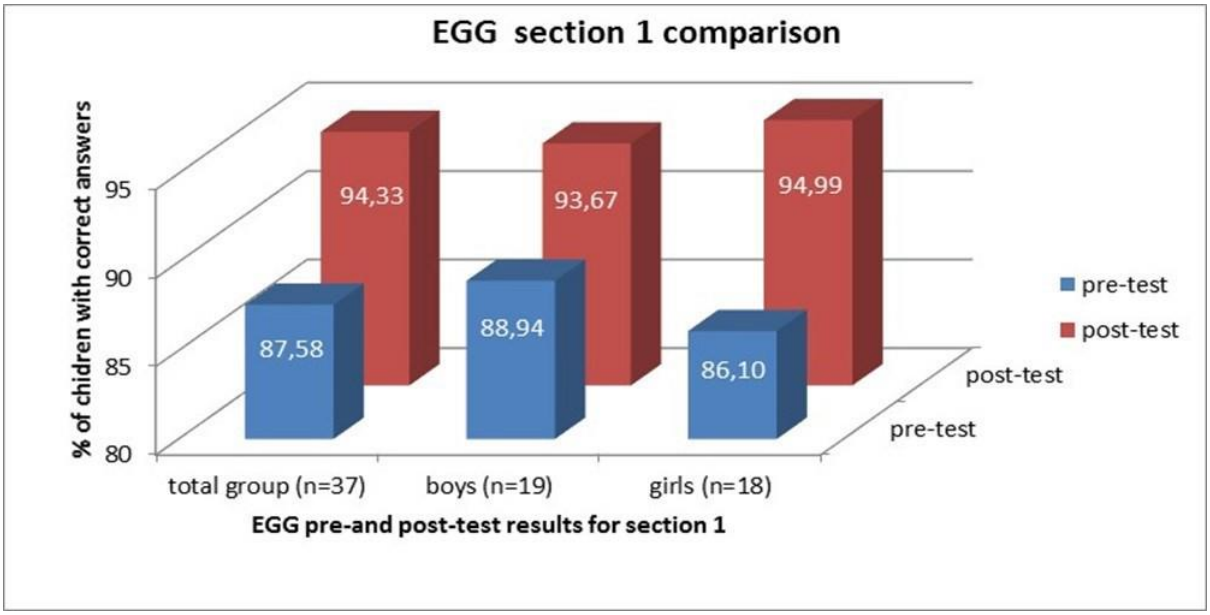

FIGURE 4: COMPARISON OF PERCENTAGE OF CHILDREN WITH CORRECT PRE-AND POST-TEST ANSWERS FOR SECTION ONE FOR THE EXPERIMENTAL GOVERNMENT SCHOOL TOTAL GROUP, BOYS AND GIRLS

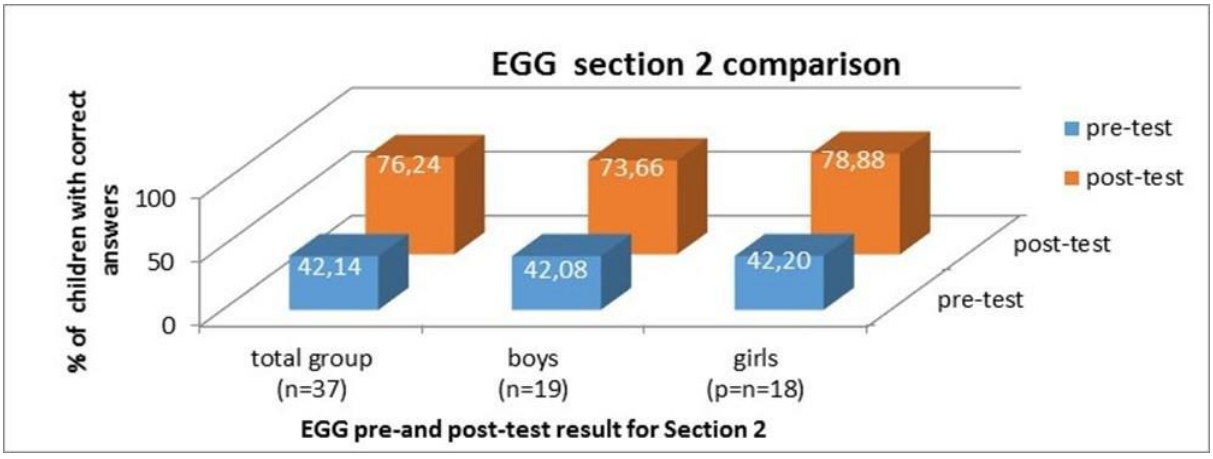

FIGURE 5: COMPARISON OF PERCENTAGE OF CHILDREN WITH CORRECT PRE-AND POST-TEST ANSWERS FOR SECTION TWO FOR THE EXPERIMENTAL GOVERNMENT SCHOOL TOTAL GROUP, BOYS AND GIRLS

(93.67%) and girls (94.99%) obtained very similar post-test results.

It is observed in Figure 5 that for the total EGG (n=37) group in section two, after the NEP, there was an increase of 34.10% in the percentage of children with correct answers. A minority (42.14%) knew the correct answers in the pre-test compared to the majority (76.24%) after the intervention. For the individual group of boys (n=19) and girls (n=18) there was an improvement in the percentage of children with correct answers with 31.58% and 36.68% respectively. The girls achieved the highest percentage of post-test correct answers (78.88%), compared to the boys at 73.66%.

Figure 6 presents the EPG (n=40) comparison of the percentage of children with correct pre-and post-test answers for the whole test, sections one and two. An improvement in the percentage (16.67%) of children with correct answers was observed between the pre-(70.83%) and post-test (87.50%) results for the whole test. In section one, although the majority of children in the EPG (84.00%) knew the correct answers before the intervention, there was a 14.75% improvement in the percentage of

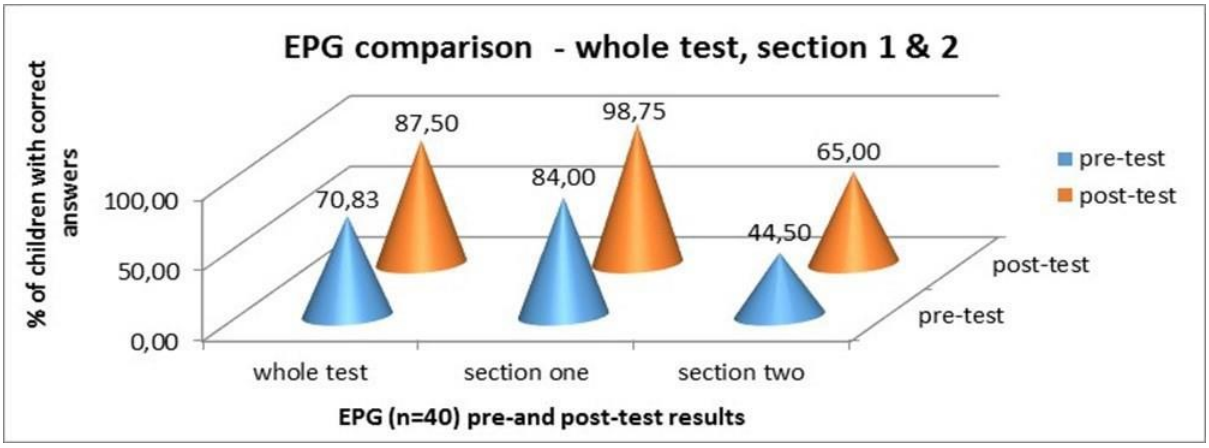

FIGURE 6: COMPARISON OF PERCENTAGE OF CHILDREN WITH CORRECT PRE-AND POST-TEST ANSWERS FOR THE EXPERIMENTAL PRIVATE SCHOOL GROUP FOR THE WHOLE TEST, SECTION ONE AND TWO

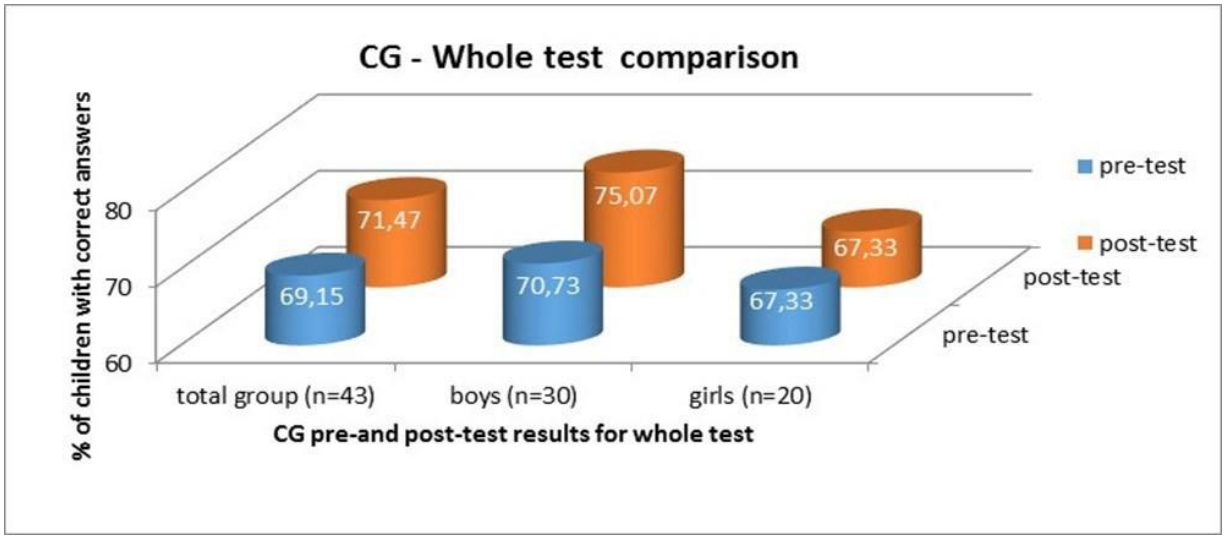

FIGURE 7: COMPARISON OF PERCENTAGE OF CHILDREN WITH THE CORRECT PRE- AND POST-TEST ANSWERS FOR THE WHOLE TEST FOR THE TOTAL CON- TROL GROUP, BOYS AND GIRLS

children with correct answers observed in the post-test (98.75%). In section two, the majority of the EPG did not know the correct answers in the pre-test (44.50%). However, post intervention there was a robust 20.50% increase in knowledge as 65.00% of the children provided the correct answers.

For the entire CG (n=43) (Figure 7) for the whole test, there was a minimal increase in the percentage of children with correct answers (2.32%) between the pre-and the post-test results (69.15% and 71.47% respectively). The girls (n=20), as an individual group, showed no increase (67.33%), obtaining an identical number of correct answers in the first and second tests. The increase of 4.34% for the boys (n=23) (pre-70.73% and post-test 75.07%) contributed to the overall increase in the percentage of children with correct answers in the CG. For section one the majority (84.19%) of the CG children at pre-test was knowledgeable. There was a similar trend for boys (85.66%) and girls (82.50%). Post-test results showed a slight percentage increase in children with the correct answers for the whole group (1.84%) and the boys (4.35%). However, the girls had a marginal decrease (1.00%) in the percentage of children with correct answers. At baseline for section two, only the minority of the CG (39.08%) had knowledge relating to these questions, with a similar trend being observed in both the group of boys (40.88%) and girls (37.00%). The post-test results found an increase in the percentage of

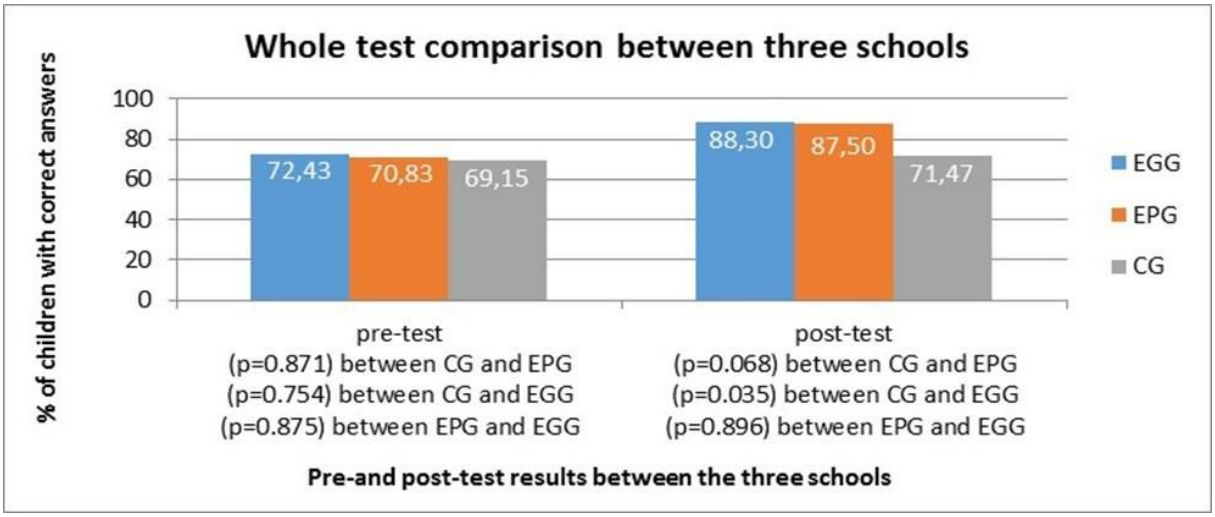

FIGURE 8: THE PERCENTAGE OF CHILDREN WITH CORRECT ANSWERS AT PRE-AND POST-TEST FOR THE WHOLE TEST BETWEEN THE THREE SCHOOLS WITH STATISTICAL SIGNIFICANT DIFFERENCE P<0.05 (2 TAILED T-TEST)

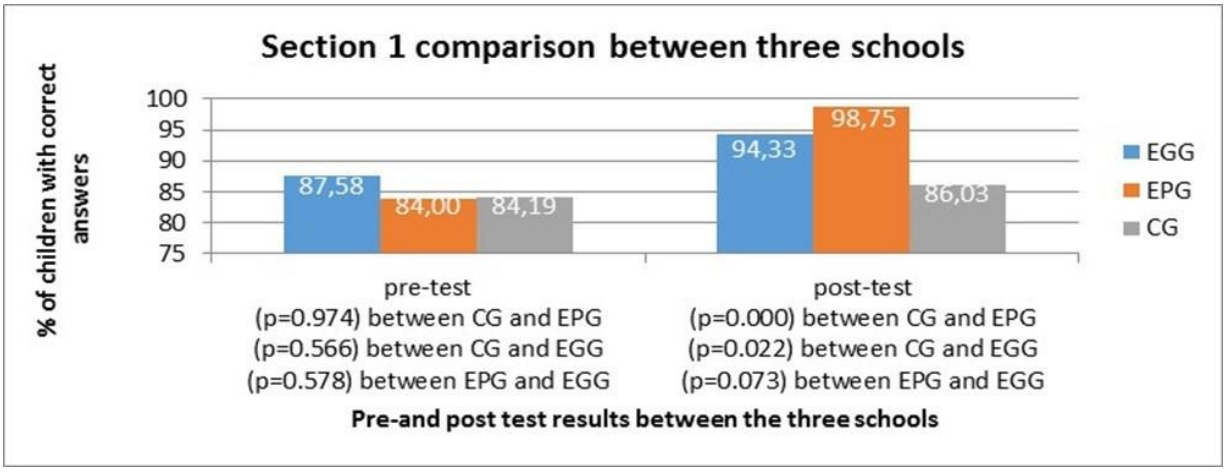

FIGURE 9: PERCENTAGE OF CHILDREN WITH CORRECT ANSWERS AT PRE-AND POST-TEST FOR SECTION ONE BETWEEN THE THREE SCHOOLS WITH STATISTICAL SIGNIFICANT DIFFERENCE P<0.05 (2 TAILED T-TEST)

boys (4.32%) with correct answers, with the girls" improvement at 2.00%. Overall, the whole group showed a slight percentage increase in food group knowledge (3.26%).

Comparison of the whole test, section one and section two results between the three schools for the total group

Presented in Figure 8 is a comparison of the EGG (n=37), EPG (n=40) and the CG (n=43) pre- and post-test results for the whole test based on the percentage of children with correct answers. The pre-test results revealed that the knowledge of the children in all three schools was very similar and not statistically significant. In the pre-test, the EGG obtained the highest (72.43%) percentage of children with correct answers whilst the CG had the lowest (69.15%) with the difference between them being minimal (3.28%). After the NEP, the whole test results showed that the percentage of children with correct answers in the EGG (88.30%) was similar but not significantly different to the EPG (87.50%). There was, however, a significant (p=0.035) difference (16.83%) between the EGG and CG.

In section one the results shown in Figure 9 represent the percentage of children with correct answers pre-and post-test between the three schools. In the pre-test, the majority of children in all three schools knew the answers. However, the EGG (n=37) (87.58%) had the highest

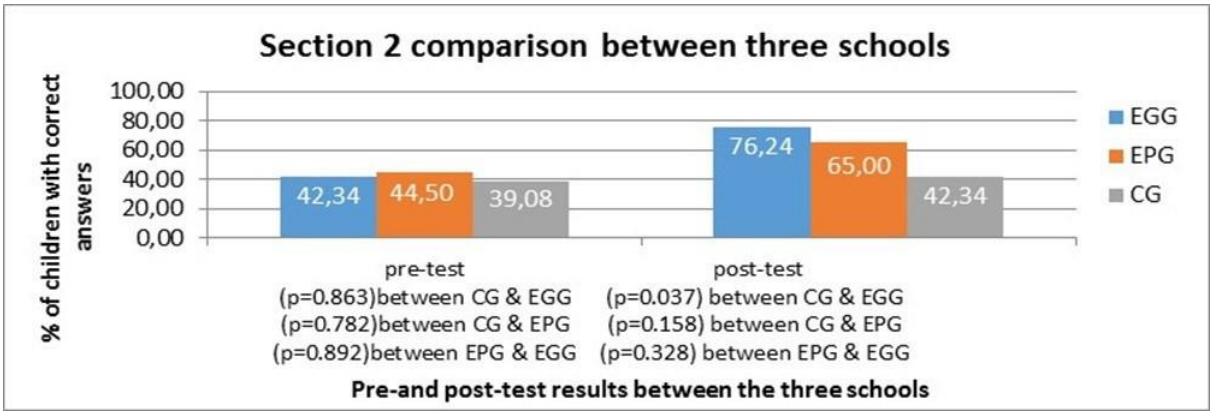

FIGURE 10: THE PERCENTAGE OF CHILDREN WITH CORRECT ANSWERS FOR THE THREE SCHOOLS AT PRE-AND POST-TEST FOR SECTION TWO

percentage of children with the correct answers and the EPG (n=40) (84.00%) the least. There was no significant difference between any of the groups in the pre-test, indicating a similar prior knowledge with a minimal difference of 3.58% noted between the EGG and the EPG. The NEP in the two EGs resulted in an increase in the percentage of children with correct answers. However, the difference (4.42%) noted between them was not significant, with the EPG obtaining the highest percentage of correct answers (98.75%). The CG (n=43) post-test results were the lowest at 86.03% and there was a statistically significant difference in the percentage of children with correct answers between the CG and each of the two EGs (EGG, p=0.022 and EPG, p=0.000).

The pre-test for section two (Figure 10) indicated that most children in all three groups did not answer correctly. The CG (n=43) had the least knowledge (39.08%) with the EPG (n=40) obtaining the highest percentage (44.50%) of correct answers, with non-significant differences in knowledge between the three schools at pre-test. The NEP had an impact on the food group knowledge of the children in both EGs. However, the difference (11.24%) in the percentage of children with correct answers between the two experimental schools (EGG (n=37) 76.24% and EPG (n=40) 65.00%) was not significant. The CG post-test knowledge (42.34%) was significantly lower (p=0.037, 33.90%) than that of the EGG.

DISCUSSION

The aim of implementing a classroom based NEP was to improve the nutrition knowledge of Grade R learners in a suburban setting in Durban, KZN. The motivation for this study was to improve the nutrition status and health of the children and the school setting was considered the optimal cost-effective place for NE to occur during the school day (Blom-Hoffman and Du Paul, 2003). Previous SA studies on NE programmes presented in this paper were conducted in low income communities but this study focused on children in middle- and high income communities, making it a unique study. Few children are afforded the opportunity to receive the minimum yearly 50 hours of NE recommended by the American Dietetic Association, School Nutrition Association and Society for Nutrition Education (Briggs et al., 2010). A European literature review by van Cauwenberghe et al. (2010) concluded that a NEP can be successful in motivating healthier food choices by children. An intervention in this age group was warranted as dietary patterns are still forming and a change to healthier behaviour is possible as they are still impressionable (Sharma, 2011). Four to seven year olds do not have the inborn ability to make healthful food choices and therefore need to learn this skill through NE and understand the link between health and food habits (Singleton et al., 1992). Furthermore, there is a paucity of SA NE studies conducted in pre-primary schools and the impact of a Grade R NEP based on the FBDGs had not been studied in Durban. Similar programmes conducted in Boipatong (Oosthuizen, 2010) and the Vaal (Oldewage- Theron and Egal, 2009) using the identical NETs had resulted in an improvement in the nutrition knowledge of the children. The present study would therefore be of value to the Department of Health (DoH) in their drive to decrease malnutrition through NE in pre-primary schools in SA which can have a positive effect on the well-being of the family and benefit the community.

Knowledge relating to the FBDGs was established in section one of the NKQ. In section two, the classification of a variety of foods into their appropriate food groups was assessed and some of the children had difficulty, pre-and post-intervention, understanding the classification of food groups. Classification of food is a skill appropriate for preschool children (Murphy et al.,1995), however this can be difficult for children in this age group depending on the type of classification required. It is easier for children to categorize food according to the sugar, fat or salt content rather than into nutrient-based food groups. Nevertheless, as a result of the NE the children did improve in their ability to classify foods.

The results of this study revealed that due to the implementation of a Grade R NEP, immediate nutrition knowledge of the FBDGs and food groups by children in a government and private school significantly increased. There was minimal difference in the percentage of children in the EGG and EPG with correct answers and likewise, a marginal difference between the boys and the girls with correct answers in the study. No NEP was presented to the CG. Most children in the CG answered a similar number of questions correctly in both the first and the second test.

The pre-intervention nutrition knowledge of the Grade R children for the whole test in the three schools participating in this study was good and similar. A Grade R study in the Vaal (Oldewage-Theron and Egal, 2009) also ascertained that the children had some nutrition knowledge prior to the nutrition intervention. The NEP programme significantly improved the knowledge of the children in both EGs for the whole test. The similarity in the increase of the percentage of children in the intervention study that answered correctly in both the EGs could be attributed to the fact that a qualified foundation phase educator delivered the NEP to both schools. The increase in knowledge of both EGG and EPG reported in this study is consistent with findings of Oldewage-Theron and Egal (2009) where an 18.20% overall significant improvement of knowledge for Grade Rs in the Vaal region was observed. Internationally, five to seven year olds in England in the Eat Smart Study conducted by Warren et al. (2003) improved their nutrition knowledge significantly ($p<0.001$) during a classroom-based nutrition programme. In this Durban study children gained nutrition knowledge through active participation in this programme, working independently in an activity book and playing with the NETs in a nonthreatening, supportive learning environment, which is a sound educational approach (Department of Basic Education (DBE), 2011; FAO, 2005). This NEP was of relevance to the age group and the child‟s developmental stage, both valuable aspects contributing to the success of a programme (Contento et al., 1995).

The Grade R private school children obtained a marginally higher percentage of correct answers for the whole test because of the intervention, when compared to the children in the government school. However, the EGG at post-test had the highest percentage of children with correct answers. The government school was situated in a middle-class suburb whilst the private school was in a more affluent middle to upper class suburb. Research by Florence et al. (2008) and Shah et al. (2010) established that children in families of higher educational and socioeconomic standing will perform better than those from less wealthy backgrounds. Zarnowiecki et al. (2011) affirm that children from more affluent families are at an advantage regarding the understanding of nutrition concepts as well as access to and consumption of a healthful diet. The Durban study reinforced this fact, as the private school children had the highest percentage increase in correct answers although it did not differ vastly from the percentage increase in correct answers obtained by the children in the government school.

Florence et al. (2008) strongly believe that a child‟s gender impacts on academic performance and girls are more likely to perform better than boys as was the case in this study. However, the nutrition knowledge of the girls and boys was very similar at pre-and post-test results as in the case of a pilot study in the UK by Warren et al. (2003).

Limitations

Only three schools were used in the study which impacts the sample size. One aspect of the study was to compare the differences and similarities of nutrition knowledge of the boys and girls. In Durban, private schools are in the minority and they are not all co-educational. The private school randomly selected as the experimental school comprised of girls only. This could be viewed as a limitation although the

girls (n=78) and the boys (n=42) in the study had similar knowledge pre-and post-test. The two co-educational schools (EGG and CG) in the study were evenly matched in respect of the number of boys to girls and the CG was a private school.

CONCLUSION

It can be concluded that NE at school level is a necessity and too little time is devoted to NE in school curricula. It is recommended that NE is a separate subject with the training of educators in NE essential. Grade R children have varying abilities and nutrition knowledge as a result of their age, ethnicity, social-economic standing and child care. An eight-hour NEP with fun NE activities significantly increased immediate nutrition knowledge of Grade R children in a private and government suburban school in Durban. Irrespective of the school attended the children had very similar nutrition knowledge relating to FBDGs and food groups both prior and post the intervention. Children found it difficult to classify food per nutrient-based food groups. Children would derive even greater health benefits if NE was included in the curriculum in all grades from Grade R to 12. Knowledge is important to change dietary practices and the educator must be qualified to teach the age group and be adequately trained for the NEP. For NE to be beneficial age appropriate NETs must be used in the classroom. Activity-based learning experiences in a non-threatening environment will help children understand food and nutrition concepts more easily. The acceptability, usefulness and effectiveness of each of the educational tools used in this study could be tested separately to ascertain which one has the greatest impact on NE learning. Girls generally do better academically than boys as observed post-test in this study although the difference was statistically insignificant.

The poor nutrition status of many children living in SA has been recognized by the Department of Health (DoH) as an area of concern with NE a strategy to alleviate over- and under-nutrition. NE could contribute towards achieving nutritionally healthy behaviour in adulthood through making informed decisions. A similar baseline survey could be completed with educators in rural schools to ascertain the needs in this setting and whether a similar NEP could be used.

ACKNOWLEDGEMENT

This research used an existing validated educator‟s nutrition education questionnaire, nutrition education games and a Healthy Eating Activity book, and hereby acknowledges Professors Oldewage-Theon and Napier for these research tools. Mrs S Schauffer is acknowledged for the professional delivery of the nutrition education programme ensuring that the children had fun whilst learning.

REFERENCES

BLACK, MM & HURLEY, KM. 2016. Early child development programmes: further evidence for action. Lancet Global Health (online), Volume 4 (8): e505-6. Available: http://www.thelancet.com/pdfs/journals/langlo/PIIS2214-109X(16)30149-8.pdf.

BLOM-HOFFMAN, J & DU PAUL, GJ. 2003. School-based health promotion: the effects of a nutrition education program. School Psychology Review (online), 32(2):263-271. Available: http://search.proquest.com.dutlib.dut.ac.za/docview/219647246?pq-origsite=summon.

BOURNE, L. 2007. South African paediatric food-based dietary guidelines. Maternal and Child Nutrition, 3:227-229.

BRIGGS, M. FLEISCHHACKER, S. & MUELLER, CG. 2010. Position of the American Dietetic Association, School Nutrition Association, and Society for Nutrition Education: Comprehensive School Nutrition Services. Journal of Nutrition Education and Behavior, 42 (6): 360-371.

CONTENTO, IR. 1995. The effectiveness of nutrition education and implications for nutrition education policy, programs, and research: a review of research. Journal of Nutrition Education, 27(6):291-364.

CONTENTO, IR. 2011. Nutrition Education: Linking Research, Theory, and Practice. 2nd ed. USA: Jones and Barlett Learning.

DEPARTMENT OF BASIC EDUCATION see REPUBLIC OF SOUTH AFRICA.

DRAPER, CE, DE VILLIERS, A, LAMBERT, EV, FOURIE, J, HILL, J, DALAIS, L, ABRAHAMS, Z & STEYN, NP. 2010. HealthKick: a nutrition and physical activity intervention for primary schools in low-income settings. BioMed Central (BMC) Public Health (online), 10:398. Available: http://www.biomedcentral.com/1471-2458/10/398.

FAO. 2005. Nutrition Education in Primary Schools. A planning guide for curriculum development. Volume 1: The Reader and Volume 2: The Activities (online). Available:

http://www.fao.org/docrep/009/a0333e/a0333e00.htm.

FAO. 2007. Improving the nutritional quality of street foods to better meet the micronutrient needs of schoolchildren in urban areas (online). Available: ftp://ftp.fao.org/docrep/fao/009/ag430e/ag430e00.pdf.

FLORENCE, MD, ASBRIDGE, M & VEUGELERS, PJ. 2008. Diet quality and academic performance. Journal of School Health, 78(4): 209-215.

GRANTHAM-MCGREGOR, S, BUN CHEUNG, Y, CUETO, S, GLEWWE, P, RICHTER, L, STRUPP, B & THE INTERNATIONAL CHILD DEVELOPMENT STEERING GROUP. 2007. Developmental potential in the first 5 years for children in developing countries. The Lancet (online), 369(9555):60-70. Available: http://www.who.int/child_adolescent_health/documents/pdfs/lancet_child_dev_series_paper1.pdf.

GURIAN, M. 2011. Boys and Girls learn differently: a guide for teachers and parents. 10th ed. San Francisco, United States of America: Jossey-Bass.

HALL, K. 2013: Children‟s access to education. In: Berry, L, Biersteker, L, Dawes, H, Lake, L & Smith, C. eds. South African Child Gauge 2013: Part 3 - Children count – The numbers (online). Cape Town: The Children‟s Institute. Available: http://www.ci.org.za/depts/ci/pubs/pdf/general/gauge2013/ Gauge2013ChildrenCountEducation.pdf.

HALL, K, SAMBU, W, BERRY, L, GIESE, S, ALMELEH, C & ROSA, S. 2016. South African Early Childhood Review 2016 (online). Cape Town: Children‟s Institute, University of Cape Town and Ilifa Labantwana. Available: http://www.ci.org.za/depts/ci/pubs/pdf/resources/general/2016/SA_ECD_Review_2016.pdf.

HENDRICKS, MK, GOEIMAN, H & DHANSAY, A. 2007. Food-based dietary guidelines and nutrition interventions for children at primary healthcare facilities in South Africa. Maternal and Childhood Nutrition, 3(4):251-258.

HSRC, 2013: SANHANES-1 Media Release No. 2: Nutritional Status of Children (online). Pretoria: HSRC. Available: http://www.hsrc.ac.za/uploads/ pageContent/3895/02%20NUTRITIONAL% 20STATUS% 20OF%20CHILDREN.pdf.

KELLER, I & LANG, T. 2007. Food-based dietary guidelines and implementation: lessons from four countries-Chile, Germany, New Zealand and South Africa. Public Health Nutrition, 11 (8):967-874.

MATVIENKO, O. 2007. Impact of a nutrition education curriculum on snack choices of children ages six and seven years. Journal of Nutrition Education Behaviour, 39:281-285.

MURPHY, A, YOUATT, JP, HOERR, SL, SAWYAR, CA & ANDREWS, SL. 1995. Kindergarten Students‟ Food Preferences are not Consistent with their Knowledge of the Dietary Guidelines. Journal of the American Dietetic Association, 95(2):219-223. OLDEWAGE-THERON, WH & EGAL, A. A.

2009. The evaluation of a nutrition education programme on the nutrition knowledge of children aged six and seven years. Journal of Family Ecology and Consumer Sciences, 37:45-51.

OLDEWAGE-THERON, WH & NAPIER, CE. 2011. Nutrition education tools for primary school children in the Vaal region. Development of Southern Africa, 28(2):283-292.

OOSTHUIZEN, D. 2010. Impact of a nutrition education programme on nutrition knowledge and dietary intake practices of primary school children in Boipatong. D. Tech, Vaal University of Technology.

PROVO, AM. 2013. Towards sustainable nutrition for all: Tackling the double burden of malnutrition in Africa. Sight and Life, 27(3):40-48.

RAMAN, M, MCLAUGHLIN, K, VIOLATO, C, ROSTOM, A, ALLARD, JP & CODERRE, S. 2010. Teaching in small portions dispersed over time enhances long-term knowledge retention. Medical Teacher, 32(3):250-255.

REPUBLIC OF SOUTH AFRICA. Department of Basic Education, Curriculum. 2011. Curriculum and Assessment Policy Statement: Grades R-3, Life Skills (online). Available: http://www.education.gov.za/Curriculum/CurriculumAssessmentPolicyStatements/tabid/419/Default.aspx.

REPUBLIC OF SOUTH AFRICA. Department of Basic Education. 2016. Information for parents and guardians (online). Available: http://www.education.gov.za/Parents/Childregistration/tabid/407/Default.asp.

RICKARD, KA, GALLAHUE, DL, GRUEN, GE, TRIDLE M, BEWLEY, N & STEELE, K. 1995. The play approach to learning in the context of families and schools: An alternative paradigm for nutrition and fitness education in the 21st Century. Journal of the American Dietetic Association, 95(10):1121- 1126.

ROSSOUW, HA, GRANT, CC & VILJOEN, M. 2012. Overweight and obesity in children and adolescents: The South African problem. South African Journal of Science (online), 108(5/6): Art. # 907, 7 pages. Available: http://www.sajs.co.za/index.php/SAJS/article/viewFile/907/1161.

SHAH, P, MISRA, A, GUPTA, N, HAZRA, DK, GUPTA, R, SETH, P, AGARWAL, A, GUPTA, AK, JAIN, A, KULSHRESHTA, A, HAZRA, N, KHANNA, P, GANGWAR, PK, BANSAL, S, TALLIKOTI, P, MOHAN, I, BHARGAVA, R, SHARMA, R, GULATI, S, BHARADWAJ, S, PANDEY, RM & GOEL, K. 2010. Improvement in nutrition-related knowledge and behaviour of urban Asian Indian school children: findings from the „Medical education for children/ Adolescents for Realistic prevention of obesity and diabetes and for healthy aGeing‟ (MARG) intervention study. British Journal of Nutrition, 104(3): 427-436.

SHARIFF, ZM, BUKHARI, SS, OTHMAN, N, HASHIM, N, ISMAIL, M, JAMIL, Z, KASIM, SM, PAIM, L, SAMAH, BA & HUSSEIN, ZAM. 2008. Nutrition education intervention improves nutrition knowledge, attitude and practices of primary school children: A pilot study. International electronic Journal of Health Nutrition, 11:119-132.

SHARMA, M. 2011. Dietary education in school-based childhood obesity prevention programs. Advances in Nutrition, 2(2):207S-216S.

SINGLETON, J, ACHTENBERG, C & SHANNON, B. 1992. Role of food and nutrition in the health perceptions of young children. Journal of the American Dietetic Association, 92: 67-71.

UNITED NATIONS CHILDREN‟S FUND (UNICEF). 2016. Joint press release: World Bank Group, UNICEF urge greater investment in early childhood development (online). New York: UNICEF. Available: www.unicef.org/media/ media_90863.html.

VAN CAUWENBERGHE, E, MAES, L, SPITTAELS, H, VAN LENTHE, FJ, BRUG, J, OPPERT, JM & DE BOURDEAUDHUIJ, I. 2010. Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and „grey‟ literature. British Journal of Nutrition, 103(6):781-797.

VORSTER, HH. 2001. South African Food-Based Dietary Guidelines. The South African Journal of Clinical Nutrition, 14(3) (Supplement S1-S80): S3-S6.

VORSTER, HH, BADHAM, J & VENTER, CS. 2013. An introduction to the revised food-based dietary guidelines for South Africa. South African Journal of Clinical Nutrition, 26(3):S5-S12.

WALTON, J. (ed). 2012. National Pre-School Nutrition Survey, summary report on: Food and nutrient intakes, physical measurements and barriers to healthy eating (online). Ireland: Irish Universities Nutrition Alliance. Available: http:// www.iuna.net/wp-content/uploads/2012/06/ Summary_Report_National_PreSchool_Nutrition _Survey_June_2012.pdf.

WARREN, JM, HENRY, CJK, LIGHTOWLER, HJ, BRADSHAW, SM & PERWAIZ, S. 2003. Evaluation of a pilot school programme aimed at the prevention of obesity in children. Health Promotion International, 18(4): 287-296.

ZARNOWIECKI, D, SINN, N, PETKOV, J & DOLLMAN, J. 2011. Parental nutrition knowledge and attitudes as predictors of 5-6-year-old children‟s healthy food knowledge. Public Health Nutrition, 15(7):1284-1290.