Journal of African Studies in Educational Management and Leadership
Vol: 9 , January - April 2018, 20-33
Scholarly, Peer Reviewed

Impact of the School Feeding Programs: A Case of Mateka Early Childhood Development Centre, Bungoma County

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Abstract

Hunger and malnutrition are burdens in developing countries where they manifest in form of protein energy malnutrition. Protein energy malnutrition compromises a child's immune system leading to direct mortality and increased vulnerability to infectious diseases, stunting and poor brain development. According to the County Early Childhood Education Bill of 2014, every County Education Board should carry out feeding programs in early childhood education centres. The Act further states that the feeding programs should provide adequate and nutritious foods based on physiological needs and regional demands. This was a longitudinal study that sought to establish the effect of a nutritionally adequate and consistent school feeding program on child nutrition status and school attendance at Mateka Early Childhood Development Centre. Findings revealed that the prevalence of malnutrition at baseline was high with 30.1%, 6.7% and 10.8% of the children stunted, wasted and underweight respectively. This is attributed to consumption of cereals, root tubers and dark green vegetables with very little consumption of meat, eggs, milk and milk products. At the centre, the children were fed on maize–meal porridge which hampered their growth. Introduction of soymeal as a fortificant in an experimental study revealed reduced levels of wasting (3.8%) and underweight (5.4%). It is recommended that awareness of the nutritional benefits of soybean should be raised to increase consumption at household level and in the school feeding programs to alleviate protein energy malnutrition.

Key words: Malnutrition, school feeding program, soybean complementation.

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Introduction

Malnutrition is the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions (UNICEF/WHO/WB, 2012). In 2014, 6.3 million children were reported globally by the World Health Education Service (WHES, 2015) to have died of malnutrition. Majority of the children were in developing countries. Infant and young child malnutrition can be broadly classified into two groups: protein energy malnutrition (PEM) and micro nutrient deficiencies (UNICEF, 2012). PEM is considered the worst form of malnutrition associated with lack of energy and proteins and a major deficiency disease that affects children in Asia and other developing countries (DeLange, 2010; UNICEF, 2013). PEM compromises the child's immune system leading to direct mortality and increased vulnerability to infectious diseases, stunting and poor brain development which makes them not achieve their education potential (Black et al., 2008).

Publisher: Kenya Association of Educational and Management (KAEAM)
| ISSN 2078-7650 Online# 2018 , http://www.kaeam.or.ke

In Western Kenya, children are largely fed on starchy staple cereals that are inadequate in their nutritional quality and quantity (Kinyuru et al., 2012). Malnutrition is therefore a serious health problem brought about by inequalities in the economic systems and social injustices resulting in incidences of underweight and stunting among children (UNICEF/WHO/WB, 2015). The rates of malnutrition in Bungoma County stand at 24.4% stunting, underweight incidence at 2.9% and wasting at 9% (KNBS & ICF Macro, 2015). These levels of malnutrition differ with the national figures of stunting 26%, wasting 4%, and underweight 11%. The poverty rates in the County stands at 53% and food insecurity stands at 20-50% depending on the sample area. The high levels of poverty are a factor that contributes to low consumption of animal protein in the diets at household level (KNBS & SID, 2013).

Hunger and malnutrition are burdens in developing countries where they manifest themselves in the forms of PEM (Dewey, 2013). Increasing PEM levels in Sub-Saharan Africa and Asia is attributed to high levels of poverty such that most families in these countries cannot afford to include animal protein in their diets (FAO, 2015). With this regard, people consume plant based diets as they are cheaper, although their quality is poorer compared to animal proteins which contain all indispensable amino acids and have high digestibility (Hoffman & Falvo, 2004). Diets fed to children in developing countries usually are monotonous staples and cereals with little intake of animal source foods (Kennedy, Pedro, Seghieri, Nantel, & Brouwer, 2007). This becomes an exacerbating factor to malnutrition because children are at their critical point of growth where they require adequate nutrients to meet the growth demands.

The County Early Childhood Education Bill of 2014 of Kenya states that every County Education Board should carry out feeding programs in early education centres in areas where children are affected by malnutrition or have special nutritional needs (Republic of Kenya, 2014). The Act further states that the county board should issue guidelines and support efforts for the feeding program and that the feeding programs should provide adequate and nutritious foods based on the physiological needs and the regional demands. To this effect, every parent provided 6kg of maize and 1kg of sugar per term for each child attending Mateka Early Childhood Development Centre (ECDC). The porridge made out of maizemeal flour did not meet the protein needs of the growing children. Therefore, this study sought to assess nutrient adequacy of the meals provided at Mateka ECDC centre and recommend appropriate measures to improve the feeding program.

Theoretical Framework

This study was based on Stufflebeam's improvement oriented model (Stufflebeam & Coryn, 2014). This model takes into consideration that the paramount function of evaluation is to foster improvement, provide accountability records, and promote increased understanding of the phenomenon under review. Stufflebeam defines evaluation as the process of delineating, obtaining and providing descriptive and judgmental information about the worth and merit of some object's goals, design, implementation and impacts in order to guide decision making, serve the needs for accountability, and promote understanding of the involved phenomenon. He developed CIPP model for program evaluation, meaning context, input, process and product evaluation. **Context evaluation** identifies the strengths and weaknesses of some object; **input evaluation** helps prescribe a program to bring about needed changes; **process evaluation** is an ongoing check on the implementation plan; **product evaluation** measures, interprets and judges the attainment of a program. Context, input, process and product evaluation serve unique functions although they are interrelated. The main emphasis in this study was the improvement function of evaluating the school feeding program at Mateka ECDC, Bungoma County.

A conceptual framework (Fig 1) was developed from Stufflebeam's theoretical framework. **Concepts** within the context included the children rights to food, the implementation of the County Early Childhood Educational Bill, 2014 and resources available for running the school feeding program. Resources were provided by the parents / guardians of the children at the centre. An **input** into the feeding program was provision of maizemeal porridge to all children at the ECDC. **Process** included the school feeding program. Complimentary feeding was introduced in the study to improve the nutrient density of the porridge already being provided. Nutrition extension education for all stakeholders was important for achievement of the provision of adequate and nutritious foods based on the physiological needs and the regional demands. **Product** was the improved child nutrition status, increased enrolment and regular class attendance. The context, input, and process have an impact on the product.

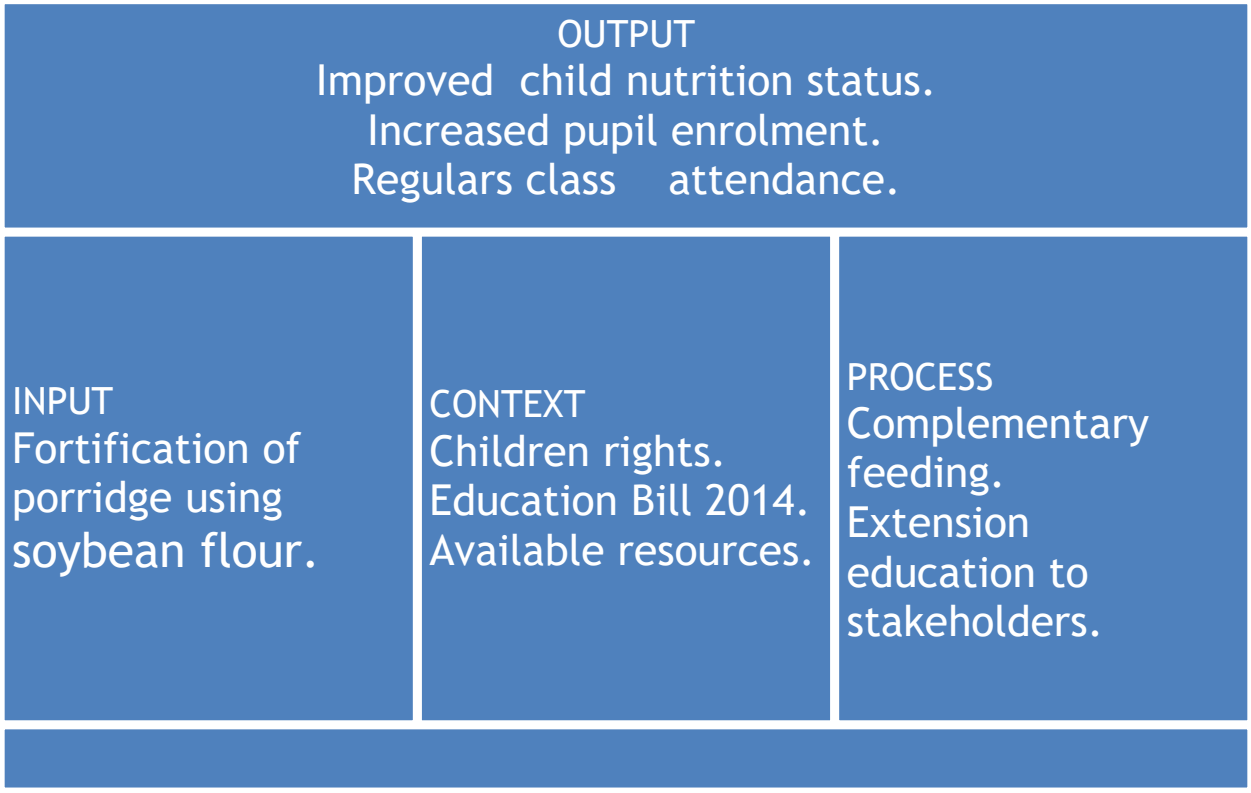


Fig 1: Conceptual Framework adapted from CIPP model by Stufflebeam & Coryn (2014)

Research Design

At the onset, a baseline survey was carried out using questionnaires administered to 70 parents / caregivers to children attending school at Mateka Early Childhood Development Centre (ECDC). The aim of the survey was to determine sociodemographic characteristics of households and the children's feeding habits. Three ECDC teachers and 1 cook were interviewed to assess the implementation of the school feeding program. For all the 120 children enrolled at the Centre, child nutrition status was determined using clinical examination and nutritional anthropometry which included age, weight, height and mid-upper arm circumference. Nutritional anthropometric data were collected according procedures described by Caulfield, De Onis, Blössner, & Black (2004). Nutritional status was determined based on World Health Organization Z-scores (WHZ) for normal, stunting, wasting and underweight.

The Codex Alimentarius Commission of the United Nations recommends compositing of legumes and starchy staples as a means of improving the nutrient quality of foods for young children (FAO / WHO, 2002). Different protein sources can be used as fortificants in the complementary foods depending on the availability, accessibility, and acceptability. The fortificants can, therefore, vary depending on the ecological zone, food cultures, and beliefs of different people.

A feeding trial was therefore set up with the inclusion of sorghum and soybean flour in the feeding program. Three treatments i.e 100% maizemeal porridge as the control; 25% soybean and 75% maizemeal porridge; and 25% soybean, 25% sorghum and 50% maizemeal porridge were used in the study. This is according to WHO recommendation of the ratio 3:1 of carbohydrates to proteins in supplementary foods (FAO / WHO, 2002). Completely Randomized Design (CRD) was used to assign the treatments to the three classes (baby, middle, top) at the centre. A standardized recipe was used to prepare the porridge and standard cups provided for the feeding program (Onoja, Akubor, Gernar, & Chinmma, 2014). Children were served 250ml of porridge daily. Proximate analysis using Association of Official Analytical Chemists (AOAC) International methods was carried out prior to the implementation of the experiment to determine the nutrient composition of the porridge varieties. All the tests were carried out in triplicate and the average value taken. Besides, 2 more cooks were hired to manage the feeding program. All children in attendance were included in the feeding program which lasted for seven months. Although all children at the centre participated in the feeding trails, nutritional anthropometry was carried on children five years and below on a monthly basis. The class registers were also assessed on a monthly basis to determine school attendance. At the end of the seventh month, an impact assessment was done involving 120 parents / caregivers, 3 teachers and 3 cooks. Permission was sought from parents / caregivers of children involved and the Sub-County Education Office of Bumula Sub-County. Socio-demographic data was analyzed using SPSS Version 21 (2007). ENA for SMART was used to analyze data on nutritional status of the children. This aided in classifying the children in three categories i.e normal, severe acute malnutrition (SAM) and moderate acute malnutrition (MAM).

Results and Discussion

Sociodemographic Characteristics

Findings from the baseline survey indicated that children were aged between 3 – 7 years while the parents / caregivers were aged between 15 and 53 years. More than half (56%) of the parents / caregivers had primary level education, whereas those who had achieved university or college education were only 9%. The average number of children in a household was 5. The mean household monthly income was Ksh 2700. This translates to a daily income of Ksh 90 which is below the national and the international poverty line index of one dollar per day (KNBS & ICF Macro, 2015). This shows that for most of the households, the amount of money earned was not enough to meet the daily food budget and other household expenditures such as medical needs.

From the food frequency questionnaire, the results indicate that cereals and starchy roots and tubers were the most consumed foods and that they contributed majorly to the energy intake of the children. The most commonly consumed staples were maize, sorghum and cassava. The reason is that most of these staples are commonly grown in the area due to favorable climate (Macharia et al., 2012). Furthermore, according to KNBS and ICF Macro (2015), maize is the most consumed staple in rural households and a national staple food for Kenyans. Food consumption surveys in Western Kenya have documented that cereals and starchy staples were the most consumed food group (Waswa, Keding, Irmgard, Johannes, & Michael, 2015; Walingo & Ekesa, 2013; Ekesa, Walingo, Abukutsa-Onyango, 2008). The second reason for high consumption is that starchy staples are less expensive in comparison to foods from other food groups. This could be a contributing factor to the high levels of malnutrition (Stephenson et al., 2010; Gewa & Leslie, 2015).

This study established that the major source of proteins in the diets of the children were legumes. Findings revealed that most of the children did not meet their intake for critical nutrients for growth at baseline. Animal sources of proteins were rarely consumed. It is recommended that a larger portion of the protein be provided from animal sources as the proteins are of high quality and support maximum growth in children (Bwibo & Neumann, 2003). To this effect, the study incorporated soybeans in cereals to improve nutrient quantity and density.

School Feeding Program

Maize is the most consumed staple in rural households and a national staple food for Kenyans and this includes Bungoma county (KNBS & ICF Macro, 2015; Kinyuru et al., 2012). Given that parents were expected to provide ingredients for the feeding program, it was a school requirement that each parent provides for each child 6kg of maize, 1kg of sugar, one thousand Kenya shillings and a cup at the beginning of each school term. The funds were used to procure firewood and for the cook's wages. Porridge was provided at ten o'clock. Findings revealed that the amount of porridge served was not of a standard measure because the children had cups of different sizes.

A sample of the porridge was collected and proximate analysis done (Table 1). Maizemeal based diets are deficient in amino acids lysine and tryptophan making it a poor protein food (Kamau, 2015). This was a weakness identified in the school feeding program. WHO (2013) proposes that the proper infant and young child feeding (IYCF) practices need to be adhered to in order to ensure

that children grow up healthy. This can only be realized when the quality of food is improved to match the nutrient needs of the infants and young children. Legumes are important for children because they have considerable amount of amino acid composition which complements the amino acid profile of cereals particularly for communities whose diets are cereal-based (Michelsen et al., 2009). When the relative deficiency of an amino acid in one protein is compensated by a surplus from another protein consumed at the same time, complementation is achieved. Combining cereals and legumes where one supplements the other with the deficient amino acid creates a balance that results in nutritional complementation (Young & Pellet, 1994). According to USDA (2013), the nutritive value of soybean is much higher than other staple foods. Soy is particularly high in protein content which can be up to 34.5% compared to other legumes and cereals such as cassava and maize with 1.4% and 9.42%, respectively (USDA, 2013). Soybeans which are a cheap source of protein and micronutrients can be used to improve the protein quality of maize through complementation (Table 1). Composite flours comprise one of the ways that can be adopted in ensuring that the complementary foods are protein sufficient (Serrem, de Kock, Oelofse & Taylor, 2011). According to Table 1, fortification of cereals significantly increases their nutrient density in terms of energy, protein, fat and ash content hence can alleviate Protein Energy Malnutrition and micronutrient deficiency. Compositing of flours with soybean flour increases Protein Digestibility Corrected Amino Acid Score (PDCASS) value and increases the ability to achieve supply of essential amino acids (Kamau, 2015).

Table 1: Proximate composition of 100g of porridge varieties (g/100g)

	Ash	Moisture	Oil	Protein	CHO	Energy
Maize (M)	0.83	10.17	4.33	9.48	75.19	1580.16
Maize: Soybeans (M:S)	5.50	9.33	11.33	17.41	56.42	1662.44
Maize: Sorghum: Soybeans (M:S:S)	5.17	9.17	10.00	18.43	57.24	1642.92

Prevalence of Malnutrition

The prevalence of malnutrition at baseline was high. The prevalence of stunting was at 30.1%. Stunting is a result of prolonged inadequate intake of food as well as diseases making young children to have a low height for age (UNICEF/WHO/WB, 2015; Nungo, Okoth, & Mbugua, 2012). Stunting is associated with low cognitive development and increased morbidity in children under 5 years old (Dewey, 2013). The prevalence of stunting in the area is almost similar to that reported in Western Kenya in the Kenya Demographic Health Survey (KDHS) at 24.4% (KNBS & ICF Macro, 2015) and Waswa *et al.*, (2015) at 29.4%. However, this value is higher than the national prevalence of 26% (KNBS & ICF Macro, 2015). The prevalence of stunting at this age group suggests that under-nutrition starts at very early age and therefore appropriate nutritional efforts need to be focused at an early age. It also suggests that most of the households in the area are perennially food insecure and therefore the diets fed to the children might be inadequate.

The prevalence of underweight in this study was at 10.8%. This value is higher than that reported in the Kenya Demographic Health Survey 2014 in Western Kenya of 2.9%. However, this value is almost similar to the national value on underweight prevalence of 11%. The prevalence of wasting in this study was 6.25%. This value is higher than national prevalence of 4% (KNBS & ICF Macro, 2015).

The ultimate measure for growth was the weight gain. Protein is needed for growth and development of body tissues. The quality of proteins is very important in supporting the growth of infants and young children (FAO, 2011). All the groups of children gained weight. This is attributed to the consistent provision of porridge. At the end of the study the children had gained

weight as follows: baby class 32.34%, middle class 24.92% and top class 12.5% (Table 2). The top class gained significant weight within the first three months and then maintained a fairly constant weight. This is because the group had the least amount of protein which is required for growth. Baby class and middle class gained much more weight because of increased protein content in the porridge that was provided. Maize-soy porridge emerged superior to the other varieties of porridge provided. Soy-fortified diets had higher PDCAAS than the non-fortified diets. Maize: soy had a PDCAAS of 70% compared to 53% in pure maize meal which translates into a 32.08% increment as a result of fortification, while sorghum: soy had 56% (Kamau, 2015). Lesser protein of higher PDCAAS is better than higher quantity protein with lower PDCAAS at supporting growth (FAO/WHO, 2002). Mariam (2005) also established that a single serving of the soy-fortified complementary foods would not meet the nutrient needs of children. However, if the IYCF guidelines by UNICEF (2013) are adhered to and the children take at least 3 meals in a day, the energy requirements would be met, implying that the children would not be deficient.

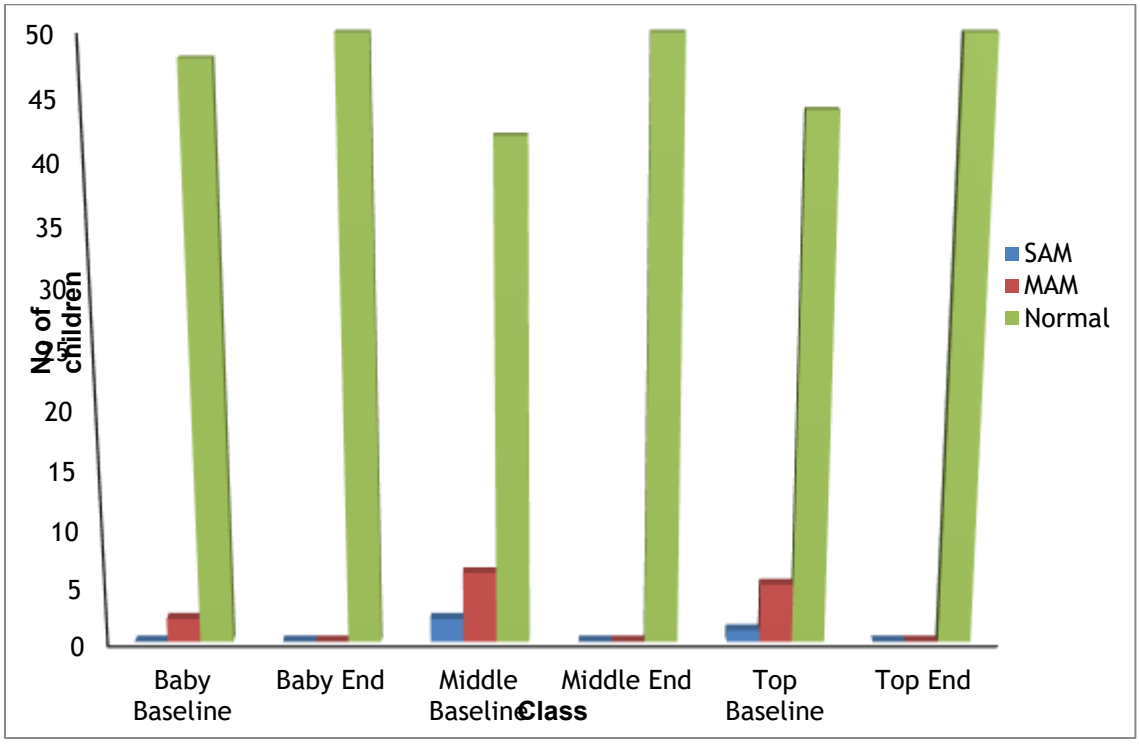
Table 2: Mean weight gain

	Month 1 (baseline)	**Month 3**	**Month 5**	**Month 7**
Baby Class (M:S)	16.70 (±2.81)	18.75 (±2.31)	20.12 (±2.22)	22.10 (±2.00)
Middle Class (M:S:S)	17.53 (±2.80)	18.62 (±1.90)	19.90 (±2.44)	21.90 (±1.83)
Top Class (M)	19.44 (±2.45)	21.37 (±3.19)	21.44 (±2.41)	21.87 (±2.01)

Values are means± standard deviation.
M: S – Maize: soybean; M: S: S – Maize: soghum: soybean; M – Maize

The lesser increase in weight gain among middle class group could be due to the presence of phytates, tannins in sorghum and soy anti-nutritional factors complexed with nutrients that reduced their digestibility (Aremu, Osifade, Basu, & Ablaku, 2011). Kure and Wyasu (2013) also found out that after fortifying sorghum with soy, there was an increase in levels of lysine, methionine, and tryptophan. This confirms that soy fortification increases the protein quality of the complementary foods through complementation of the amino acids.

At the end of the study no child was found to suffer severe acute malnutrition (SAM) (Fig 2). This confirms that soy fortification increases the protein quality of the complementary foods through complementation of the amino acids and therefore lowering the prevalence of Protein Energy Malnutrition.



Note: <-2SD to -3SD (Moderate Acute Malnutrition- MAM); < 3 SD (Severe Acute Malnutrition- SAM)

Fig 2: Comparison of nutritional status at baseline and at the end of the feeding program based on WHZ

School attendance

There was a significant increase in enrolment of the baby class and consistent school attendance in middle and top class (Table 3). Hunger and malnutrition are burdens that are pronounced in developing countries and poor households (Dewey, 2013). Provision of porridge at Mateka ECDC was a strength in that it kept children in school and alleviated hunger. More children enrolled at the center as the trial progressed. There was evidence of new listings in the baby class and middle class registers.

Table 3: School attendance

	Month 1	Month 3	Month 5	Month 7
Baby Class (M:S)	20	46	51	42
Middle Class (M:S:S)	40	46	43	45
Top Class (M)	60	66	78	78

Note: This included all children attending school at the centre

Conclusion

Using the CIPP model of evaluation and the conceptual framework (Fig 1), implementation of the County Early Childhood Education Bill of 2014 of Kenya was a strength. Children from poor households had meals provided at the Centre. This helped improve pupil enrolment and attendance. However, the weakness of the program was that maizemeal porridge which was deficient in all essential amino acids is what was provided to children. This was because the community did not have enough resources to provide a nutritious snack to the children. There was also improved child nutrition status. Porridge made from soy fortified flours can be used to rehabilitate malnutrition thus keep children in school.

Recommendations

There was need to look for alternative resources to improve the nutrient density and quality of the porridge provided at the ECDC. This can be achieved through identification of a suitable fortificant that is acceptable and sustainable by a majority of the population in Bumula Sub-County. Soy bean is such a fortificant (Onofiok & Nnanyelugo, 2012). It is therefore important to promote the production and utilization of soybeans in Bungoma County. It is also important that awareness of the nutritional benefits of soybeans be raised to increase their consumption at household level and in the school feeding programs to alleviate Protein Energy Malnutrition.

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