Sugar as a potential vehicle for vitamin A fortification: Experience from Kamuli district in Uganda

Medi Kawuma
Department of Opthhalmology, Faculty of Medicine, Makerere University, P. O. Box 7072 Kampala, Uganda.

ABSTRACT

Background: Despite measures put in place by the Uganda Government ten years ago to combat Vitamin A deficiency, the number of children suffering from this deficiency remains high.

Objective: To determine whether sugar may be used as a vehicle for vitamin A fortification.

Design: Cross - sectional descriptive study

Setting: Kamuli district in Uganda

Patients: One thousand one hundred and four children, and one thousand one hundred and two mothers or care-takers participated in the study. Sugar consumption patterns for the two age groups were determined. The methods of sugar storage in households were also determined.

The children were aged 12 to 36 months, and mothers /caretakers 16 to 45 years.

Results: The overall proportion of households where sugar was consumed in the last seven days was 89.2% for children, and 88.3% for mothers/ caretakers. Sugar was stored in covered tins in 67% of the households, and in covered baskets in 28% of households.

Conclusion: Sugar is a potential vehicle for fortification with vitamin A for Kamuli district. Storage of sugar in covered tins and baskets means that the stability of the vitamin A in the fortified sugar might not be affected by exposure to light.

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INTRODUCTION

The scope and dimension of vitamin A deficiency is now well recognised as being of a global nature, with adverse consequences to health of children even in the mildest deficiency states[1].

Vitamin A deficiency remains amongst the most devastating problems facing the majority of the world's population and today, constitutes a major constraint on future development[2]. Vitamin A deficiency is the most serious preventable cause of blindness in children worldwide. In addition, it is attributed to be responsible for a large proportion of illnesses and death among the under-five children. Available evidence shows that improvement of vitamin A status of young children results in a significant improved survival effect on severe morbidity arising from the three main health threats facing children throughout the developing world, namely measles, pneumonia and diarrhoeal diseases[3].

In Uganda, the magnitude and distribution of vitamin A deficiency has not been fully documented at the national level. However, results of a sub-national blindness and vitamin A deficiency prevalence assessment completed in 1991 in Kamuli district, documented evidence of Vitamin A deficiency at levels of public health significance[4].

This paper reports results of a study on the availability of sugar to both children and mothers in terms of quality and frequency of consumption. The paper also reports on the common forms of storage of sugar. The general objective of the study was to identify potential food vehicles for vitamin A fortification. The specific objectives were to determine the frequency and amount of sugar consumed amongst children and mothers/caretakers, and identify the methods of sugar storage in households in Kamuli district in eastern Uganda.

MATERIALS AND METHODS

Pilot study: In April (1999) a pilot study was carried out in Kamuli district in eastern Uganda. Fifty mothers/caretakers in households with one or more children aged 12 - 36 months were interviewed from each of the four counties of Kamuli district. The pilot study aimed at determining the frequency of consumption of each of the following foods /food ingredients: maize meal, cooking oil, salt and sugar. The intention was to determine potential food vehicles for possible fortification with vitamin A.

The procedure used to interview mothers/caretakers was a semi-quantitative; seven-day recall that counts the number of days per week a specific food is consumed. Maize meal was consumed by 33% of the households,

Medi Kawuma
Department of Ophthalmology
Faculty of Medicine
Makerere University
P. O. Box 7072 Kampala, Uganda
Tel: 256-41-540411

cooking oil 17%, salt 27%, and sugar 78%.

From the pilot study results it was decided to carry out a full study to evaluate if sugar could be a potential vehicle for fortification of vitamin A among households in Kamuli district.

Main study: Patients/study population: The study population included 12 - 36 months old children and 16 - 45 years old mothers/caretakers in Kamuli district.

Study design: This was a semi-quantitative descriptive study in which mothers/caretakers in a house hold with one or more children aged 12 - 36 months were subjected to a researcher - administered questionnaire.

Inclusion criteria: Children aged 12 to 36 months with their mothers/caretakers aged 16 - 45 years were recruited into the study provided informed consent to recruit such a child and such a mother/caretaker had been solicited for and obtained by the investigators.

Exclusion criteria: Children whose mothers /caretakers were absent from home at the time the investigators visited such a household. Also children who had been suffering from any condition preventing them from eating or drinking normally were excluded from the study.

Ethical issues: Permission to carry out the study was obtained from the Director of Health Services, Kamuli District. Written consent was obtained from the mothers /caretakers after explaining to them the objective of the study. All information collected from each individual was held in strict confidence.

Sampling and Sample size: Children who fulfilled the selection criteria were consequently enrolled into the study. Using random sampling technique, a representative sample of communities, eligible households and one of the respondent's eligible children were selected for the study. In each of the numerous communities identified within each survey area, a previously determined number of households with mothers or children aged 12 -36 months were visited for the sugar intake interviews.

The sample size required for each sampling area using the Fortification Rapid Assessment guidelines and tool (FRAT)[6] was 210 households (based on a level of confidence of 95%, a precision of 10%, a minimum of expected prevalence[7] of consumption of the potential vehicle of 50%.

Survey: The following was the process of conducting the survey to correctly implement the FRAT. All days of the week were proportionately included in the survey, and interviews were conducted proportionately on each day of the week.

Selecting households was the first step in conducting the survey. Eligible households for the FRAT had to have at least one child between 12 - 36 months. To facilitate the selection of households, we tried to obtain a listing of all eligible households with the assistance of the Local Council (LC1) Chairperson.

Each interview took 10-15 minutes. Before going to the households, the interviewer wrote the name of the sample area, the cluster identification number, and the date on the questionnaire forms that (s)he was going to use.

To conduct the survey (i.e. implement the FRAT) the following steps were carried out in each household:

Where there was no list of eligible households the interviewer asked whether there were any children between 12-36 months living in the household. If the answer was "yes" the study proceeded. If the answer was "no" the interviewer went to the next household.

Then the names of women aged 16-45 years in the household were recorded and each eligible woman was asked if she had any children aged 12-36 months, or if she was the primary caretaker of a child between 12 and 36 months.

If only one woman present had a child (or was the primary caretaker of the child) between 12-36 months, then she was selected as the respondent. If more than one woman present had a child between 12-36 months, we randomly selected one of these women to be the respondent. If there was no woman between 16-45 years in the household, then the caretaker of the child(ren) between 12-36 months was the respondent. If the selected respondent looked after more than one child between 12-36 months, then we selected the oldest child only.

The mothers or caretakers were interviewed. Each questionnaire form had questions about the mother or caretaker and the child.

The above steps were repeated until information was obtained on a sufficient number of children between 12 36 months. Where the research assistant had not interviewed as many women between 16-45 years, they continued visiting households to interview women only until the same number of women interviewed as children was realised.

After completing a questionnaire, the gram equivalent of the food consumed for the woman and the child was calculated.

Statistical analysis: Data was entered into a computerised database using CDC/WHO computer software Epi Info[8]. Analysis involved cross tabulations with their asso-

ciations. Chi-square was used to ascertain statistical significance for categorical variables. Comparison of continuous variables was done by comparing means, and testing for significance using the t-test.

RESULTS

One thousand one hundred four children and one thousand one hundred two mothers/caretakers were studied. There were 530(48%) males and 574(52%) female children aged 12-36 months with a mean age of 18.4(50) months.

The mean age for mothers/caretakers was 28.6. These were generally, young women. Figure 1 shows the level of sugar consumption in children and mother /caretakers in the four counties of Kamuli district. Well over 80% of children and mothers / careakers consume sugar in all the four counties of the district.

However, the consumption of sugar by both children and mothers/caretakers was statistically higher in Buzaaya than in the other three counties. There was no statistical difference in the percentage of children or mothers/caretakers consuming sugar in Budiope, Bugabula and Bulamogi.

Figure 1: Level of sugar consumption in the 4 counties in Kamuli district

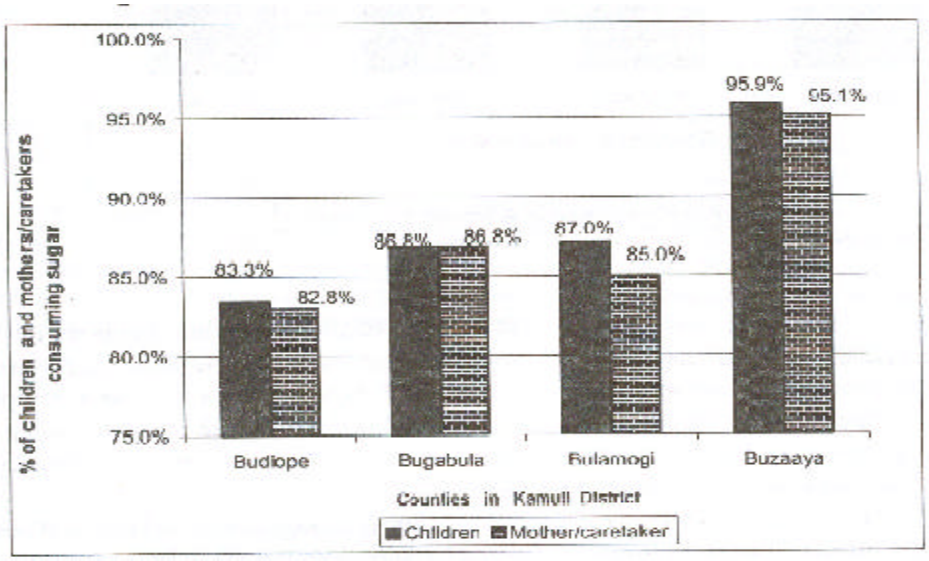


Figure 2 shows the common mode of sugar consumption among children in the four counties. This table shows that the consumption of sugar in tea, porridge and orange juice in the four counties is just about average, with no statistical difference between any two counties or between one type of beverage in any two counties.

Figure 2: Mode of sugar consumption in the 4 counties in Kamuli district

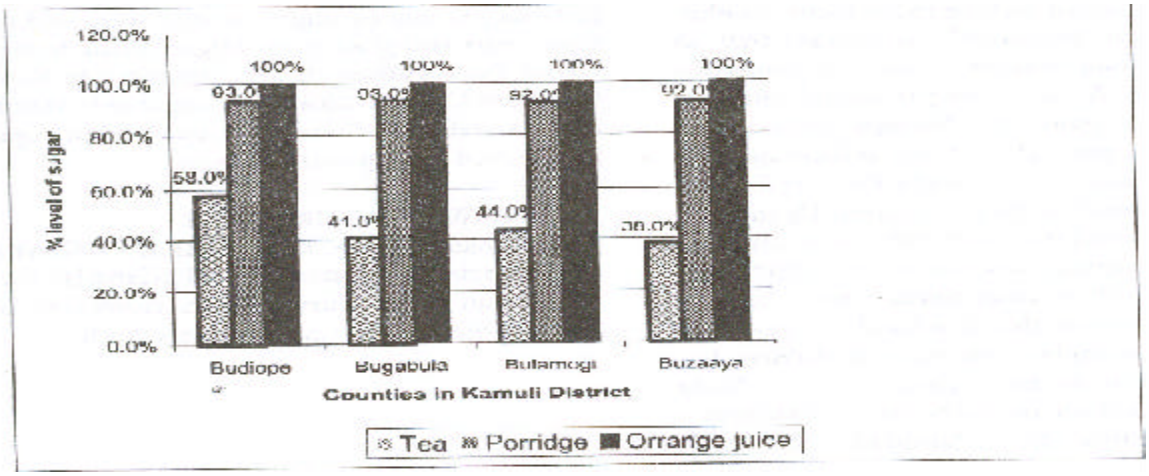
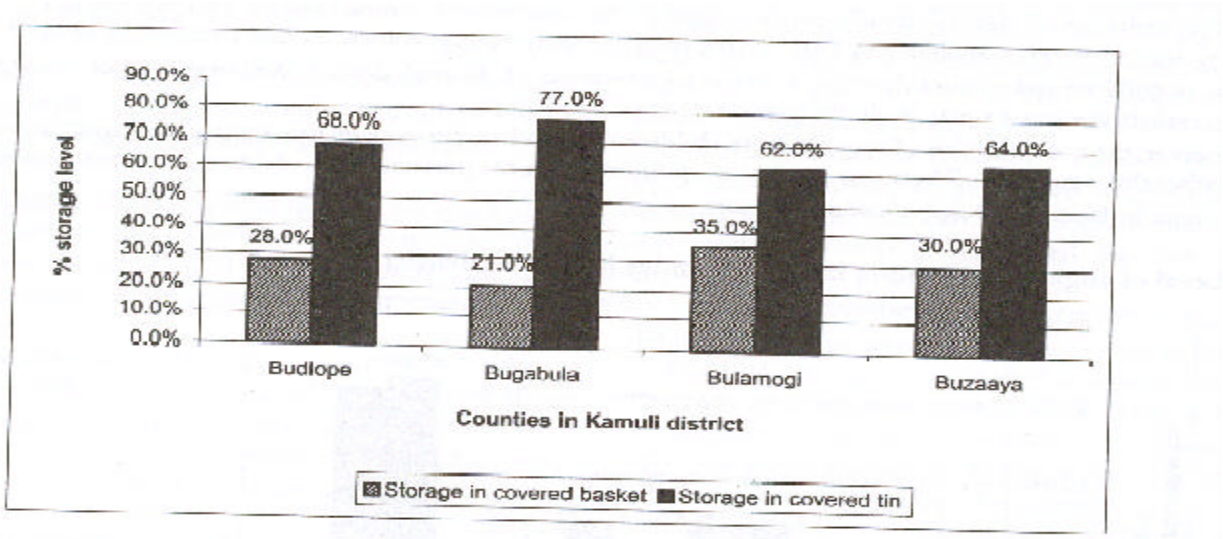


Figure 3 shows the two common forms of sugar storage in the four counties. Sugar is stored mainly in covered tins and baskets. Ninety four percent of sugar is stored in this form.

Figure 3: Common forms of sugar storage



DISCUSSION

Food fortification is a sustainable means to ensure adequate vitamin A intake as the process may not interfere with normal food choices nor eating patterns. Staple foods such as wheat flour and sugar have been popular foods to fortify in order to address vitamin A deficiency in several developing countries[9,10]. Zambia and Tanzania are among the latest developing countries to attempt fortification of staple foods with this vitamin[11-14]. South Africa has in the last two and a half years embarked on the fortification of *inkomazi* with vitamin A[15]. *Inkomazi* has for many years been a traditional meal accompaniment for indigenous Africans in South Africa. Recently reported efficacy trials on fortified foods include those from the Philippines, South Africa and Tanzania[13]. An efficacy trial in the Philippines found that vitamin A fortified margarine improved the vitamin A status of preschool children within six months. It is against this background that this study was conducted to generate baseline information on whether or not sugar would be suitable for fortification with vitamin A for Kamuli district, in eastern Uganda.

This study found that over 80% of all children in each of the four sampling areas consume sugar regularly. The figure for mothers /caretakers is very similar.

FRAT recommends that if a food is consumed by at least 50% of the sample population of children between 12 - 36 months in the last 7 days, it is most likely that fortifying such a food will be an effective public health intervention for the entire region sampled. This study found that 89.2% of children between 12 - 36 months and 88.3% of mothers /caretakers had consumed sugar in the last 7 days for the entire region sampled. Therefore, sugar fortification with vitamin A might be an effective way of combating vitamin A deficiency in Kamuli district.

Sugar storage in covered tins, and covered locally made baskets, does not allow light exposure to the sugar. This prevents vitamin A disintegration. Therefore, the amount of fortified vitamin A in the sugar would be consumed wholesome per gram of sugar; children and adults consuming such sugar would benefit as intended. Tin and basket storage accounts for 94% of the total storage. Other (inferior) forms of sugar storage were sacks, paperbags, open cups and glass pots. Sugar seems to be a potential vehicle for fortification with vitamin A in Kamuli District in eastern Uganda. Storage of sugar in covered tins means that the stability of vitamin A in fortified sugar might not be affected by exposure to light.

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