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GLYCEMIC INDEX AND IMPACT OF FOOD FORMULATED FROM LOCALLY AVAILABLE STUFF ON PROTEIN STATUS OF MALNOURISH CHILDREN IN KANO, NIGERIA

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ABSTRACT
This research was carried out to study the effect of consumption of food formulated from locally available stuff on serum protein profile of malnourished children of Hasiya Bayero pediatric Hospital Kano State, Nigeria. Ethical approval was sought from the ethical committee of Ministry of health Kano. Males (10) and females (10) malnourished inpatient children aged 6-59months participated in the study. Food was formulated using sorghum (*Sorghum arundinaceum*), date (*Phoenix dactylifera*), groundnut (*Arachis hypogaea*), soybean (*Glycine max*) and moringa leaf (*Moringa oleifera*). The formulated food (300g) was given to each child per day and consumed for a period of 2 weeks. Appetite test and glycemic index of the food were determined. Serum total protein (TP), albumin (ALB) and globulin (GLO) were determined before (baseline) and 2 weeks after feeding. Glycemic index of the formulated food was found to be high of about 91.66mg/dl. Mean serum TP, ALB, and GLO levels of male children as well as mean serum GLO of female children volunteers were significantly increased ($P<0.05$) following food consumption for two weeks. Based on the present study, the formulated food was highly accepted by the children as seen from the result of appetite test conducted and also it altered the protein status of the malnourished children positively.

Keywords: Food formulation, local ingredients, protein status, malnourish children

INTRODUCTION

Malnutrition is a condition that results from eating a diet in which nutrients are either not enough or are too much such that the diet causes health problem. It is often specifically refer to under nutrition where there is not enough calories, protein and micronutrients (Young, 2012), or over-nutrition that results from eating too much, eating too many of the wrong things, not exercising enough, or taking too many vitamins or other dietary replacements (Bryan *et al*., 2004). Malnutrition may results from inadequate or unbalanced diet, problems with digestion or absorption and certain medical conditions. It may occur due to starvation or due to deficiency of single vitamin in the diet (Grover, 2009).

Nigeria is among the 20 countries in the world that account for 80% of undernourished children (UNICEF, 2012). Acute malnutrition in Nigeria has remained at alert levels of 5-9.9% over the years since 2014. The prevalence of Underweight among children aged 0-59 months was 19.9 percent, just at the margin of the 20 percent threshold for serious situation that it has been since 2014, higher than the global estimate of 15 percent, but consistent with the rates in the West and Central Africa region 22% (NNHS, 2018). The prevalence of stunting was 32.0 percent and has remained the largest burden of malnutrition with stagnated rates of above 30 percent since 2014, and with many states in the north west and north east recording prevalence above 40 percent- the WHO critical levels (NNHS, 2018). Stunting indicates a long term nutritional problem in the country and at similar levels to that of Sub-Saharan region (37 percent) with serious and irreversible consequences. Overweight prevalence at 1.2 has however remained below the 7 percent threshold in all 36 states of Nigeria including federal capital territory. Overall, only 64 percent of children in Nigeria are growing healthily without being stunted or wasted (NNHS, 2018).

Treatment and prevention of severe acute malnutrition via Community Management of Acute Malnutrition (CMAM) programme is one of the interventions that has a positive impact on the treatment of severe acute malnutrition (SAM) in Nigeria. The program comprises four major components i.e community involvement, outpatient care, inpatient care, and services addressing the immediate and underlying causes of under nutrition such as supplementary feeding and food security programs. It provides take home ready to use therapeutic food (RUTF) as well as appropriate medical treatment on outpatient basis (Farouk *et al*., 2016). The RUTF provides sufficient nutrient intake for complete recovery from SAM. It can be stored for three to four months without refrigeration, even at tropical temperatures (UNCF, 2013).

Around 1.96 million children suffering from SAM were treated with RUTF in 2011, accounting for around 10 per cent of the estimated 20 million suffering from SAM globally (UNCF, 2013). Successful treatment has been achieved and recorded

with RUTF, but only 15% of children with SAM receive it (Weber *et al;* 2017). The cost, availability and affordability of current standard RUTF are the major obstacles to scaling up management of SAM through CMAM, an important child survival strategy. Identifying a cheaper alternative in tackling SAM is the fastest way of solving the problem which is also a global public health priority. Therefore, this study was aimed at studying the effect of consumption of food formulated from locally available stuff on serum protein profile of malnourished children.

MATERIALS AND METHODS

MATERIALS

Commercially prepared reagent kits for Total protein (TP) and Albumin (ALB) obtained from Randox Laboratories, Antrim, UK, were used for the determination of serum TP and ALB respectively. Centrifuge machine (C2004 Centurion Scientific), spectrophotometer (6705 UV/Vis), refrigerator LR207C (Lec Medical), Glucometer (Acucheck), test tubes, and micropipette (Switzerland, SOCOREX) were used.

STUDY AREA

The study area was Hasiya Bayero Pediatric Hospital Kano - Nigeria.

ETHICAL APPROVAL

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the ethical committee of Ministry of health Kano -Nigeria.

INFORMED CONSENT

A written informed consent for inclusion into the study was obtained from the parents/guardians of the children before participation in the study, furthermore, they were made aware that all the information obtained will be treated confidential and would be used for research purpose only.

SAMPLES COLLECTION

Food samples that ware used in formulating therapeutic food include; Soybeans, Sorghum, Groundnut, Date palm and Moringa leaves. The Samples were purchased from Rimi market in Kano state. The fresh samples were carefully selected and labeled properly in a polythene bags and then taken to the Botany Department of Biological Sciences, Bayero University Kano for identification. The blood sample was collected by a well-trained personnel in to a plain well labeled bottles for serum collection to the laboratory for the investigation of the parameters required for the research.

METHODS

Ten male and ten female malnourished inpatient children, aged 6-59month were recruited for the research. Their blood samples were collected before the commencement of the feeding and after receiving the therapeutic food for the period of two weeks to check serum total protein using biuret method (Tiez, 1995) and serum albumin by the method of Grant (1987). Serum globulin was determined by difference between Total protein concentration and Albumin concentration using the formula: [Globulin] = [Total protein] – [Albumin]. Mean serum protein profile was compared between the base line and after treatment with therapeutic food using the statistical package for social sciences (SPSS) Version 16.0 to check the effectiveness of the therapeutic food on serum TP, ALB and GLO.

RESULTS AND DISCUSSION

The results of Glycemic index of the control food containing 60gram of carbohydrate and that of the study food are presented in table 1. Mean Glycemic index of the control food was recorded as 95.3 which reflect a high Glycemic index according to the glycemic index scale (low G.I<55, moderate G.I=56-69, high G.I=70 and above). Likewise for the formulated food, the Glycemic index was recorded as 91.66 which is also a high Glycemic index value. The high Glycemic Index of the study food indicate how consumption of the food could lead to the production of high glucose in the body which is the major fuel in driving metabolic activities, hence this may lead to the recovery of the children by promoting body activities due to more energy produced from the food. Result of appetite test (table 2) shows that, the study food is highly acceptable to the children as they can finish 150gram of the food within 6.4 minutes and the energy content of the food is about 490.1Kcal/kg.

A significant increase ($p<0.05$) in mean serum total protein, albumin and globulin concentrations (table 3) of male malnourished children was found when compared between baseline and after receiving the study food for the period of two weeks. Also, significant increase ($p<0.05$) in mean serum globulin concentration of female malnourished children was found after receiving the study food for the study period. Although, no statistical significant increase ($p<0.05$) in mean serum total protein and albumin of the female volunteers was found (table 3), the values were found to be higher after treatment with the study food than at the baseline level. Manary *et al*., 2004 reported that protein quantity not protein quality, accelerates whole body leucine kinetics and the acute phase response during acute infection in marasmic Malawian children. Hence, it could be suggested that the food could have positive impact on serum protein profile. A study showed tha, total protein and serum albumin are significantly lower in malnourished children when compared to normal healthy children (Chandra and Shweta, 2013). This shows the role of protein in identifying issues of malnutrition in children which can be used as a diagnostic tool in nutritional assessment. Result of this study (table 3) shows that, male subjects were found to have significantly higher ($p<0.05$) mean serum protein and albumin levels before and after treatment than the female volunteers, while female volunteers were found to have significantly higher ($p<0.05$) mean serum globulin level than the male volunteers. This shows that, the study food when consumed by malnourished children can cause a change on their serum protein profile (both males and females).

CONCLUSION

The findings of this study shows that, the glycemic index of the study food is high and has a low glycemic load. The food was highly acceptable to the children, and was found to increase serum protein profile of malnourished children.

Table 1: Glycemic Index and Glycemic load of Study Food and that of Bread

FOOD	Glycemic index (mg/dl)	Glycemic load
BREAD	95.30 ± 12.02	57.18
STUDY FOOD	91.66 ± 6.54	27.65

Values for glycemic index are expressed as mean ± standard deviation

Table 2: Energy content and Acceptability of study Food by Children

Study food Energy Kcal/kg	Rate of consumption of 150g of study food (min)
490.01	6.4±1.02

The value of the rate of consumption is expressed as mean ± standard deviation.

Table 3: Serum Protein Profile of Males and Females Malnourished Children Before and After Administration of Therapeutic Food.

PARAMETERS	Concentration before Consuming study food (mg/ml)		Concentration after consuming study food (mg/ml)	
	Male n=10	Female n=10	Male n=10	Female n=10
TP	1.697 ± 0.508[a]	1.480 ± 0.561[a]	1.786 ± 0.556[b]	1.678 ± 0.582[b]
ALB	1.098 ± 0.244[a]	1.181 ± 0.369[a]	1.182 ± 0.260[b]	1.326 ± 0.296[b]
GLO	0.599 ± 0.437[a]	0.299 ± 0.483[a]	0.604 ± 0.432[b]	0.352 ± 0.478[b]

Results are presented as mean ± standard deviation, the values bearing similar superscript across the rows are significantly different ($p<0.05$). Total protein TP, Albumin ALB and Globulin GLO

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