

Original Article

Carbaodeim: A natural haematinic blend for treatment of dimorphic anemia of malnutrition

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ABSTRACT

Sudanese nomadic tribes living in the Sahara Region west of Khartoum State depend completely on food made of sour milk and other milk products cooked with onion and dried meat. This is usually added to a porridge made of sorghum flour. Goat and sheep milk is the main component and green vegetables are not commonly taken with this meal. Adults, who move out of their residential areas may have access to other types of food in towns and cities while mothers and children, staying always at home, do not have similar chances. Furthermore, in these desert areas there is always difficulty in reaching health care facilities and getting medicines. Children from these areas who presented to Ombada Teaching Hospital – west of Omdurman- had very low hemoglobin and their peripheral blood picture showed dimorphic type of anemia. In the search for locally available ingredients that can prevent the occurrence of this type of anemia among the affected population, we

studied the constituents of the commonly available fruits and vegetables in the area. We succeeded to formulate a blend (Carbaodeim) made of Carrots (25 gm), Baobab (100 gm) and Godeim (100 gm) which is found to contain iron (34.8 mg), folic acid (2.5 mg), ascorbic acid (372.8 mg), vitamin A (7000 mg), calcium (896.7 mg) and potassium (1910 mg), with many other components that have high nutritional value. This blend is easy to make, safe, nutritious, refreshing and cost effective.

Carbaodeim is a naturally available and cost effective haematinic blend that might be added to the food menu of nomadic people as well as patients admitted to hospital with malnutrition or dimorphic type of anemia.

Key words:

Nutrition; carrots; baobab; godeim; haematinic blend; vitamins; minerals

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INTRODUCTION

Iron deficiency anemia is the most common type of anemia seen in the pediatric age group 3-5 years. In the absence of evident blood loss secondary to peptic ulcer, Meckle's diverticulum, polyps, hemangioma, cow's milk protein allergy or heavy worm infestations, inadequate iron intake should be suspected especially in areas where iron-containing food is not always available or it is costly or difficult to process. The vicious cycle of poor income, poor intake, poor health and poor production has a strong impact on the life of Sudanese children belonging to Kawahla, Gurayat and Hawara tribes living in the desert area east of Kordofan and west of Khartoum State. These are nomadic tribes who lack information, transport and an income that allows them to have balanced diet or access to health facilities. Children usually present late with symptoms and signs of cardiac decompensation and in some, severe anemia was an incidental finding. In the search for iron-containing foods that are available in these areas, are affordable and do not need cumbersome processing, we looked at the vegetables, fruits, poultry products and other food items commonly used by people. Baobab, Godeim and Carrots were found to be available, affordable, easy to process and among the most common fruits and vegetables used by the indigenous population of this area.

Carrot

This is a root vegetable that can be eaten fresh or cooked, however, light cooking and steaming increases its carotenoids content (Figure 1). It is available mostly during autumn and winter seasons. It contains high levels of vitamin A, C, K and folic acid. Its high content of carotenoids (pro-vitamin A) prevents blindness [1- 3]. It contains lycopenes that are known to lower the blood cholesterol, prevent dryness of the skin and prevents lung cancer and mouth ulcers by its antimutagenic and immunostimulant properties.

It contains antioxidants that act against free radicals and its high content of pectin is useful in treatment of diarrhea. A medium size carrot weighs about 125 grams and a small tea cup measures 100 grams of peeled and chopped carrots.

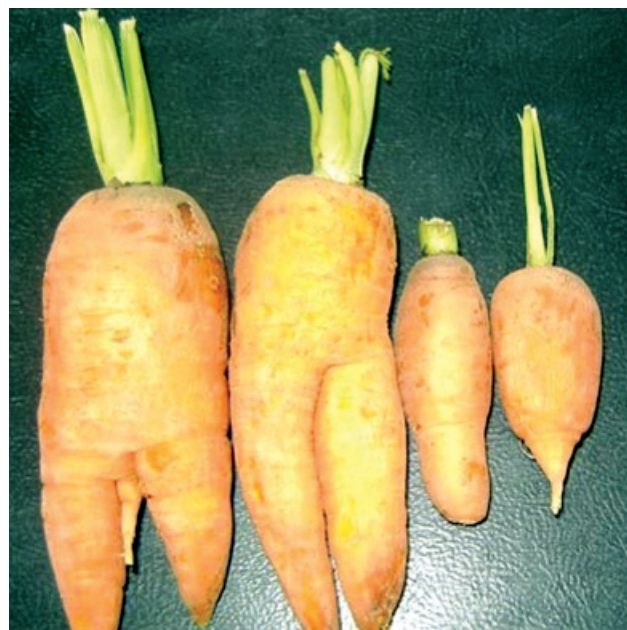


Figure 1 - Carrots family.

Baobab

This is a dry fruit that has an ovoid shell with a white pulp enclosed within hard fibrous locules (Figure 2). Locally, it is called Gonglaize and Tabaldi. The fruit is collected from a deciduous tree that has long life span and it is tolerant to high temperatures and long periods of draught. The tree, *Adansonia Digitata*, has a huge and capacious stem that is usually cavitated by people to store water in it for use during dry seasons. The leaves of the tree are used in preparation of salads and soups and the fruit is used as a refreshing drink. The pulp is white in color and changes into brown when exposed to air and sun because of its high pectin content. The presence of citric, tartaric, malic and succinic acids gives it an acidic taste and is used as a curdling agent for milk.



Figure 2 - Baobab with shell, locules and pulp.

Pectin substances identified in Baobab include galacturonic acid, rhamnase, arabinose, and xylose. It has high levels of calcium, phosphorous, potassium, iron, ascorbic acid and thiamine. It has very low fat, trypsin inhibitors, and phytate content [4-10]. Two small tea cups full of baobab (pulp and seed) measures about 100 grams, while one small tea cup full of powdered bulb equally measures 100 grams. It is used in Senegal as a nutrient for pregnant and lactating ladies. It is recently endorsed as a food supplement by the Italian cyclists, Formula One drivers and football players.

Godeim

This is a fruit collected from the shrub, *Grewia Tenax*, that grows in Savanna and heavy rain regions (Figure 3). It grows also in rocky and semi-desert areas. It is a two meter tall shrub and the fruit is red-orange colored with 4 spheroid lobes. The fruit is stored dry, has a sweet taste and is commonly used as a refreshing drink, though the fermented drink is used by some as an alcoholic beverage. It has high carbohydrate

content (starch and reducing substances), pectin, iron, potassium and calcium. It has low content of fat, protein, tannin and sodium [11, 12].



Figure 3 - Godeim: Orange-red spheroid fruit.

MATERIAL AND METHODS

To make this blend, Baobab (100 gram) and Godeim (100 grams) are washed and soaked in water overnight, filtered with muslin cloth, the solution is used for the blend and the residue is discarded. Carrot (25 grams) is washed, peeled, cut in small pieces, smashed by a pestle and mortar and then added to the solution. The blend is stirred vigorously and may be served after adding sugar or without sugar according to request. Small tea cups were used for measuring the amounts of the ingredients as they are available with all families and are easy to use. One small tea cup full of Baobab powder (leveled) or two small tea cups of pulp and seeds equals almost 100 gm. One small tea cup full of Godeim fruits (heaped) equals 100 gm. For carrots, only one quarter of a small tea cup full is used in the blend (or one quarter of a medium size

carrot). The total amount of water to be added to the fruits is one liter i.e. 7 small tea cups full of water (one small tea cup full of water equals 150 ml). To avoid fermentation and contamination, the blend should be used on the same day. Analysis methods used to determine the contents of the blend were the AOAC and Ranganna methods [13, 14].

RESULTS

The blend, Carbaodeim, (Figure 4) which is made of 100 grams of Baobab, 100 grams of Godeim and 25 grams of Carrots contains 9.8 – 10.6 grams protein, 0.87 grams of fat, 142.42 grams carbohydrates, 30.3 – 39.3 mg iron, 372.55 mg ascorbic acid, 3.5 mg folic acid, 896.65 mg calcium, 146.8 mg phosphorous, 260 mg magnesium, 3.7 mg zinc, 7000 µg vitamin A, 0.03 mg B6, 3.3 µg vitamin K, 1910.5 mg potassium and 265.1 mg sodium (Table 1).



Figure 4 - *CARBAODEIM containing 100 gm measures of Carrots, Baobab and Godeim (Car: Carrots; Bao: Baobab; Deim: Godeim)

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Table 1 – Composition of Carbaodeim

	Carrots (100 gm)	Baobab (100 gm)	Godeim (100 gm)	Grand total	Total with ¼ Carrot (25gm)	RDA
Vit A	28000 µg			28000 µg	7000 µg	400 µg
B6	0.14 mg			0.14 mg	0.03 mg	0.9-1.3 mg
Vitamin K	13.2 µg			13.2 µg	3.3 µg	
Potassium	910 mg	283 mg	1400 mg	2593 mg	1910.5 mg	
Sodium	910 mg	27.9 mg	9.7 mg	947.6 mg	265.1 mg	
	Carrots (100gm)	Baobab (100gm)	Godeim (100gm)	Grand total	Total with ¼ Carrot (25gm)	RDA
Protein	4-5gm	3.2gm	5.6gm	12.8- 13.8gm	9.8-10.6gm	
Fat	0.19gm	0.3gm	0.52gm	1.01gm	0.87gm	
CHO	10.14gm	76.2gm	63.7gm	150.04gm	142.42gm	
	Carrots (100gm)	Baobab (100gm)	Godeim (100gm)	Grand total	Total with ¼ Carrot (25gm)	RDA
Ca	27mg	295mg	595mg	917mg	896.65mg	800mg
Ph	44mg	50.8mg	85mg	179.8mg	146.8mg	800mg
Mg	15mg	90mg	167mg	272mg	260.7mg	150- 200mg
Zn	-	1.8mg	1.9mg	3.7mg	3.7mg	10mg
	Carrots (100gm)	Baobab (100gm)	Godeim (100gm)	Grand total	Total with ¼ Carrot (25gm)	RDA
Fe		9.3mg	21-30mg	30.3- 39.3mg	30.3- 39.3mg	
Ascorbic acid	9.3mg	300mg	70.25mg	379.55mg	372.55mg	
Folic acid	14mg			14mg	3.5mg	

RDA = Recommended daily allowance.

DISCUSSION

Nutritional anemia is common among children in the age group 3 to 5 years. It is seen late in children of the nomadic tribes of the Saharan region east of Kordofan region and west of Khartoum State because of inadequate supply of iron-containing foods and difficulties to access health facilities. Common fruits and vegetables used by these people included Carrots, Baobab and Godeim. With the amounts used in Carbaodeim blend, for healthy children as well as anemic or malnourished children admitted to hospital for treatment, the blend supplies amounts of iron, folic acid, ascorbic acid and protein that outweigh the amounts given by commonly used hematinic syrups, formulae and mineral-vitamin mix (Table 2). The high content of vitamin A, vitamin C, iron and potassium makes it possible to use the blend once or twice a week rather than on daily basis. In the mean time, the presence of ascorbic acid, amino acids sugars and citrates in this blend enhances the absorption of the non-haem iron found in Godeim. Pectin which is a soluble but non-absorbable fiber decreases the episodes of diarrhea in these children. Compared to the commonly used commercial haematinics and the WHO Combined Mineral and Vitamin Mix (CMVM), F-75, F-100 and RUTF, Carbaodeim is superior in its

mineral and vitamin contents, thus it may be added to the food menu for children with dimorphic type of anemia and for severely malnourished children. A paste made of mango, pumpkin, baobab and godeim was formulated by Abdel-Rahman et al [15], however in a nomadic setting of life, cost, processing and storing are difficult to attain, thus limiting the use of such a product. Furthermore, the presence of high level of vitamin A in both mango and pumpkins makes it hazardous to use such a paste without good monitoring.

Carbaodeim is a haematinic blend that is easy to prepare from ingredients that are in common use and almost always available at a low cost in the Western part of Sudan. We recommend that Carbaodeim should be part of health education on nutrition delivered to school girls, mothers, pregnant ladies and lactating mothers. As well, it may also be included in the food menu of children admitted to hospital with nutritional anemia or those who present with severe malnutrition. However, a controlled trial in hospital and in a community rehabilitation center is recommended to assess acceptability, compliance, efficacy and outcome of using this blend in treatment of anemic children.

Table 2: Constituents of Carbaodeim compared to other hematinic drugs and the Required Daily Allowance (RDA)

	Carrots (per 100gm)	Baobab (per 100 gm)	Godeim (per 100 gm)	Grand Total	Total (with 25gm carrots)	*Multivitamin Syrup per 5ml (+honey)	**Multivitamin + Iron per 5ml (+honey)	F-100 per 100gm	CMVM per Liter	RDA (1-5yrs)
Protein	4-5gm	3.2gm	5.6gm	13.3 gm	11.55 gm			2.9gm		
Fat	0.19gm	0.3gm	0.52gm	1.01 gm	0.87gm			60gm		
CHO	10.14 gm	76.2gm	63.7gm	150.04 gm	142.42gm			4.2gm		
Ca	27mg	295mg	595mg	917 mg	896.7mg	25mg	10mg	300mg		800mg
Ph	44mg	50.8mg	85mg	179.8 mg	146.8mg	25mg	10mg	300mg		800mg
Fe		9.3mg	21-30mg	34.8 mg	34.8mg		10mg	<0.2mg		15-10mg
Vit A	28000 µg			28000 µg	7000 µg	1200 I U		800µg	1.5mg	400-500 I.U
Vit D						100 I U		15µg	30µg	400 I.U
Thiamine						1mg	5mg	0.5mg	0.7mg	0.7-0.9 mg
Riboflavin						1mg	1mg	1.6mg	2mg	0.8-1mg
Niacin	0.92mg				0.23mg	5mg	10mg	-	10mg	9-11mg
Ascorbic Acid	9.3mg	300mg	70.25mg	379.55 mg	372.85mg	50 mg	-	50mg	100mg	45-50mg
Pyridoxine B6	0.14mg			0.14 mg	0.03 mg	0.5 mg	1mg	0.6mg	0.7mg	0.9-1.3 mg
Folic Acid	14mg			14 mg	3.5mg		2mg	200µg	0.35mg	100-200 µg
Mg	15mg	90mg	167mg	272 mg	260.7mg		-	80mg	3.5gm	150-200mg
Zn		1.8mg	1.9mg	3.7 mg	3.7mg		3mg	11mg	3.3gm	10 mg
Iodine							-	70µg		70 µg
Vit E						1mg		20mg	22mg	5-6mg
B12							5µ g	1.6µg		2-2.5 µg
Manganese							0.25mg	-		
Cu							0.2mg	-	0.56 gm	
Lysine							20mg	-		
Vit K	13.2 µgm			13.2µgm	4.4mg		20mg	15µgm	40 µg	
K	910mg	283mg	1400mg	2593 mg	1910 mg		20mg	1100mg	121.9gm	
Na	910mg	27.9mg	9.7mg	947.6 mg	264.6 mg		20mg	<290mg		

*200 ml=25.5 SDG, **200ml=21.5 SDG (commonly used brands in Sudan). F100: WHO Formula 100. CMVM: WHO mineral vitamin mix. RDA: Required Daily Allowance

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