

**A review of nutritional guidelines and menu  
compositions for school feeding  
programs in 12 countries.**

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## ABSTRACT

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**Study objectives:** To analyse the nutritional guidelines and menu compositions of school meal provision in various different countries.

**Background:** School feeding is the provision of food on-site or to take home which aims to increase school enrolment, attendance and retention, and exist as a social safety net for households with very low income. Home-grown school feeding (HGSF), additionally, aims to stimulate local economies by providing a source of income for local smallholder farmers.

**Methods:** Literature searches using the Ovid MEDLINE databases, gathered information from in-country stakeholders, and accessed the programme websites of various countries. Nutrient composition of these menus was calculated from nutritional guidelines and menu compositions using a nutrition linear programming tool (NUTVAL).

**Country comparisons:** School feeding aims differ between countries of each income group. The implementation, delivery of service and nutritional content of foods also differ considerably between countries and income groups. In high-income countries, guidelines and standards have been recommended in an attempt to combat rising levels of overweight and obesity, and to model healthier lifestyle habits. In low-income countries there is a gap in terms of guidance on nutrition standards and menu composition.

**Conclusions:** Provision of evidence-based guidance on nutrition standards to middle and low income countries who have recently established or are planning to establish school feeding has the potential to greatly enhance and improve the quality of service and improve the life of millions of children worldwide.

**Key words:** *school feeding, home-grown school feeding, nutrition, guidelines, poverty, education*

## INTRODUCTION

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Nearly a billion people in the world do not have enough to eat and 98% of them live in middle and low-income countries.<sup>(1)</sup> Women make up over 60% of the hungry in the world whilst they represent just over 50% of the world population.<sup>(2)</sup> High-income, and now increasingly middle and low-income countries have an additional social problem and challenge. Overweight and obesity levels are increasing and various studies have identified that schoolchildren consume unhealthy foods and lack adequate knowledge in healthy eating habits and lifestyle choices.<sup>(3-6)</sup> School feeding is one important method of positively addressing these complex issues in all these countries.

### ***What is School Feeding (SF) and Home-Grown School Feeding (HGSF)?***

School feeding (SF) is the provision of food on-site or to take home. Home-grown school feeding is a broad based definition for SF programmes where goods and services for meal preparation are procured from small-holder farmers and businesses. HGSF can be seen as a vehicle to stimulate local economies by providing a market and source of income for local smallholder farmers. In addition, it can also be used as a strategy to ensure that SF menus contain a variety of nutritious food that schoolchildren are accustomed to. These programmes aim to achieve a variety of positive outcomes. The aims of school feeding differ according to country. This review focuses on school feeding in high, middle and low-income countries. For each country we have mentioned the main aims and objectives of the country-specific school feeding program (SFP), its framework, service delivery, nutritional guidelines (or the lack of it) and the nutritional composition of menus.

In high-income countries, SFPs aim to tackle the rising levels of childhood overweight and obesity. In middle and low-income countries SFPs have two different branches of aims. In the short-term, it aims to alleviate hunger, exist as a social safety net for households with very low income and increase enrolment of children into schools.<sup>(7)</sup> In the longer-term, it aims to improve the nutritional status, attendance, cognitive development and retention of schoolchildren.<sup>(7)</sup> A Cochrane review, which contained trials from five continents and spanning eight decades, concluded that “school feeding programmes significantly improve growth and cognitive performance of disadvantaged children.”<sup>(8)</sup>

There are two main modalities of school feeding: in-school feeding and take-home rations.<sup>(9)</sup> These are usually complimented with other interventions such as fortified biscuits and deworming programmes.

There is evidence that school feeding increases enrolment, attendance, retention, educational achievement and alleviates short-term hunger.<sup>(10-12)</sup> However, further research must be conducted in order to determine how much of a significant longer-term benefit school feeding has over other social safety nets.

These positive aspects of school feeding are coupled with the negative aspects or trade-offs. There is plenty of evidence that show school feeding increases enrolment, attendance and retention; however, this is not the case with the improvement of overall nutritional status of schoolchildren.<sup>(10)</sup> It has been observed that in certain cases SFPs have led to schoolchildren being fed less at home as some parents use the SFP as a replacement for feeding at home whereas, in reality, it is meant to complement the child’s diet in addition to home-feeding.<sup>(8)</sup> These families view the SFP as an income transfer and tend to spend the food budget of these

schoolchildren on other household purchases. For a SFP to be successful it must be ensured that this substitution effect does not take place.

Studies conducted in Ghana, Kenya, Mali and Rwanda have concluded that there is a need for guidelines on nutrition and menu designs to be recommended in countries that have established HGSF programmes.<sup>(13)</sup> Currently, there are no nutritional guidelines in these countries and very little guidance on menu design.

This review analyses the nutritional guidelines and menu compositions of various countries in order to gauge the amount of nutrients that are being delivered through SFPs via on-site feeding, with a view to highlight where there is a need to establish and implement guidelines to improve the quality of life of schoolchildren. In England, France, USA, Italy, Finland and Brazil we focused mainly on the current nutritional guidelines and how national programmes of school meal provision are implemented. In Ghana, India, Kenya, Mali and Rwanda we examined if a standard existed for SF programmes, the nutritional content of menus and how much local produce is incorporated into these menus.

## **METHODS**

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Relevant literature was searched using a variety of methods, including searches using the Ovid MEDLINE databases (from 1946 to present), information from PCD teams' currently collecting data in Nigeria, Kenya and Ghana, and through school food programme websites of various countries. We focused on on-site feeding and lunch time meals only. We used reviews to obtain nutritional guidelines, and studies and state school feeding documents to obtain menu compositions. We compared these nutritional values with the Recommended Daily Allowance (RDA) advised by the World Health Organization (WHO) for each nutrient. Nutritional guidelines were

obtained for England, France, USA and Brazil and the percentage composition of nutrients was calculated using these guidelines. There are no legislated or advised nutritional guidelines in Ghana, India, Kenya, Mali and Rwanda: nutritional values were calculated using the 'NutVal' nutritional value calculator,<sup>(12)</sup> from a sample of menu compositions found for each country in the literature. For Ghana we were not able to find guidelines or the daily ration amount for the menu composition so values were estimated in comparison with other countries in the region. Nutritional guidelines or menu compositions for Italy and Finland were not available. For countries without references to the cost per meal, the cost per daily meal per child was calculated using average costs of SFPs of these countries. All currency units were converted into US dollars using the online XE Currency Converter.<sup>(14)</sup> Data were collected and compared for eleven countries classified into their respective income groups as per World Bank classifications.<sup>(15)</sup>

## **NUTRIENT INTAKE**

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Recommended Nutrient Intake (RNI) is the daily intake which meets the nutrient requirements of almost all apparently healthy individuals in an age and sex-specific population. There may be differences in the equivalence for different countries. RNI is equivalent to that of Recommended Dietary Allowance (RDA) as used by the Food and Nutrition Board of the US National Academy of Sciences.

RNI are usually captured for both macronutrients and micronutrients.

**Macronutrients** (basically carbohydrates, protein and fat) provide the energy (kilocalories) needed by the body to maintain essential body functions, growth and physical activities. The recommended level of dietary energy intake for a population group which is the mean energy requirement of healthy, well-nourished individuals

who constitute that group may differ slightly depending on the situation. Children and adolescents in rural, traditional communities of developing countries for example are more active than their counterparts living in urban areas, or children from developed, industrialized countries, and hence may have a slightly different requirement. The FAO/WHO/UNU Consultation (2004) endorsed the recommendation to reduce or increase by 15% the requirement of population groups that are less or more active than average, starting at 6 years of age.

**Table 1: Recommended ranges of nutrient intakes (Source: WHO/FAO 2004).**

| <b>Dietary component</b> | <b>Goal expressed as % of total energy</b> |
|--------------------------|--|
| Total carbohydrates      | 55-75%                                     |
| Total fat                | 15-30%                                     |
| Proteins                 | 10-15%                                     |
| Free sugars              | <10%                                       |

There are important differences in energy and nutrient requirements between boys and girls. These differences increase with age, at approximately 5% for boys aged 6, and up to 15% for older boys at around 14 years. Because these differences are minor, there is no need to allocate different rations in mixed schools. On the whole, requirements for macro-nutrients for preschool children are roughly about 70% of the requirements of primary school children. Those of adolescents at the lower secondary level are about 40% higher than those of primary school-age children. It is recommended to use the same commodities (but different ration sizes) for the different age groups whenever the school feeding programme targets pre-primary, primary or lower secondary schools.

Table 2 below presents estimates of recommended energy, protein and fat intakes for purposes of planning food rations for children and adolescents. Although RNI are age and sex specific, for purposes of ration planning for school feeding, wider age ranges are generally used than those of RNI (WFP, 200?) and the proposed age groups are: Pre-primary: 3 to < 6 years; Primary: 6 to <12 years and in some

instances lower secondary, 12 to ≤ 16 years. In all instances, an even distribution by age and sex within each age group is assumed. In view of this arbitrary assumption and classification, the term “Estimated Recommended Nutrient Intakes (ERNI)” is used in our discussion so as to differentiate from the Recommended Nutrient Intakes (RNI).

**Table 2: Estimates of Daily Macronutrient Requirements for Children and Adolescents. (Source FAO/WHO/UNU, 2004.)**

| Age Groups /<br>education<br>level | Age<br>(years)                          | Daily Energy<br>Requirements |                 | Estimates of Daily RNI              |   |   |
|------------------------------------|---|------------------------------|-----------------|-------------------------------------|---|---|
|                                    |   | Boys<br>(Kcal)               | Girls<br>(Kcal) | Energy<br>Boys &<br>Girls<br>(Kcal) | Protein<br>Boys & Girls<br>[10-15% of<br>energy]<br>(g) | Fat<br>Boys & Girls<br>[15-30% of<br>energy]<br>(g) |
| Pre-<br>Primary/ECD                | 3-4                                     | 1252                         | 1156            |                                     |   |   |
|                                    | 4-5                                     | 1360                         | 1241            | 1300                                | 33-49   | 22-43   |
|                                    | 5-6                                     | 1467                         | 1330            |                                     |   |   |
|                                    | <i>Average<br/>for 3-6<br/>years</i>    | <i>1360</i>                  | <i>1240</i>     |                                     |   |   |
| Primary                            | 6-7                                     | 1573                         | 1428            |                                     |   |   |
|                                    | 7-8                                     | 1692                         | 1554            |                                     |   |   |
|                                    | 8-9                                     | 1830                         | 1698            |                                     |   |   |
|                                    | 9-10                                    | 1978                         | 1854            | 1850                                | 46-69   | 35-62   |
|                                    | 10-11                                   | 2150                         | 2006            |                                     |   |   |
|                                    | 11-12                                   | 2341                         | 2149            |                                     |   |   |
|                                    | <i>Average<br/>for 6-12<br/>years</i>   | <i>1930</i>                  | <i>1780</i>     |                                     |   |   |
| Lower<br>secondary                 | 12-13                                   | 2548                         | 2276            |                                     |   |   |
|                                    | 13-14                                   | 2770                         | 2379            |                                     |   |   |
|                                    | 14-15                                   | 2990                         | 2449            | 2600                                | 65-98   | 44-88   |
|                                    | 15-16                                   | 3178                         | 2491            |                                     |   |   |
|                                    | <i>Average<br/>for 12-<br/>16 years</i> | <i>2870</i>                  | <i>2400</i>     |                                     |   |   |

**Micronutrients** comprise vitamins and minerals that help to regulate growth, activity, development, functioning of the immune and reproductive systems and are needed by the body in minute amounts.

The age grouping used by FAO, UNICEF, UNU and WHO for nutritional requirements, does not coincide with that of UNESCO as regards level of schooling in the education system, particularly for adolescents. Recommended intakes for iron are disaggregated by sex for the subgroups 11-14 and 15-17. In this case, the 11-14 years sub-group coincides roughly with “early adolescence” although this differs from UNFPA age grouping of 10-15 years. Recommended iron intakes are much higher for menstruating adolescents (for example in the case low iron bioavailability, the recommended intake is 32.7 mg/day as compared with 14.0 mg/day for non-menstruating adolescents.) In the case of adolescent girls, the figures retained in the table below are those of non-menstruating adolescents based on a review of various studies which report average age at menarche (menstruation) to range from 12.5 years in high income countries, to 15 and above in poorer countries (WHO 2005). This figure needs to be verified as there is an indication that age at menarche is progressively decreasing in high income countries. For iron, the proposed estimate is based on very low iron bioavailability (i.e. 5%), The figure in brackets refers to situations of low iron bioavailability (i.e. 10%). The table below focuses on three micronutrients of great concern in developing countries particularly for adolescent girls and children, namely iron, iodine and vitamin A.

**Table 3: Recommended micronutrient intakes. (Source FAO/WHO/UNU, 2001.)**

| Age Groups <sup>a</sup><br>(years) | Recommended Safe Level of Intake |          |                     |                           | Estimates of Daily RNI for<br>planning daily rations <sup>f</sup> |        |           |
|------------------------------------|----------------------------------|----------|---------------------|---------------------------|---|--------|-----------|
|                                    | Iron based on<br>bioavailability |          | Iodine              | Vitamin A                 | Iron  | Iodine | Vitamin A |
|                                    | mg/day <sup>c</sup>              |          | µg/day <sup>d</sup> | µg<br>RE/day <sup>e</sup> | Mg  | µg     | µg RE     |
|                                    | Low                              | Very low |                     |                           |   |        |           |
| Pre-Primary                        |                                  |          |                     |                           |   |        |           |
| 1-3                                | 5.8                              | 11.6     | 90                  | 400                       | 12 (6) <sup>g</sup>   | 90     | 450       |
| 4-6                                | 6.3                              | 12.6     | 90                  | 450                       |   |        |           |
| Primary                            |                                  |          |                     |                           |   |        |           |
| 7-10                               | 8.9                              | 18.8     | 120                 | 500                       | 17.8 (9)  | 120    | 500       |
| Lower<br>Secondary                 |                                  |          |                     |                           |   |        |           |
| 10-18                              |                                  |          |                     |                           |   |        |           |
| Females 11-14 <sup>b</sup>         | 14                               | 28       | 150                 | 600                       | 29 (15)   | 150    | 600       |
| Males 11-14                        | 14.6                             | 29.2     |                     |                           |   |        |           |

#### Age Groups

- a) **Iron:** “Recommended Iron Intake (mean + 2 SD) for diets of different bioavailability” based on UNICEF/UNU/WHO (2001) Iron Deficiency Anaemia Assessment, Prevention, and Control - *A guide for programme managers*. Geneva, World Health Organisation.
- b) **Iodine:** “Daily Iodine Requirement” based on WHO (2001b) Assessment of the iodine deficiency disorders and monitoring their elimination. Geneva, World Health Organization.
- c) **Vitamin A:** “Recommended Safe Intake” based on FAO/WHO (2001a) Human Vitamin and Mineral Requirements, Report of a joint FAO/WHO Expert Consultation Bangkok, Thailand.

## COUNTRY COMPARISONS

This section examines in detail the school meal provision in five high-income countries (England, France, USA, Italy and Finland), four middle-income countries (Brazil, Ghana, India and South Africa) and three low-income countries (Kenya, Mali and Rwanda).

### High income countries

In **England**, the School Meals Review Panel, appointed by the Government, published its report titled *‘Turning the Tables’*<sup>(16)</sup> which led to the implementation of

new food standards regarding food sold or served in schools. The Department for Education and Skills (DfES) established the School Food Trust (SFT) in 2005 and aims “to promote the education and health of children and young people by improving the quality of food supplied and consumed in schools”.<sup>(17)</sup> Various funding mechanisms are in place to aid the SFT.<sup>(18)</sup> Nutrient-based food standards came into effect in September 2008.<sup>(16)</sup> Catering is provided either by the Local Authority or schools organised their own catering service via private catering services or through an in-house service.<sup>(19)</sup> Local Authorities (LAs) either offer an offer in-house catering service or use a centrally procured private contractor. The average cost of a school meal is \$2.58 in primary schools and \$2.72 in secondary schools (in 2006-2007).<sup>(20)</sup> Free school meals (FSM) are available to children from families as per assessment criteria by HM Revenue & Customs.<sup>(21)</sup> A canteen style service is in place in almost all schools with some pupils bring packed lunches from home. There has been much emphasis on making the dining environment more appealing.<sup>(22)</sup> The SF framework for England is shown in *Table 4* and the nutritional guidelines are shown in *Table 5*.

**France** aims to ensure that schoolchildren receive essential and high-quality nutrients. Funding for school meals in France is subsidised by approximately 50% by the Ministry of education and the remainder paid by parents, the amount being determined according to their level of employment.<sup>(23)</sup> Local councils are in charge of providing the meals and they are increasingly contracting the meals to private caterers.<sup>(24)</sup> The cost of a school meal varies across France from around \$5.54 to \$7.12 per child.<sup>(25)</sup> Approximately 50% of schoolchildren eat a school lunch.<sup>(26)</sup> The majority of French schools operate a canteen-style service. School meals are mostly 3 or 4 courses. Vending machines were banned in schools in September 2005.<sup>(27)</sup>

The SF framework for France is shown in *Table 4* and the nutritional guidelines are shown in *Table 5*.

In the **United States of America** (USA), the National School Lunch Act was passed with the aim of improving the health and well-being of the schoolchildren. At the federal level, the United States Department of Agriculture's (USDA) administers the National School Breakfast Programme and the National School Lunch Programme and at the local level, state education agencies operate the programmes.<sup>(28)</sup> It was reported by USDA in 2003 that the programme's cost £7.1bn.<sup>(23)</sup> The Fresh Fruits and Vegetables Program operate in four states and three tribal Organizations.<sup>(29)</sup> School districts use the lowest cost bid approach in order to reduce costs. Reducing costs are deemed as necessary due to stringent federal reimbursement processes. This has led to many questions being raised about the quality of food served.<sup>(30)</sup> The average cost of a canteen lunch is \$1.55,<sup>(23)</sup> with subsidies and free school meals available to families with low-income.<sup>(31)</sup> Majority of the meals are served canteen style. The SF framework for the USA is shown in *Table 4* and the nutritional guidelines are shown in *Table 5*.

In **Italy** there is a great emphasis on organic food and sustainability. The Finance Law 488 ensures that regional and organic sourced foods are promoted, along with Italian farming practices and the Italian food culture. The Government invests on ingredients and the school meal service.<sup>(32)</sup> Due to the promotion of organic foods, almost 60% of LAs purchase these for meal preparation and non-organic food has to be certified under specified regulations.<sup>(32)</sup> GM foods are not permitted. An average school meal costs \$4.68.<sup>(33)</sup> In families which have more than one child attending school, a 20% discount is offered on total cost of the school meal.<sup>(34)</sup> The majority of schoolchildren use a school lunch. The dining experience is considered very

important in Italy and much emphasis is placed on Italian food culture and healthy eating. Young schoolchildren (aged 2-14) sit at round tables covered by table cloths and silverware and they are served a three course meal with teachers often joining them.<sup>(32)</sup> Meals are provided free for the poorest families, with discounts for low-income families.<sup>(30)</sup> The SF framework for Italy is shown in *Table 4*. We could not find any nutritional guidelines for Italy.

In **Finland**, since 1983, all students in schools and sixth form colleges are entitled to a free meal.<sup>(25)</sup> This meal is required to fulfil one third of the pupil's daily food requirements. This is funded by the Ministry of Social Affairs and Health <sup>(35)</sup> and each municipality is responsible for organising the meals and receives an approximate 70% subsidy of the costs from the Government.<sup>(36)</sup> Meals are provided either by the municipality council or a private catering company.<sup>(25)</sup> The cost of a free meal per school child is on average \$2.63. The children serve and return the food trays themselves and this reduces labour costs.<sup>(37)</sup> The dining environment is well-furnished and there is great emphasis on the learning of table manners and Finnish customs.<sup>(25)</sup> Packed lunches are not allowed. It is required that a meal must contain a main course, salad, drink, bread and margarine.<sup>(25)</sup> The SF framework for Finland is shown in *Table 4*. We could not find any nutritional guidelines for Finland.

**Table 4: School meal provision frame work table for high-income countries. This table compares the Aims and Objectives, Policy and Implementation and Delivery of Service between high-income countries.**

| <i>(High Income)</i>               | <b>England</b>  | <b>France</b>   | <b>Italy</b>   | <b>Finland</b>   | <b>USA</b>   |
|------------------------------------|---|---|--|--|--|
| <b>Aims and Objectives</b>         | “Promoting education and health of children and young people by improving the quality of food supplied and consumed in schools”. <sup>(17)</sup>  | To ensure that schoolchildren receive essential and high-quality nutrients. Current school lunches found to be often high in fat and protein and low in dairy products, fruits and vegetables. <sup>(25)</sup>  | Great emphasis on organic food and sustainability. Promotion of Italian farming practices and the Italian diet and food culture. <sup>(25)</sup>   | To ensure students in schools and sixth form colleges receive high quality nutritious food. To support the learning of manners and Finnish customs. <sup>(25)</sup>  | Improving the health and well-being of the schoolchildren. <sup>(25)</sup>   |
| <b>Policy</b>                      | The School Food Trust (SFT) was set up by the DfES in 2005 to achieve above-mentioned aim.  | Ministry of National Education and Minister for Research has set out non-compulsory nutrient and food-based guidelines.   | The Finance Law 488 ensures that regional and organic sourced foods are promoted.  | All students in schools and sixth form colleges are entitled to a free meal. <sup>(25)</sup><br>The meal is required to fulfil one third of the pupil's RDA.   | National School Lunch Act passed to achieve above-mentioned aim. <sup>(28)</sup>   |
| <b>Implementation and delivery</b> | Catering is provided by the LA or through private catering service. LAs either offer an in-house catering service or a centrally procured private contractor. <sup>(19)</sup><br><br>Meals are usually served canteen style and some pupils bring packed lunches from home. | Local councils in charge of providing meals. An increase in contracting meals out to private caterers. <sup>(24)</sup><br><br>Majority of schools operate a canteen style service. Vending machines are banned in schools. <sup>(27)</sup> If schools do not serve breakfast, guidelines suggest, serve food, preferably a diary product, at least 2 hours prior to lunch time. <sup>(52)</sup> | The Italian government invests on ingredients and the school meal service. <sup>(32)</sup> Local Authorities purchase food-stuff for meal preparation.<br><br>Young schoolchildren (aged 2 -14) sit at round tables, table cloths, crockery and silverware and they are served a three course meal with teachers often joining them. <sup>(32)</sup> | Each municipality is responsible for organising the meals. <sup>(36)</sup> Meals are provided either by the municipality council or a private catering company. <sup>(25)</sup><br><br>Cafeteria style service.<br><br>Packed lunches are not allowed. <sup>(25)</sup> | At the federal level, the USDA administers the National School Breakfast Programme and the National School Lunch Programme whereas at the local level, state education agencies operate the programmes. <sup>(28)</sup><br><br>Majority operate a canteen style service. |

**Table 5: Nutrition guidelines comparison between England, France, USA, Italy, Finland and Brazil.**

|                                   | WHO RDA<br>(10-14<br>years) <sup>(12)</sup> | England <sup>(53)</sup> | France <sup>(53)</sup>             | USA <sup>(53)</sup>    | Italy                  | Finland                | Brazil <sup>(54)</sup> |
|-----------------------------------|---|-------------------------|------------------------------------|------------------------|------------------------|------------------------|------------------------|
| Daily ration<br>g/person/day      | -   | -                       | -                                  | -                      | -                      | -                      | -                      |
| Energy Kcal                       | 2210  | 663 (30%)               | 884<br>(40%)                       | 995<br>(45%)           | -                      | -                      | 660<br>(30%)           |
| Protein g                         | 50  | 15<br>(30%)             | 7.5<br>(15%)                       | 10<br>(20%)            | -                      | -                      | 20<br>(40%)            |
| Fat g                             | 42.1  | 15<br>(35%)             | 15<br>(35%)                        | 13<br>(30%)            | -                      | -                      | 16.3<br>(39%)          |
| Calcium mg                        | 600   | 210 (35%)               | 150<br>(25%)                       | 180<br>(30%)           | -                      | -                      | 390<br>(65%)           |
| Iron mg                           | 24  | 8<br>(35%)              | 12<br>(50%)                        | 8<br>(35%)             | -                      | -                      | 3.2<br>(13%)           |
| Iodine µg                         | 140   | -                       | -                                  | -                      | -                      | -                      | -                      |
| Vit.A µg RE                       | 550   | 193 (35%)               | -                                  | 220<br>(40%)           | -                      | -                      | 210<br>(38%)           |
| Thiamine mg                       | 0.90  | -                       | -                                  | -                      | -                      | -                      | -                      |
| Riboflavin<br>mg                  | 1.50  | -                       | -                                  | -                      | -                      | -                      | -                      |
| Niacin mg                         | 14.6  | -                       | -                                  | -                      | -                      | -                      | -                      |
| Vit.C mg                          | 25  | 9<br>(35%)              | -                                  | 11<br>(45%)            | -                      | -                      | 18<br>(72%)            |
| Approx. cost<br>per daily<br>meal | -   | \$2.58 <sup>(37)</sup>  | \$5.54 -<br>\$7.12 <sup>(37)</sup> | \$1.55 <sup>(37)</sup> | \$4.68 <sup>(37)</sup> | \$2.63 <sup>(37)</sup> | \$0.15 <sup>(39)</sup> |

### **Middle income countries**

In **Ghana**, school feeding has existed since 1958, mainly through the Catholic Relief Service (CRS) and the WFP with the main aims of tackling poverty and improving the nutritional status of communities.<sup>(38)</sup> SFPs in Ghana aim to increase enrolment and attendance.<sup>(38)</sup> Food used in the SFP menus of CRS and WFP have historically been imported US food surpluses. However, since 2005, WFP has started to purchase corn, salt and palm oil locally.<sup>(38)</sup> In 2004, Ghana developed its own national SF programme and as a result of this 405,000 children receive daily school meals.<sup>(38)</sup> The Ghanaian SFP aims to provide all primary and kindergarten schoolchildren in the poorest areas with a daily nutritious hot meal prepared using local produce. The SF framework for Ghana is shown in *Table 6*.

The Ghanaian SFP is administered at the national level through a secretariat, accountable to a range of Government Ministries, which formulates policies and establishes institutional structures. Policy and practice is filtered down to the regional and district levels. The regional government coordinates and monitors the SFP and the local government implements the programme at the district level through the District Implementation Committee (DIC). It is the responsibility of the DIC to procure food items for the SFP and ensure the running of the programme. At the school level, the School Implementation Committee (SIC) sets the menu, employs the cooks and organises the cooking and provides the food. The cost of a lunchtime meal per child per day is approximately \$ 0.32.<sup>(38)</sup> The menu composition and nutritional content of menus vary across Ghana and changes by time of year. Menu compositions are shown in *Table 7*. Detailed menu compositions can be found in *Appendix 1*.

In **Brazil**, food security is at the centre of social policy through the Zero Hunger Project (*Fome Zero*).<sup>(39)</sup> Part of this project is the *Bolsa Família* programme which gives an amount of money to children from low-income households and in return the children are, at the very least, expected to attend school and complete primary level education. A sum of \$7.41 per child per month is given to a family with an income less than \$59 per capita. For families with incomes of less than \$30 per capita, an additional \$25 is given. The *Bolsa Família* Programme aids over 30 million poor people and is considered as one of the largest conditional cash transfer schemes in the world. Brazil has placed its SFP in its food security policy framework. The SFP aims to reduce the number of malnourished children and improve the rates of school enrolment. Recently, there has been much debate on the nutritional content of the food provided in schools since nearly 40% of the Brazilian population are considered

overweight and 5% considered obese.<sup>(39)</sup> The SF framework for Brazil is shown in *Table 6*.

The SFP is implemented through the School Feeding Committee, which each municipality or state government is required by law to create. Financial transfers are carried out automatically (thus reducing paperwork and other costs) from National Fund for Development of Education to the local governments via ten instalments per year. Public schools receive \$0.09 per student and indigenous schools receive \$0.17 per student.<sup>(39)</sup> The local governments are required to spend 70% of this money on basic food materials and there is an emphasis on purchasing from local producers to stimulate local economies. The approximate cost of a meal is \$0.15.<sup>(39)</sup> Nutritional guidelines are shown in *Table 4*.

In **India** the SFP is known as the Mid-Day Meals (MDM) programme.<sup>(40)</sup> It aims to improve the nutritional status of schoolchildren and improve enrolment and retention. In 2009, The Right of Children to Free & Compulsory Education Act was passed which made it a part of the Constitution that every child has a right to full time elementary education in a formal school of satisfactory and equitable quality. In 1995, the National Programme of Nutritional Support to Primary Education (NP-NSPE) was launched. The SF framework for India is shown in *Table 3*.

The MDM programme is run at the national level by the Department of School Education and Literacy and the Ministry of Human Resources Development through the National Steering and Monitoring Committee (NSMC) which disseminates policy and guidelines, amongst various other responsibilities, to the state level.<sup>(40)</sup> There are further Steering and Monitoring Committees (SMCs) at the state and district and these committees oversee and ensure the implementation of the programme. At the local level, the responsibility for cooking the mid-day meal and its supply is normally

delegated to an organization such as a local women's self-help group, a local youth club or a voluntary organization. Menu compositions are shown in *Table 5*. Detailed menu compositions can be found in *Appendix 1*. We could not find the daily cost per mid-day meal per child in India.

In **South Africa** the school feeding project, known as the National School Nutrition Programme (NSNP), was started in 1994 by President Nelson Mandela as a project of the Reconstruction and Development Programme (RDP) and it targets the poorest areas. [Bastia, 2007].

Initially, the aim of the NSNP was stated as "To contribute to the improvement of education quality by enhancing primary pupils' learning capacity, school attendance and punctuality and contribute to general health development by alleviating hunger. Educating pupils on nutrition and also improving nutritional status through micro-nutrition supplementation. Parasite eradication where indicated. To develop the nutrition component of the general education curriculum". ((White Paper on Reconstruction and Development 1994, page 46, cited in Wilderman and Mbebetho, 2005, page 6)). This led to some confusion on whether the NSNP was a feeding programme, a nutritional intervention or whether its main objective were to improve educational attainment (Wilderman and Mbebetho, 2005). Therefore, in 2004, the NSNP decided to focus on hunger alleviation instead of its nutritional objectives as providing a nutritious meal was deemed as too expensive and difficult to monitor and evaluate. **The SF framework for South Africa is shown in Table 2.**

The Department of Education is responsible for the running of the NSNP which is financed through a central budget with no reliance on international food donations. Policy and guidelines are formulated here and disseminated via the national coordinator to individual provinces to be implemented.

The Department of Education, with consultation from the Department of Health, prepares the menus of which there are 22 options for each province to select from. The provinces select the menus based on social acceptance, availability and cost. (Kallman, 2005). The traditional South African diet is reflected in the menus with the inclusion of ingredients such as samp (a maize-based meal) and beans.

The central government pays service providers for the food procurement. The NSNP menus are only accessible for the children who are included in the programme with other school children required to bring their own food to school as food is not allowed to be sold or taken away from the school premises. Menu compositions are shown in Table 4. Detailed menu compositions can be found in Appendix 1. The cost of providing a lunchtime meal per child per day is approximately \$0.32 (Bastia, 2007).

**Table 6: School meal provision frame work table for middle-income countries. This table compares the Aims and Objectives, Policy and Implementation and Delivery of Service between middle-income countries.**

| <i>(Middle Income)</i>             | <b>Ghana</b>  | <b>Brazil</b>  | <b>India</b>   |
|------------------------------------|---|--|--|
| <b>Aims and Objectives</b>         | To tackle poverty and improve nutritional status of communities. <sup>(38)</sup><br><br>To increase enrolment and attendance. <sup>(38)</sup>               | To reduce the number of malnourished children and improve the rates of school enrolment. <sup>(39)</sup><br>To address the levels of overweight and obesity. <sup>(39)</sup> | To improve the nutritional status of schoolchildren and improve enrolment and retention. <sup>(40)</sup>   |
| <b>Policy</b>                      | Provide a nutritious hot meal daily, prepared using local produce, to all primary and kindergarten schoolchildren in the poorest areas. <sup>(38)</sup>     | The Zero Hunger Project ( <i>Fome Zero</i> ) and <i>Bolsa Familia</i> conditional cash-transfer programme address food security as social policy. <sup>(39)</sup>            | Part of policy of the Department of School Education and Literacy and the Ministry of Human Resources Development through the National Steering and Monitoring Committee. <sup>(40)</sup>  |
| <b>Implementation and delivery</b> | Administered at the national, regional and district levels. District Implementation Committee (DIC) procures food items and runs programme. <sup>(38)</sup> | The national SFP implemented through the School Feeding Committee, which each municipality or state government is required by law to create. <sup>(39)</sup>                 | The responsibility for cooking the mid-day meal and its supply is normally delegated to a group or organization such as a local women's or mothers' self-help group, a local youth club or a voluntary organization. <sup>(40)</sup> |

### ***Low income Countries***

In **Kenya**, school feeding has been in place for many years and is usually actively supported by parents.<sup>(41)</sup> The aim of the SFP is to increase school enrolment, attendance, and retention, and increase the overall literacy attainment of the country. It mainly targets the Arid and Semi-Arid Lands (ASAL). The Government of Kenya (GoK) started a HGSP program in selected schools around the country in July 2009.<sup>(41)</sup> The aim of HGSP program was to further build upon the benefits of school feeding by stimulating local economies. The program operates through funds paid by the Government directly to the School Management Committees (SMCs) to purchase cereals, pulses and oils. SMCs are also in charge of school buildings and the repair and upkeep of school property along with other responsibilities. There have been many challenges in ensuring that the food purchased is from local smallholder farmers due to the fact that Kenya has very little arable land. In 2008 1.2 million children benefitted from the SFP. The SF framework for Kenya is shown in *Table 8*. The MoE is in charge of implementing the HGSP (the WFP is gradually handing over its program to the HGSP) and it has various coordinators at the national, regional, district and local levels. The MoE has in place a program that builds upon the schools experience in financial matters. Schools already purchase textbooks and other supplies from local businesses and these processes are ensured for transparency through monitoring and evaluation, further enhanced by requiring three signatures to withdraw any funds. The GoK has not taken into account the food cost variation across the country; rather school budgets are allocated per child based on average costs based on national surveys. This may negatively impact HGSP provision in areas of high food cost.

The HGSF is implemented in the ASALs. These are areas of food deficit and 60-70% of food supplies are in fact imported from outside these areas. These regions have very little water, a small number of farmers, and of these, many focus purely on livestock. Agricultural production by local smallholder farmers is constrained by high production costs. Limited or no storage capacity means more products are prone to waste, reduces entry into markets and other alternatives, and causes farmers to sell surplus stock quickly to bidders who may exploit this urgency.

The Kenyan MoE has not specified a menu or ration composition of its own rather it has adopted the WFP's daily hot lunch ration. As part of the HGSF, cereals, pulses, and oil are purchased from local smallholder farmers.<sup>(41)</sup> Firewood and salt is required to be produced by the parents, along with water and salaries for the cooks.<sup>(41)</sup> If a household is unable to contribute these then the schools arranges alternative methods of participation with the family.<sup>(41)</sup> Menu compositions are shown in *Table 7*. Detailed menu compositions can be found in *Appendix 1*. The cost of providing a lunchtime meal per child per day is approximately \$0.19.<sup>(41)</sup>

In **Mali**, the primary aim of the SFP conducted by the MoE of the Government of Mali (GoM) is to increase enrolment and retention of primary school students.<sup>(42)</sup> This is an important objective as around 20% of children in this demographic do not attend school.<sup>(42)</sup> The MoE aims for 100% enrolment of primary age schoolchildren by the year 2012. The SF framework for Mali is shown in *Table 8*.

Mali's SFP aims to cover about 9,000 basic education or primary schools in the country. The GoM aims to implement it through a decentralized structure with various management committees overseeing the service delivery. Mali has much variation in food supply, access and availability across the country and from year to year. Sourcing foods for the HGSF programme is constrained by variability in the crop

yields from one year to another, along with low levels of productivity, lack of essential agricultural technology and the limitation in the diversity of crops, which depends heavily on the amount of rainfall.

The MoE SF policy proposes a partnership between the parents and SMCs. The program relies on developing income generating activities (IGAs) that will raise funds for the upkeep of the program.<sup>(42)</sup> Parents are asked to donate staples (rice, millet, sorghum) and condiments (peanuts, vegetables, seasonings) to help prepare the school meal.<sup>(42)</sup> Menu compositions are shown in *Table 7*. Detailed menu compositions can be found in *Appendix 1*. The cost of providing a lunchtime meal per child per day is approximately \$0.59.<sup>(42)</sup>

In **Rwanda**, the MoE of the Government of Rwanda (GoR) aims to increase access to education in the short-term and quality of education in the medium-term.<sup>(43)</sup> According to the GoR, there is 98% enrolment and 90% attendance rates in schools - it has one of the highest rates of primary school enrolment in sub-Saharan Africa).<sup>(43)</sup> There has been a 70% increase in enrolment after the removal of school fees.<sup>(43)</sup> However, according to the GoR, this has caused a lack of classrooms, teachers and head-teachers to cater for the increase in students, and it has also put a strain on the education budget. WFP is currently the primary partner of the GoR in the SFP. This is to be gradually developed into a program that is fully government-administered. The program activities will be transferred to government and community entities and WFP support will be phased out, although these plans are yet to be finalised. The MoE wants individual schools to organise food procurement from local smallholder farmers and parents to provide certain foods to make up the school ration menu and pay for school fees and labour costs for the SFP. The MoE believes that if parents are unable to aid the program through these methods then funds

generated from school gardens, animal husbandry, and milk production will be sufficient to sustain the SFP. Currently, there are no detailed plans for a SFP in any GoR documents which address education reform or economic development. A HGSF program in Rwanda could help students and smallholder farmers greatly by alleviating short-term hunger, increasing long-term food security, increasing income levels and improving livelihoods, especially for women. The SF framework for Rwanda is shown in *Table 8*. Menu compositions are shown in *Table 7*. Detailed menu compositions can be found in *Appendix 1*. The cost of providing a lunchtime meal per child per day is approximately \$0.48.<sup>(43)</sup>

**Table 7: Comparison of nutrient composition in school feeding menus of Ghana, India, Kenya, Mali and Rwanda.**

|                                | WHO RDA<br>(10-14<br>years) <sup>(12)</sup> | Ghana<br><sup>(38)</sup> | India <sup>(40)</sup> | Kenya <sup>(41)</sup>  | Mali <sup>(42)</sup>   | Rwanda <sup>(43)</sup> |
|--------------------------------|---|--------------------------|-----------------------|------------------------|------------------------|------------------------|
| Daily ration<br>g/person/day   | -   | 225                      | 178                   | 198                    | 190                    | 141                    |
| Energy Kcal                    | 2210  | 664<br>(30%)             | 680<br>(31%)          | 706<br>(32%)           | 731<br>(33%)           | 537<br>(24%)           |
| Protein g                      | 50  | 16.3<br>(33%)            | 30.9<br>(62%)         | 24.8<br>(50%)          | 17.9<br>(36%)          | 14.5<br>(29%)          |
| Fat g                          | 42.1  | 11.1<br>(26%)            | 15.7<br>(37%)         | 11.5<br>(27%)          | 11.1<br>(26%)          | 10.1<br>(24%)          |
| Calcium mg                     | 600   | 22<br>(4%)               | 158<br>(26%)          | 42<br>(7%)             | 30<br>(5%)             | 153<br>(25%)           |
| Iron mg                        | 24  | 3.7<br>(16%)             | 11.4<br>(47%)         | 5.8<br>(24%)           | 3.9<br>(16%)           | 7.8<br>(32%)           |
| Iodine µg                      | 140   | 3<br>(2%)                | 183<br>(131%)         | 181<br>(129%)          | 1<br>(0%)              | 180<br>(129%)          |
| Vit.A µg RE                    | 550   | 375<br>(68%)             | 51<br>(9%)            | 275<br>(50%)           | 104<br>(19%)           | 213<br>(39%)           |
| Thiamine mg                    | 0.90  | 0.19<br>(21%)            | 0.63<br>(70%)         | 0.86<br>(95%)          | 0.36<br>(40%)          | 0.98<br>(109%)         |
| Riboflavin mg                  | 1.50  | 0.10<br>(7%)             | 0.52<br>(34%)         | 0.38<br>(25%)          | 0.11<br>(7%)           | 0.53<br>(35%)          |
| Niacin mg                      | 14.6  | 10.4<br>(71%)            | 12.2<br>(83%)         | 4.5<br>(31%)           | 9.2<br>(63%)           | 7.4<br>(50%)           |
| Vit.C mg                       | 25  | 4<br>(18%)               | 4<br>(17%)            | 1<br>(3%)              | 1<br>(2%)              | 0<br>(0%)              |
| Approx. cost<br>per daily meal | -   | \$0.32 <sup>(38)</sup>   | -                     | \$0.19 <sup>(41)</sup> | \$0.59 <sup>(42)</sup> | \$0.48 <sup>(43)</sup> |

**Table 8 – School meal provision frame work table for low-income countries. This table compares the Aims and Objectives, Policy and Implementation and Delivery of Service between low-income countries.**

| <i>(Low Income)</i>                | <b>Kenya</b>  | <b>Mali</b>  | <b>Rwanda</b>   |
|------------------------------------|---|--|---|
| <b>Aims and Objectives</b>         | To increase school enrolment, attendance, and retention, and it mainly targets the Arid and Semi-Arid Lands (ASAL). <sup>(41)</sup> It aims to increase the overall literacy attainment of the country. <sup>(41)</sup> | To increase enrolment and retention of primary school students. This is an important objective as around 20% of children in this demographic do not attend school. <sup>(42)</sup>                               | To increase access to education in the short-term and quality of education in the medium-term. <sup>(43)</sup>  |
| <b>Policy</b>                      | Policy focus on building upon the benefits of school feeding by stimulating local economies. <sup>(41)</sup>  | The Ministry of Education implements the SFP as part of its policy. <sup>(42)</sup>  | Currently, the SFP is run by a partnership with the WFP. Currently, there are no detailed plans for a SFP in any GoR documents which address education reform or economic development. <sup>(43)</sup>                                    |
| <b>Implementation and delivery</b> | The program operates through funds paid by the Government directly to the School Management Committees (SMCs) to purchase foodstuff. <sup>(41)</sup>  | The GoM aims to implement it through a decentralized structure with service delivery through school and canteen management committees which will be overseen by the representative from the MoE. <sup>(42)</sup> | The MoE wants individual schools to organise food procurement from local smallholder farmers and parents to provide certain foods to make up the school ration menu and pay for school fees and labour costs for the SFP. <sup>(43)</sup> |

## DISCUSSION

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School feeding in middle and low-income countries have very different objectives and goals compared to the high-income countries. School meal provision in high-income countries is driven by evidence that the foods children consume in schools are very high in fat and lack adequate amounts of essential nutrients.<sup>(44,45)</sup> SFPs in middle and low-income countries, in the short-term, aim to alleviate hunger, act as a social safety net for low-income households and increase enrolment of children into schools;<sup>(7)</sup> and in the longer-term, it aims to improve the nutritional status, attendance, cognitive development and retention of schoolchildren.<sup>(7)</sup>

The increasing prevalence of childhood overweight and obesity<sup>(3-6)</sup> has been a major policy-determining factor in the drive for healthy school meal provisions in high-income countries.<sup>(46)</sup> School meal provision in high-income countries are trying to focus on modelling healthier eating habits and food choices that will enable schoolchildren to establish positive dietary habits for the future.<sup>(16,46)</sup> This is vital towards decreasing the increasing burden of non-communicable diseases on the health care systems of countries<sup>(47)</sup> and increasingly important towards combating the global obesity epidemic.<sup>(48)</sup> There is also an increasing focus on education on healthier lifestyle choices as studies have shown that the risk of obesity in children is increased by five times when they are unequipped with adequate nutritional knowledge which is subsequently complemented by unhealthy eating habits and further negatively impacted by low physical activity levels.<sup>(49)</sup>

In middle and low-income countries, policy has been mainly driven by the need to reduce poverty, establish social safety nets for financially vulnerable households and to increase and enhance the educational attainment of its population - specifically the

primary schoolchildren. Middle and low-income countries are increasingly incorporating local produce into the SF menus by implementing HGSP programmes with the aim of stimulating local markets and economies.

### ***Implementation and delivery***

In high-income countries there is no uniformity in the school meal provision, with modes of provision varying from packed lunches to canteen-style services to children going home for lunch.<sup>(13,19,23-25,32,37)</sup> There has been a shift in method of food preparation and delivery, from traditional seated dining with food prepared on-site towards catering delivery services through centrally procured private contractors, vending machines and school cafeterias.<sup>(24,27)</sup> In high, middle and low-income countries the programmes are planned at the national level with local authorities/ councils and municipalities responsible for organising and administering the programmes.<sup>(19,24,25,28,32,36)</sup> In middle and low-income countries food is increasingly procured from local farmers and prepared on-site by staff employed by the school whose salaries the parents of students are responsible for. In some cases, the parents take the responsibility of preparing the meal.

### ***Nutrition guidelines***

We were only able to find nutritional guidelines for England, France, USA and Brazil. For Ghana, India, Kenya, Mali and Rwanda there are no legislated or advised nutritional guideline so we calculated nutritional content from menus specified in the literature found for each country. An important point to note for all countries is that there is no literature verifying the implementation of these guidelines and menus. This is something that requires further research.

Details of comparisons across countries by nutrient types are presented in the following sections.

## ***Energy***

Energy is the product of cellular respiration required for the functioning of the human body. In high-income countries the focus is on ensuring that schoolchildren do not consume too much in proportion to their energy expenditure which will lead to obesity. The high-income countries and Brazil in this study recommend that the menu should provide 30% to 45% energy requirements of the RDA (see *Table 5*). In the remaining middle and low-income countries, menu compositions indicate that menus contain approximately 30% of energy requirements of the RDA (see *Table 7*). It is important to realise however that, despite the apparent similarity in energy provision between the country income groups the energy expenditure is very different between these countries. The school meal provided in middle and low-income countries tends to be the biggest or even the only meal for many schoolchildren on a given day due to poverty. Energy expenditure in schoolchildren in these countries also tend to be higher due to the methods and distance of travel to school whereas less energy is expended in high-income countries due to better transport and better-placed schools. Schoolchildren in middle and low-income countries may also have to work before or after school hours in order to support the family and also pay for school fees. It is common for schoolchildren in high-income countries to purchase high-energy foods such as sweets whereas the vast majority of schoolchildren in middle and low-income countries are unable to afford these and therefore do not have complementary methods of energy intake.

## **Protein**

Proteins are essential for the growth and repair of the human body. Proteins can provide a small amount of energy; however, their main function is building and repairing tissues. Protein-intake guidelines vary in the high-income countries with England and France recommending 30% and 15% of the RDA respectively (see *Table 5*). Protein intake in middle and low-income countries is generally much higher in comparison. Brazilian guidelines recommend 40% of the RDA and menu composition of the rest of the countries range from 29% of RDA (Rwanda) to 62% of RDA (India). This increase can be explained by the inclusion of large amounts of cereals (rice mainly) and pulses in comparison to the total of the daily ration. This is a positive factor as it will help schoolchildren in middle and low-income countries due to the various reasons mentioned previously.

## **Fat**

Fats have very important roles in the functioning of the human body. They act as an energy store and can be metabolised to produce large amounts of energy. They are vital in the absorption of essential vitamins such as A and D. High levels of fat intake can eventually lead to a various diseases such as diabetes and cardiovascular diseases thus reducing the quality of life of a person. Growing levels of overweight and obesity is a cause for concern in high-income and other countries worldwide. Many studies found that food provided in schools in high-income countries had high levels of fat and now guidelines in these countries instruct a maximum amount of fat in food: 35% of the RDA in England and France, and 30% in the USA (see *Table 5*). School meals in the USA were particularly high in fat content hence the lower guideline recommendations. Brazil recommends fat content of approximately 40% of the RDA and this is in attempt to aid schoolchildren to increase their energy storage

levels. Menu compositions in the remaining middle and low-income countries vary from 24% of the RDA in Rwanda to 37% of the RDA in India (see Table 7). Higher levels of fat in menus in the more impoverished regions in these countries will aid schoolchildren to build up their energy stores.

### ***Iron***

Iron is an essential requirement for the human body due to the importance it has in the makeup of the blood and its ability to accept and donate electrons. Lack of adequate levels of iron in the body can lead to fatigue and eventually iron deficiency anaemia. Too much iron intake can lead to iron overload and hemochromatosis which can affect organs severely. Nutrition guidelines in the high-income countries instruct iron to make up 35% (England and the USA) and 50% of the RDA (France) (see Table 5). Brazilian guidelines are much lower at 13% of the RDA. More research is required as to why it is set at that low figure. In the remaining middle and low-income countries there is much variation (see Table 7) with only India with over 35% of the RDA at 47%.

### ***Iodine***

Iodine is essential to the human body as it is necessary in the production of the vital hormones thyroxine and tri-iodotyronine which determine the basal metabolic rate of the body. Low levels of iodine intake leads to iodine deficiency which can cause goitres, cretinism and other developmental problems. According to a UN report, it is “the primary cause of preventable mental retardation in children and remains a major global public health problem”.<sup>(50)</sup> Nearly three-quarter of a billion school-aged children worldwide are reported to have inadequate iodine intake according to the WHO.<sup>(51)</sup> Adding iodine to salt is a very easy method of preventing this.

We were not able to find any nutritional guidelines for iodine intake in the high-income countries and Brazil. This is most likely due to levels of iodine intake being classified as adequate by the Ministries without need for suggesting guidelines in order to ensure adequate consumption. In the remaining middle and low-income countries we found some interesting results. Four countries, India, Kenya, Rwanda and South Africa, specifically mentioned the inclusion of iodized salt in their menus and these menus provided 131%, 129%, 129% and 59% of the RDA respectively. Ghana and Mali did not specifically mention iodized salt in their menus and therefore was calculated to contain 2% and 0% of the RDA respectively. Further research is required to better study this element of the menu.

### ***Vitamin A***

Vitamin A is a vital nutrient for the human body and the lack of it can lead to night blindness initially and eventually total blindness if left unaddressed. Vitamin A deficiency is one of the biggest causes of blindness in developing countries. Guidelines in England and the USA recommend that menus should contain 35% and 40% of the RDA respectively. France does not have any guidelines for Vitamin A in menus and Brazilian guidelines recommend 38% of the RDA. Menus in Ghana and Kenya have high levels of Vitamin A, 68% and 50% of the RDA respectively. This is due to the inclusion of palm oil in Ghana and maize in Kenya both of which are high in Vitamin A content. Rwanda menus have maize meals too, however, the amount served is less hence it delivers 39% of the RDA. Menus in India and South Africa indicate very low Vitamin A content (9% and 2% of the RDA respectively) and more research needs to be done in order to find out if this is being addressed.

## **Costs**

The financial aspect of school meals varies. In middle and low-income countries, school meals are provided free of charge and the government either pays the local authority/ municipality in full or subsidises the cost. In high-income countries, schoolchildren pay for school meals but free school meals are provided to children from households earning below a defined threshold. In Finland all students in schools and sixth forms are entitled to a free school meal.

There is variation in the cost of providing a school meal for lunch. School meals in high-income countries can be provided for as little as \$1.55 per day in certain parts of USA (see *Table 5*) whereas in France a meal can cost between \$5.54 and \$7.12. In middle-income countries it is much cheaper - in Ghana and South Africa the cost of a meal is \$0.32 (see *Table 7*) and \$0.15 in Brazil (see *Table 5*). The cost of a meal in low-income countries is slightly higher, \$0.59 and \$0.48 in Mali and Rwanda respectively; with the exception of Kenya where a meal costs approximately \$0.19. The differences in the prices between income groups and within income groups are due to the prices, availability and procurement methods amongst many other factors an analysis of which is beyond the scope of this work.

## **Limitations**

This analysis is limited by a number of important factors. In countries that did not have any guidelines we had to compare guidelines with menu compositions. This is not ideal but it was the only accessible method in the time-frame for this review. Furthermore, the choice of menus in the literature might not be reflective or representative of actual menu compositions at schools as adherences to these menus have not been verified. With more time it would have been possible to obtain a variety of menus and calculated averages. Further research also needs to be

conducted in order to verify actual menu compositions being implemented in schools in countries of all income groups. Another point to note is that the analysis involved comparisons between nutritional values to the RDAs of healthy 10-14 year old children. This cannot be used in the case of sick children. Further research on this topic will aid greatly in setting these menus and improving the quality of life of these children.

## **CONCLUSION**

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In conclusion, the aims of school feeding differ between countries of different income groups. Middle and low-income countries are increasingly adopting HGSF programmes and it would be very useful if guidance would be provided on establishing nutritional guidelines through evidence-based research. The menu composition needs to be tailored to each country's nutritional needs and the level of the implementation of these guidelines needs to be assessed. Ensuring the provision of healthy foods in schools in all countries is vital to increasing attendance and retention, enhancing nutritional status and cognitive development, combatting poverty and obesity, and an important social safety net for low-income households. Collaborative research and subsequent evidence-based policy implementation can greatly enhance and improve the quality of life of millions of children worldwide.

## REFERENCES

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- (1) Food and Agriculture Organization of the United Nations. *Global hunger declining, but still unacceptably high*. [Online] Available from: <http://www.fao.org/docrep/012/al390e/al390e00.pdf> [Accessed 23rd May 2012].
- (2) United Nations Secretary General. *Strengthening efforts to eradicate poverty and hunger, including through the global partnership for development*. [Online] Available from: <http://documents.wfp.org/stellent/groups/public/documents/communications/wfp224568.pdf> [Accessed 23rd May 2012].
- (3) CBC Health News. *Obesity world's biggest health hurdle, conference told*. [Online] Available from: <http://www.cbc.ca/news/health/story/2006/09/08/obesity.html> [Accessed 23rd May 2012].
- (4) British Medical Association Board of Science. *Preventing childhood obesity*. British Medical Association; 2005.
- (5) World Health Organisation. *Obesity and overweight. Global strategy on diet, physical activity and health*. [Online] Available from: <http://www.who.int/dietphysicalactivity/media/en/gsf Obesity.pdf> [Accessed 3rd May 2012].
- (6) National Heart Forum. *Overweight and Obesity*. [Online] Available from: [http://www.heartforum.org.uk/AboutCHD\\_Riskfac\\_Oweightobesity.aspx](http://www.heartforum.org.uk/AboutCHD_Riskfac_Oweightobesity.aspx) [Accessed 1st May 2012].
- (7) Jomaa LH, McDonnell E, Probart C. School feeding programs in developing countries: impacts on children's health and educational outcomes. *Nutrition reviews* 2011;69(2): pp. 83-98.
- (8) Greenhalgh T, Kristjansson E, Robinson V. Realist review to understand the efficacy of school feeding programmes. *BMJ Publishing Group Ltd* 2007;335(7625): pp. 858-861.
- (9) Bundy D, Burbano C, Grosh M, Gelli A, Jukes M, Drake L. What Is School Feeding? *Rethinking School Feeding USA: The World Bank*; 2009. pp. 7.
- (10) Bundy D, Burbano C, Grosh M, Gelli A, Jukes M, Drake L. Trade-Offs in Program Design: Targetting, Feeding, Modalities, and Costs. *Rethinking School Feeding USA: The World Bank*; 2009. pp. 51.
- (11) Galloway R. *Developing Rations for Home Grown School Feeding (PCD working paper 214)*. Partnership for Child Development; 2010.
- (12) United Nations High Commissioner for Refugees (UNHCR), World Food Programme (WFP), UCL Futures, IASC Nutrition Cluster. *NutVal*. [Online] Available from: <http://www.nutval.net/2008/05/download-page.html> [Accessed 5th May 2012].
- (13) United States Department of Agriculture (USDA), Foreign Agriculture Service, Office of Capacity Building and Development. *Assessments of Local Production for School Feeding: Reports for Ghana (June 1-12, 2009), Kenya (June 19-July 1, 2009), Mali (April 26-May 8, 2009) and Rwanda (July 8-22, 2009)*. USDA; 2009.

- (14) XE. *XE - Universal Currency Converter*. [Online] Available from: <http://www.xe.com/ucc/> [Accessed 20th May 2012].
- (15) The World Bank. *Country and Lending Groups*. [Online] Available from: <http://data.worldbank.org/about/country-classifications/country-and-lending-groups> [Accessed 10th May 2012].
- (16) Department for Education and Skills (DfES) UK. *Turning the Tables – Transforming School Food*. DfES; 2005.
- (17) Harper C, Wood L, Mitchell C. *The Provision of School Food in 18 Countries*. School Food Trust; July 2008.
- (18) Department for Children Schools and Families. *Funding boost for the school food revolution*. [Online] Available from: <http://www.whitehallpages.net/news/archive/72735> [Accessed 16th May 2012].
- (19) Nicholas J, Wood L, Morgan C, Russell L, Nelson M. *Survey of Local Authorities*. School Food Trust & LACA; January 2008.
- (20) Nicholas J, Wood L, Nelson M. *The second annual survey of take up of school meals in England*. The School Food Trust UK; September 2007.
- (21) NI Direct Government Services. *Pension Credit and free school meals*. [Online] Available from: <http://www.nidirect.gov.uk/pension-credit-and-free-school-meals> [Accessed 19th May 2012].
- (22) School Food Trust UK. *A fresh look at the school meal experience*. [Online] Available from: <http://www.schoolfoodtrust.org.uk/school-cooks-caterers/resources/a-fresh-look-at-the-school-meal-experience-second-edition> [Accessed 20th May 2012].
- (23) Wyatt C. School dinners around the world. *BBC*. 12 March 2005.
- (24) Department of Education France. *School food catering: Organisation of the school lunch*. [Online] Available from: <http://translate.google.com/translate?hl=en&sl=fr&u=http://www.education.gouv.fr/&sa=X&oi=translate&resnum=2&ct=result&prev=/search%3Fq%3Dfrench%2Bministry%2Bof%2Beducation%26hl%3Den> [Accessed 22nd May 2012].
- (25) Harper C, Wood L, Mitchell C. *The Provision of School Food in 18 Countries*. School Food Trust; July 2008.
- (26) The Guardian Global Cuisine. *School meals around the world*. [Online] Available from: <http://www.guardian.co.uk/education/2005/mar/30/schoolmeals.schools1> [Accessed 13th May 2012].
- (27) Mercer C. *French ban on vending machines*. [Online] Available from: <http://www.nutraingredients.com/Regulation/France-launches-controversial-school-vending-machine-ban> [Accessed 14th May 2012].
- (28) Murphy C. *Over 187 Billion Served: Food Safety in the National School Lunch Program*. [Online] Available from: <http://leda.law.harvard.edu/leda/data/723/Murphy05.pdf> [Accessed 12th May 2012].

- (29) United States Department of Agriculture. *Fresh Fruit and Vegetable Program (FFVP): Quick Facts*. [Online] Available from: [http://www.portal.state.pa.us/portal/server.pt?open=512&objID=7652&mode=2&externalurl=http://www.fns.usda.gov/cga/FactSheets/FFVP\\_Quick\\_Facts.htm](http://www.portal.state.pa.us/portal/server.pt?open=512&objID=7652&mode=2&externalurl=http://www.fns.usda.gov/cga/FactSheets/FFVP_Quick_Facts.htm) [Accessed 11th May 2012].
- (30) Liquori T. *Rome, Italy: A Model in Public Food Procurement What Can the United States Learn?* [Online] Available from: [http://www.ncrlc.com/1-pfd-files/briefing\\_paper.pdf](http://www.ncrlc.com/1-pfd-files/briefing_paper.pdf) [Accessed 12th May 2012].
- (31) California Food Policy Advocates-Services & Resources. *Enrolling a child in free or reduced price school lunch programs*. [Online] Available from: [http://www.kidsdata.org/resources\\_topic.jsp?t=23](http://www.kidsdata.org/resources_topic.jsp?t=23) [Accessed 12th May 2012].
- (32) Pearce H, Green M, Noble E, Sonnino R, Morgan K. *Double Dividend: Promoting good nutrition and sustainable consumption through healthy school meals*. Sustainable Development Commission; 2005.
- (33) Sonnino R. *Sustainable school meals in Italy: the Roman model*. [Online] Available from: [http://www.soilassociation.org/Web/SA/saweb.nsf/e72f0c7da90e70da80256cd9004e17d6/628fcef681086069802572ab004732da/\\$FILE/scotland\\_ffl\\_sonnino.pps#256,1,Sustainable](http://www.soilassociation.org/Web/SA/saweb.nsf/e72f0c7da90e70da80256cd9004e17d6/628fcef681086069802572ab004732da/$FILE/scotland_ffl_sonnino.pps#256,1,Sustainable) School Meals in Italy: The Roman Model [Accessed 17th May 2012].
- (34) Miele M. *School meals and the public domain*. [Online] Available from: <http://www.esds.ac.U.K./news/eventsdocs/cookingMar07MM.ppt> [Accessed 15th May 2012].
- (35) The Ministry of Social Affairs and Health Finland. *Green Paper on promoting healthy diets and physical activity*. Euro Commerce; 2005.
- (36) Roos G, Lean M, Anderson A. Dietary interventions in Finland, Norway and Sweden: nutrition policies and strategies. *Journal of Human Nutrition and Dietetics* 2002;15(2): pp. 99-110.
- (37) Caterer Search. *Lure of a Finnish model*. [Online] Available from: <http://www.caterersearch.com/Articles/31/07/2006/308035/Lure-of-a-Finnish-model.htm> [Accessed 2nd May 2012].
- (38) Fisher E. *A Desk Review of the Ghana School Feeding Programme*. Centre for Development Studies, University of Swansea; July 2007.
- (39) Otsuki K, Arce A. *A Desk Review of the National School Feeding Programme (Brazil)*. The Netherlands: Rural Development Sociology Group, Department of Social Sciences, Wageningen University.; July 2007.
- (40) Chettiparambil-Rajan A. *A Desk Review of the India Mid-Day Meals Programme (India)*. UK: School of City and Regional Planning, Cardiff University; July 2007.
- (41) USDA Foreign Agricultural Service. *Assessment of Local Production for School Feeding in Kenya*. USDA Office of Capacity Building and Development; 2009.
- (42) USDA Foreign Agricultural Service. *Assessment of Local Production for School Feeding in Mali*. USDA Office of Capacity Building and Development; 2009.
- (43) USDA Foreign Agricultural Service Office. *Assessment of Local Production for School Feeding in Rwanda*. USDA Office of Capacity Building and Development; 2009.

- (44) Office of Population Censuses and Surveys, Social Survey Division Department of Health and Social Security, Ministry of Agriculture, Fisheries and Food 1983. *Schoolchildren's dietary survey*. [Online] Available from: <http://www.dataarchive.ac.uk/findingData/snDescription.asp?sn=2657&key=2657&catg=xm|Sn> [Accessed 15th May 2012].
- (45) Ministry of Education 2. *Catering for Healthier Lifestyles – compulsory nutritional standards for school meals: a conocument*. [Online] Available from: [http://www.deni.gov.uk/catering\\_for\\_healthier\\_lifestyles-2.pdf](http://www.deni.gov.uk/catering_for_healthier_lifestyles-2.pdf) [Accessed 15th May 2012].
- (46) Department of Health. *Choosing Health: Making healthy choices easier*. Department of Health; 2004.
- (47) World Health Organisation. *The challenge of obesity in the WHO European region*. WHO; 2005.
- (48) World Health Organisation. *Obesity: preventing and managing the global epidemic. Report of a WHO consultation*. WHO; 2000.
- (49) Flynn MAT, McNeil DA, Maloff B, Mutasingwa D, Wu M, Ford C, et al. Reducing obesity and related chronic disease risk in children and youth: a synthesis of evidence with best practice recommendations. *Obesity Reviews* 2006;7: pp. 7-66.
- (50) United Nations System Standing Committee on Nutrition. *5th Report on the World Nutrition Situation, Nutrition for Improved Development Outcomes*. UN; 2004.
- (51) The Lancet. Iodine deficiency - way to go yet. *The Lancet* 2008;372(9633): pp. 88.
- (52) Official Bulletin of the Ministry of National Education and Ministry of Research. *School restoration: Composition on meals in schools restoration and food safety*. France: Ministry of National Education and Ministry of Research.
- (53) Harper C, Wells L. *School meal provision in England and other Western countries: a review*. School Food Trust UK; May 2007.
- (54) Programa Nacional de Alimentação Escolar. *Valores de Referência de Energia, Macro e Micronutrientes*. [Online] Available from: [http://www.rebrae.com.br/banco\\_arquivos/arquivos/cardapio/Tabela%20de%20Macro%20e%20Micronutrientes%20-%20Anexo%20III%20-%20Resolucao%2038-2009-FNDE.pdf](http://www.rebrae.com.br/banco_arquivos/arquivos/cardapio/Tabela%20de%20Macro%20e%20Micronutrientes%20-%20Anexo%20III%20-%20Resolucao%2038-2009-FNDE.pdf) [Accessed 19th May 2012].

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## Appendix 1 – Detailed nutrient compositions of school feeding menus of Ghana, India, South Africa, Kenya, Mali and Rwanda.

| <i>Ration Contents (Ghana)</i>        | Daily ration g/person/day <sup>(38)</sup> | Energy kcal | Protein g   | Fat g       | Calcium mg | Iron mg    | Iodine µg | Vit.A µg RE | Thiamine mg | Riboflavin mg | Niacin mg   | Vit.C mg |
|---------------------------------------|---|-------------|-------------|-------------|------------|------------|-----------|-------------|-------------|---------------|-------------|----------|
| Rice                                  | 150                                       | 540         | 10.5        | 0.8         | 14         | 2.6        | 0         | 0           | 0.15        | 0.05          | 8.4         | 0        |
| Palm Oil                              | 5   | 44          | 0           | 4.9         | 0          | 0          | 0         | 300         | 0           | 0             | 0           | 0        |
| Tomato (ripe)                         | 30  | 5           | 0.3         | 0.1         | 3          | 0.1        | 1         | 75          | 0.01        | 0.01          | 0           | 4        |
| Onion                                 | 10  | 4           | 0.1         | 0           | 2          | 0          | 0         | 0           | 0           | 0             | 0           | 1        |
| Beef (moderately fat)                 | 30  | 71          | 5.5         | 5.3         | 3          | 1.1        | 2         | 0           | 0.02        | 0.05          | 2.0         | 0        |
| <b>Ration total</b>                   | <b>225</b>                                | <b>664</b>  | <b>16.3</b> | <b>11.1</b> | <b>22</b>  | <b>3.7</b> | <b>3</b>  | <b>375</b>  | <b>0.19</b> | <b>0.10</b>   | <b>10.4</b> | <b>4</b> |
| WHO RDA (10-14 years) <sup>(12)</sup> |   | 2210        | 50          | 42.1        | 600        | 24         | 140       | 550         | 0.90        | 1.50          | 14.6        | 25       |
| % of requirements supplied by ration  |   | 30%         | 33%         | 26%         | 4%         | 16%        | 2%        | 68%         | 21%         | 7%            | 71%         | 18%      |

| <i>Ration Contents (India)</i>        | Daily ration g/person/day <sup>(40)</sup> | Energy kcal | Protein g   | Fat g       | Calcium mg | Iron mg     | Iodine µg  | Vit.A µg RE | Thiamine mg | Riboflavin mg | Niacin mg   | Vit.C mg |
|---------------------------------------|---|-------------|-------------|-------------|------------|-------------|------------|-------------|-------------|---------------|-------------|----------|
| Rice                                  | 100                                       | 360         | 7           | 0.5         | 9          | 1.7         | 0          | 0           | 0.10        | 0.03          | 5.6         | 0        |
| Lentils                               | 20  | 68          | 5.6         | 0.2         | 10         | 1.8         | 0          | 2           | 0.10        | 0.05          | 1.4         | 1        |
| Beans (soya)                          | 50  | 208         | 18.2        | 10          | 139        | 7.9         | 3          | 4           | 0.44        | 0.44          | 5.2         | 3        |
| Vegetable oil                         | 5   | 44          | 0           | 5           | 0          | 0           | 0          | 45          | 0           | 0             | 0           | 0        |
| Salt (iodised)                        | 3   | 0           | 0           | 0           | 0          | 0           | 180        | 0           | 0           | 0             | 0           | 0        |
| <b>Ration total</b>                   | <b>178</b>                                | <b>680</b>  | <b>30.9</b> | <b>15.7</b> | <b>158</b> | <b>11.4</b> | <b>183</b> | <b>51</b>   | <b>0.63</b> | <b>0.52</b>   | <b>12.2</b> | <b>4</b> |
| WHO RDA (10-14 years) <sup>(12)</sup> |   | 2210        | 50          | 42.1        | 600        | 24          | 140        | 550         | 0.90        | 1.50          | 14.6        | 25       |
| % of requirements supplied by ration  |   | 31%         | 62%         | 37%         | 26%        | 47%         | 131%       | 9%          | 70%         | 34%           | 83%         | 17%      |

| <i>Ration Contents (Kenya)</i>        | Daily ration g/person/day <sup>(41)</sup> | Energy kcal | Protein g   | Fat g       | Calcium mg | Iron mg    | Iodine µg  | Vit.A µg RE | Thiamine mg | Riboflavin mg | Niacin mg  | Vit.C mg |
|---------------------------------------|---|-------------|-------------|-------------|------------|------------|------------|-------------|-------------|---------------|------------|----------|
| Maize (yellow)                        | 150                                       | 525         | 15          | 6           | 20         | 4.1        | 0          | 212         | 0.58        | 0.30          | 3.3        | 0        |
| Vegetable Oil (fortified)             | 5   | 44          | 0           | 5           | 0          | 0          | 0          | 45          | 0           | 0             | 0          | 0        |
| Legumes (split peas)                  | 40  | 136         | 9.8         | 0.5         | 22         | 1.8        | 1          | 18          | 0.28        | 0.08          | 1.2        | 1        |
| Salt (iodised)                        | 3   | 0           | 0           | 0           | 0          | 0          | 180        | 0           | 0           | 0             | 0          | 0        |
| <b>Ration total</b>                   | <b>198</b>                                | <b>706</b>  | <b>24.8</b> | <b>11.5</b> | <b>42</b>  | <b>5.8</b> | <b>181</b> | <b>275</b>  | <b>0.86</b> | <b>0.38</b>   | <b>4.5</b> | <b>1</b> |
| WHO RDA (10-14 years) <sup>(12)</sup> |   | 2210        | 50          | 42.1        | 600        | 24         | 140        | 550         | 0.90        | 1.50          | 14.6       | 25       |
| % of requirements supplied by ration  |   | 32%         | 50%         | 27%         | 7%         | 24%        | 129%       | 50%         | 95%         | 25%           | 31%        | 3%       |

| <i>Ration</i> | Daily ration | Energy | Protein | Fat | Calcium | Iron | Iodine | Vit.A | Thiamine | Riboflavin | Niacin | Vit.C |
|---------------|--------------|--------|---------|-----|---------|------|--------|-------|----------|------------|--------|-------|
|---------------|--------------|--------|---------|-----|---------|------|--------|-------|----------|------------|--------|-------|

| <i>Contents<br/>(South Africa)</i>            | g/person/day<br>(40) | y<br>kcal  | n<br>g      | g           | m<br>mg    | mg         | µg        | µg RE     | ine<br>mg   | avin<br>mg  | mg        | mg       |
|---|----------------------|------------|-------------|-------------|------------|------------|-----------|-----------|-------------|-------------|-----------|----------|
| Rice  | 40                   | 144        | 2.8         | 0.2         | 4          | 0.7        | 0         | 0         | 0.04        | 0.01        | 2.2       | 0        |
| Sardines                                      | 45                   | 139        | 9           | 11.3        | 180        | 1.4        | 10        | 2         | 0.02        | 0.09        | 5.7       | 0        |
| Lentils                                       | 30                   | 101        | 8.4         | 0.3         | 15         | 2.7        | 0         | 4         | 0.14        | 0.08        | 2         | 2        |
| Vegetables<br>(cabbage)                       | 10                   | 3          | 0.2         | 0.0         | 5          | 0.1        | 0         | 6         | 0.02        | 0           | 0.1       | 5        |
| Salt (iodised)                                | 1                    | 0          | 0           | 0           | 0          | 0          | 72        | 0         | 0           | 0           | 0         | 0        |
| <b>Ration total</b>                           | <b>126</b>           | <b>387</b> | <b>20.4</b> | <b>11.8</b> | <b>204</b> | <b>4.8</b> | <b>82</b> | <b>12</b> | <b>0.22</b> | <b>0.18</b> | <b>10</b> | <b>7</b> |
| WHO RDA<br>(10-14 years)<br>(12)              |                      | 2210       | 50          | 42.1        | 600        | 24         | 140       | 550       | 0.90        | 1.50        | 14.6      | 25       |
| % of<br>requirements<br>supplied by<br>ration |                      | 18%        | 41%         | 28%         | 34%        | 20%        | 59%       | 2%        | 25%         | 12%         | 69%       | 27%      |

| <i>Ration<br/>Contents<br/>(Mali)<sup>(42)</sup></i> | Daily ration<br>g/person/day | Energy<br>kcal | Protein<br>g | Fat<br>g    | Calcium<br>mg | Iron<br>mg | Iodine<br>µg | Vit.A<br>µg<br>RE | Thiamine<br>mg | Riboflavin<br>mg | Niacin<br>mg | Vit.C<br>mg |
|--|------------------------------|----------------|--------------|-------------|---------------|------------|--------------|-------------------|----------------|------------------|--------------|-------------|
| Rice   | 150                          | 540            | 10.5         | 0.8         | 14            | 2.6        | 0            | 0                 | 0.15           | 0.05             | 8.4          | 0           |
| Pulses (split<br>peas)                               | 30                           | 102            | 7.4          | 0.4         | 17            | 1.3        | 1            | 14                | 0.21           | 0.06             | 0.9          | 1           |
| Vegetable Oil<br>(fortified)                         | 10                           | 89             | 0            | 10          | 0             | 0          | 0            | 90                | 0              | 0                | 0            | 0           |
| <b>Ration total</b>                                  | <b>190</b>                   | <b>731</b>     | <b>17.9</b>  | <b>11.1</b> | <b>30</b>     | <b>3.9</b> | <b>1</b>     | <b>104</b>        | <b>0.36</b>    | <b>0.11</b>      | <b>9.2</b>   | <b>1</b>    |
| WHO RDA<br>(10-14 years)<br>(12)                     |                              | 2210           | 50           | 42.1        | 600           | 24         | 140          | 550               | 0.90           | 1.50             | 14.6         | 25          |
| % of<br>requirements<br>supplied by<br>ration        |                              | 33%            | 36%          | 26%         | 5%            | 16%        | 0%           | 19%               | 40%            | 7%               | 63%          | 2%          |

| <i>Ration<br/>Contents<br/>(Rwanda)<sup>(43)</sup></i> | Daily ration<br>g/person/day | Energy<br>kcal | Protein<br>g | Fat<br>g    | Calcium<br>mg | Iron<br>mg | Iodine<br>µg | Vit.A<br>µg<br>RE | Thiamine<br>mg | Riboflavin<br>mg | Niacin<br>mg | Vit.C<br>mg |
|--|------------------------------|----------------|--------------|-------------|---------------|------------|--------------|-------------------|----------------|------------------|--------------|-------------|
| Maize meal   | 100                          | 366            | 8.5          | 1.7         | 110           | 5.3        | 0            | 141               | 0.83           | 0.46             | 5.5          | 0           |
| Beans (dried)  | 30                           | 101            | 6            | 0.4         | 43            | 2.5        | 0            | 0                 | 0.15           | 0.07             | 1.9          | 0           |
| Vegetable Oil  | 8                            | 71             | 0            | 8           | 0             | 0          | 0            | 72                | 0              | 0                | 0            | 0           |
| Salt (iodised)   | 3                            | 0              | 0            | 0           | 0             | 0          | 180          | 0                 | 0              | 0                | 0            | 0           |
| <b>Ration total</b>                                    | <b>141</b>                   | <b>537</b>     | <b>14.5</b>  | <b>10.1</b> | <b>153</b>    | <b>7.8</b> | <b>180</b>   | <b>213</b>        | <b>0.98</b>    | <b>0.53</b>      | <b>7.4</b>   | <b>0</b>    |
| WHO RDA<br>(10-14 years)<br>(12)                       |                              | 2210           | 50           | 42.1        | 600           | 24         | 140          | 550               | 0.90           | 1.50             | 14.6         | 25          |
| % of<br>requirements<br>supplied by<br>ration          |                              | 24%            | 29%          | 24%         | 25%           | 32%        | 129%         | 39%               | 109%           | 35%              | 50%          | 0%          |