

**Weaning Foods:
Characteristics, Guidelines, and the Role of Soyfoods**

**Published by WISHH
World Initiative for Soy in Human Health
12125 Woodcrest Executive Dr.
Suite 100
St. Louis, MO 63141 USA
wishh@asaim.soy.org
<http://www.wishh.org>**

2006

Abstract:

Weaning foods are generally introduced between the ages of six months to three years old as breastfeeding is discontinued. While breastfed infants are often able to maintain adequate growth through their sixth month, additional nutrients are required to complement or, in some cases, replace breastfeeding completely. The main concern is making sure that there is no gap between nutrient requirements and what a child is able to consume, absorb, and utilize. Nutritional status in children is most vulnerable during the weaning stages when both macro and micronutrients may be insufficient to maintain growth and development. Protein-energy malnutrition and micronutrient under-nutrition occur together. It is an important part of weaning strategies to optimize nutritional status and to tackle undernutrition-related problems as a group for maximum effectiveness.

Traditionally, weaning foods are liquids and semisolids which are later replaced by foods eaten by older family members. In some cases these types of foods can be filling and yet not meet the child's nutrient needs. Establishing appropriate characteristics for nutrients and other aspects of weaning foods that assist in motor skills and mental development will be important to assure the appropriateness of targeting foods to this age group. Soyfoods can play an important role in enhancing the nutritional value and acceptance of weaning foods. This paper will discuss issues around the topic of weaning foods, such as the background knowledge and experience, nutritional needs, and weaning food characteristics. In addition, the role for soyfoods and services available from the World Initiative for Soy in Human Health (WISHH) will be outlined.

Background

10 million children under the age of 5 years old die each year.¹ More than half of the deaths occur because of malnutrition. If adequate health systems were in place nearly 2/3 of the deaths could be prevented. Part of the health systems picture is to promote appropriate feeding practices for infants and young children.

If at all feasible breastfeeding is recommended during the first six months, the most vulnerable period for developing under-nutrition remains the transition from breastfeeding to family foods. Breast milk composition may vary dramatically between women and from the beginning and month six.² Breast milk contains everything a newborn child needs to grow. Breastfeeding should continue throughout this gradual weaning process through at least the first year of life and for two years if possible in order to provide the best nutrition for the growing child, with the exception of cases where there may be the risk for HIV transmission from mother to child.³ A reduction in breast milk consumption and the protection it provides during gastrointestinal infection can increase the risk for illness due to diarrhea in children during weaning.⁴

Weaning is the process of transition from a breast feeding to a semi solid diet for the infant. The weaning period is crucial for the maintenance and continued growth and development of the child and yet it is often the time when foods are given to provide the volume necessary to keep the child from being hungry without regard to the nutritional quality of the transitional foods. Poor quality of weaning foods and improper weaning practices predispose infants to malnutrition, growth retardation, infection, diseases, and high mortality.^{5,6} Mothers may stop breast feeding children early, some times as early as one month's age. Many children are weaned directly into family regular diet without transitioning with foods that provide the required nutrient density and developmental aspects of food behavior. All these factors predispose infants to malnutrition, growth retardation, infection, and higher rates of mortality.

Malnutrition and growth retardation have life long consequences for people and their societies, in terms of higher health care costs, lower productivity, and increased poverty. According to one report until recently 63 out of every 1,000 children born in India died before reaching one year of age.⁷ The vast majority of these children die with preventable diseases, much of which is related to malnutrition. Nutrition-related problems should be identified and counseling should be implemented to promote appropriate feeding practices.^{8 9 10}

Multi-approach strategies, involving the development of improved recipes and processing for weaning foods, nutrition education, access to safe water, good sanitation, economic empowerment of women, reduction in workload, and promotion of breastfeeding and other strategies, are required for a long term and permanent solution to problems associated with early childhood malnutrition. In addition to its role in infant nutrition, when nutritious weaning foods are included in the diet of preschool children, the result may be a decrease in malnutrition and mortality.

Children can develop multiple nutrient deficiencies and it will be important to improve all nutritional parameters at the same time in order to have the best impact on health outcomes. For instance, protein-energy malnutrition can impair iron absorption. Providing iron without addressing protein-energy malnutrition is likely to be less effective and have more potential for adverse effects that can occur with iron supplementation.

Economic and social issues will affect the acceptability and sustainability of weaning food strategies. Integrating weaning products and strategies into the health and social infrastructures that exists for the care and treatment of mothers and their children may be most effective. Multiple products may be required to help to address disparities in financial capacity and social traditions.

Characteristics of Weaning Foods

Infants, toddlers, and preschoolers have high protein and calorie needs. They need more protein and energy per kilogram of body weight than older children and adults do because of their tremendous rate of growth. Generally, children double their birth weight by 6 months of age and triple it by 12 months. During the first month of life, the energy cost for growth is approximately 35% of calories consumed (assuming an adequate calorie intake). This number declines to around 3% at the age of 12 months. Total grams of protein and energy needs may be higher in adults, but are actually lower when compared as grams or calories per kilogram of body weight. Children who are malnourished have even higher needs for catch-up growth, and children who are ill have increased needs to fight infection and disease. Digestion and absorption capacity of the gastrointestinal tract may still be relatively immature during the early weaning period and can impact the effectiveness of weaning foods and the ability to recover nutritional status in malnourished children.^{11 12}

Protein guidelines issued by the U.S. Food and Nutrition Board of the Institutes of Medicine¹³ make these general recommendations for daily protein intake for a normally healthy child. These guidelines should be adjusted upward in cases of illness and the need for catch-up growth.

2 – 6 months old	1.52 g protein/kg body weight
7 – 11 months old	1.5 g protein/kg body weight
1 – 3 years old	1.1 g protein/kg body weight

Energy needs range between 500-800 kcal/day, or approximately 95 kcal/kg/day, during the six-month weaning period and girls tend to need slightly fewer calories than boys (at least 541 kcal/day vs. 603 kcal/day). Energy requirements depend on a number of variables, but formulas used to derive estimates for adequate caloric intake for a normally healthy child are:

4 – 6 months old	$(89 \times \text{weight [kg]} - 100) + 56$
7 – 12 months old	$(89 \times \text{weight [kg]} - 100) + 22$
13 – 35 months old	$(89 \times \text{weight [kg]} - 100) + 20$

There can be a variety of food sources that can offer the mix of nutrients required (see Table 1 for recommended intakes for 7-12 month old children). Foods that are lacking can be fortified with protein and micronutrients with special care to assure that amounts are adequate, but care should be taken to avoid high-doses.

Table 1. Dietary Reference Intake Recommendations¹⁴

Nutrient	RDA 7-12 mo
Energy (kcal)	743
Carbohydrate	95 g/d
Protein	11 g/kg/d
Fat	30 g/d
Protein	13.5 g
Vitamin A (ug/d)	500
Vitamin C (mg/d)	50
Vitamin D (mg/d)	5
Vitamin E (mg/d)	5
Vitamin K (mg/d)	2.5
Thiamin (mg/d)	0.3
Riboflavin (mg/d)	0.4
Niacin (mg/d)	4
Vitamin B6 (mg/d)	0.3
Folate (ug/d)	80
Vitamin B12 (ug/d)	0.5
Pantothenic acid (mg/d)	1.8
Biotin (ug/d)	6
Choline (mg/d)	150
Fluoride (mg/d)	0.7
Iron (mg/d)	40
Selenium (ug/d)	45
Zinc (mg/d)	5

Guidelines for weaning foods suggest that weaning can occur between the ages of 7-12 months. The foods given should have characteristics according to nutritional needs, appropriate textures and viscosity, and appropriate forms (liquid, semisolid, solid) to support mental and physical development. Special attention should be paid to microbial safety during these months as the immune system is still maturing and the protection provided by mother's milk may not be present. For a summary of weaning food characteristics and recommendations, see Table 2.

Table 2. Weaning Food Characteristics

Consideration	Description	Weaning Food Comments
Early breastfeeding cessation	The mother doesn't initiate breastfeeding or ends breastfeeding earlier than the recommended six months	Breastmilk replacement; generally liquid with modified milk or substitute to meet neonatal nutrient needs
Abrupt breastfeeding cessation at six months or later	The mother abruptly stops breastfeeding according to guidelines because of HIV infection or other reason	Weaning foods are generally semi-solid in the form of porridges from 6-8 months and then in the form of semi solid foods until the 12 th month when family foods are integrated
Frequency of feeding	Variations in feeding times occur due to cultural and resource difference; mother/ care taker time may be a consideration in frequency of feeding and the viscosity of the foods.	Feeding is recommended at least four times daily with foods that have an energy density of at least 85 kcal/100 grams. If this is not feasible and if the child requires additional nutrients for catch-up growth, then more nutrient dense weaning foods may be required at more than 120 kcal/100 gram density.
Micronutrients	The quality of the diet should be well-rounded for micronutrients, especially vitamin A, calcium, and iron. The Recommended Nutrient Intake (RNI) is equivalent to the Recommended Dietary Allowance (RDA) in the U.S.	Fortification ingredients or formulas may be required. General nutrition catch-up is important to the ability to absorb and utilize micronutrients, so the weaning foods should concentrate on priorities of fluids, calories, protein, and then micronutrients. Also, it may be necessary to assure combinations that enhance optimal nutrient absorption, such as assuring a vitamin C source with iron-rich plant-based foods.

Consideration	Description	Weaning Food Comments
Knowledge	Mothers and care providers should be well-informed of choices they make in the weaning process due to the high vulnerability of the child during this time.	The development of weaning foods should be based on needs and should include clear instructions and options for the use of the products or ingredients. Cultural beliefs and traditions as well as the potential for stigma should be considered in the development and distribution of weaning foods. Community-based and government-based organizations should also be included in the education and implementation process. Teaching one on one is an effective way to communicate information on the products/ ingredients.
Cost and availability	Economic and geographical constraints affect food choices.	Weaning foods need to consider economic feasibility.
Sustainability	Both the availability and the reinforcement of education should be a part of promoting optimal feeding practices.	Promotion of behavioral change is an ongoing process and will require a long-term plan for the availability of the product and appropriate reinforcement once it is introduced. Wherever possible, recipes can be included to allow for variety of uses with the products and/or ingredients
Storage	Storage capability varies widely according to geographic location and socio-economic issues	Shelf-life should be a consideration in processing. With the use of local ingredients, clear instructions on mixing and storing products are important to nutrient stability and safety.

In the case of maternal HIV infection, recommendations are different in that exclusive breastfeeding should be followed by immediate weaning rather than mixed feeding or complementary feeding as is commonly recommended in non-HIV infected populations. This can place the child at additional risk during the gap between breastfed and fully weaned.¹⁵ Whatever the circumstance, mothers/care givers will require clear and appropriate information on which to base their choices

for child feeding and the introduction of non-breast milk foods.¹⁶ It can be psychologically difficult for mothers to make the transition for their children.

Between the ages of 6-8 months pureed and mashed foods can be introduced and given from a cup or bowl. Viscosity of the foods can affect the volume and nutrient consumption of the weaning foods and this can be used to advantage by individualizing the instructions for an undernourished child.^{17 18} From 8-12 months of age cut up foods that can be handled by the child are appropriate. After 12 months of age, family foods should be relied on for nutrient supplies.

Of special interest in resource-limited settings is the ability to provide iron-rich weaning foods.¹⁹ Meats provide a good source of bioavailable heme-iron, but may not be available or economically feasible for some families. Plant sources of iron should include other food sources of vitamin C to enhance the bioavailability of the non-heme iron provided. Fortification with iron is desirable as long as weaning foods contain appropriate amounts of both iron and vitamin C.

Specific recommendations include assuring adequate fluid provision. Vitamin-rich fruits and vegetables should be provided every day along with adequate protein sources. Fortified foods are recommended and vitamin-mineral supplementation is recommended where fortified foods are not available. Animal foods or adequate substitutes should be provided to assure a source of quality protein and other nutrients.²⁰ Ready-to-use products are especially appropriate where animal foods and breast milk substitutes are less commonly available.

Weaning foods should have good acceptability by both the mothers/care givers and the infants. It is possible that the child's feeding preferences are set early by foods and beverages that may be used as an adjunct to breastfeeding as early as the first week of life.^{21 22} Local foods and fortifying ingredients have been utilized creatively with acceptability in mind.^{23 24 25 26 27 28 29 30} Ingredients should meet expected standards for nutrient content and value as well as food safety. Sources of fluids, calories, protein, and other nutrients can include a wide variety of ingredients that are likely to range in acceptability by mothers/care givers as well as children.³¹

The development and introduction of weaning foods that meet both generally-accepted guidelines and local preferences requires testing in areas where the product is proposed for use.^{32 33} Recipes and instructions on preparation for the preservation of nutrients and the assurance of safety are important features of introducing home-processed or home-prepared weaning foods. Mothers/care givers should be instructed on how to introduce a cup or bowl for feeding with better hygiene. In addition, general food handling precautions, such as hand washing before and after food preparation, careful cleaning of utensils, and appropriate food preparation and storage methods should be included in education activities.

In addition to the characteristics, policy guidelines and directives should be considered in the development, distribution, and commercialization of weaning foods. Policy development requires research on which to build evidence-based practice guidelines. Outcomes from processing to health impact require documentation for the recommendation of feasible methods and materials for weaning foods.^{34 35}

Several policy recommendations and regulations are available online. Examples of guidelines include the World Health Organization's International Code of Marketing of Breast Milk Substitutes,³⁶ Baby Friendly Hospital Initiative,³⁷ the Innocent Declaration from the "Convention of the Rights of the Child",^{38 39 40} and Codex Alimentarius,⁴¹ among others. In addition, each country is likely to have governmental regulations that pertain to the development, distribution, and marketing of infant weaning products.

Guidelines are not always clear to the end user and definitions that pertain to other populations may not transfer well to weaning foods. Such is the issue of "fiber" and "non-digestible carbohydrates", of which the former can be problematic in feeding young children and the latter has been suggested as helpful in supporting the colonization of the gut with beneficial bacteria.⁴²

Role for Soy in Weaning Foods

Most traditional weaning foods are based on cereals, and hence low in protein. In Africa weaning foods are generally fermented products made with one or more of the following cereals: maize, sorghum, and millet. Often rice, roots and tubers are also included. In India and many other countries in Asia, weaning foods generally consist of lentil and rice soups and wheat-based gruels. Adding sugar and oil can increase energy content, but not many can afford these ingredients. In addition, these foods are low in protein that is essential to growth and development. These ingredients make foods bulky to fill a child's stomach without necessarily providing adequate nutrition. Adults and older children, whose stomachs are larger, can often eat enough of these starchy foods to compensate for their lower-quality protein and nutrients, but babies and toddlers are not able to process that much food. They need high-quality protein and nutrient-dense foods. Without adequate protein and calories, babies tend to develop protein-energy malnutrition, which often stunts their growth and development, and also makes them susceptible to illness and death.

Soy can greatly improve the nutritional value of weaning foods. Processed soy products (defatted soy flour, textured soy protein, soy protein concentrate, and soy protein isolate) have very high protein content and very high protein digestibility corrected amino acid score (PDCAAS) compared to traditional foods. Selected examples are presented in Table 3.

Table 3. Protein Digestibility of Selected Foods Used in Weaning

Product Name	Protein Content (grams/100 g of product)	PDCAAS
Isolated Soy Protein	86.0	1.00
Soy Protein Concentrate	58.1	0.99
Peas	24.6	0.73
Chickpeas	19.3	0.71
Rolled Oats	16.0	0.57
Peanut Meal	13.5	0.52
Rice	6.7	0.47
Corn	8.5	0.42
Whole Wheat	15.6	0.40

Enriching weaning foods with soy is a convenient, inexpensive, and highly effective way to upgrade the quality of traditional weaning foods and to provide the nutrition a growing child needs. Soy works together with grain proteins to achieve an overall increase in the value of the protein. Adding even small quantities of soy can greatly increase protein content and quality of weaning foods. For example, a weaning food that contains 88% cornmeal and 12% soy flour has more than one and a half times the protein as a weaning food made with cornmeal alone, and the protein is of a higher quality. Increasing the proportion of soy in any food will provide more protein. Soyfoods also provide many micronutrients that are important to health, growth, and development. Depending on the type of soy food used, the vitamin and mineral content of the weaning food may also be enhanced. Children who are weaned on foods containing adequate amounts of high quality protein, such as soy-enhanced foods, grow better and stay healthier than children who receive traditional weaning foods that are high in bulk and low in protein.⁴³

It is easy to enhance to traditional weaning foods with soy. Soy flour, cooked and mashed soybeans, or other soy protein ingredients can be mixed into traditional weaning foods during the cooking process. Soy-enriched weaning foods are generally acceptable in flavor and texture to babies and toddlers.

In order to reach millions of small children suffering from malnutrition, it is critical to develop techniques for improving protein content and overall nutritional value of traditional weaning foods. Several blended soy cereal products, such as corn soy blend (CSB), wheat soy blend (WSB), and corn soy milk (CSM) are ideally suited for weaning foods. They have an excellent nutritional profile and are easy to use. However, since they include cereals, they can only be added to traditional weaning foods by replacing a portion of less-expensive and locally available cereals. When local cereals are used, soy protein products can solve the problem of protein deficiency in these foods.

Abundant research has been conducted all over the world on how to improve nutritional value of traditional weaning food by adding higher protein ingredients. Researchers have experimented with a variety of vegetable protein sources, including all varieties of lentils and beans. Soy products have higher levels of protein (in terms of grams of protein/hundred grams) and better quality (higher PDCAAS) protein than all other vegetable protein sources. They are typically cheaper than beans and lentils. Soy protein ingredients are adaptable to almost any traditional recipe and are extremely easy to use. Blends of cereals and soybeans can be processed at the home level using commonly available equipment found in local kitchens. Soy protein ingredients have a long shelf life (generally at least one year) and can be stored like ground cereals. Soy enhanced weaning foods are very well accepted by children. The Appendix provides several recipes for enhancing traditional weaning foods with soy.

Weaning Food Production

A wide variety of commercially produced weaning foods are available in the developing countries. A variety of different cereals products are enhanced with dairy or soy protein. The products are often fortified with vitamin-mineral premixes. These commercial weaning foods offer excellent nutrition for babies and toddlers, but may be somewhat expensive. They are considered luxury items, used



largely by the wealthier segments of society. Care providers may dilute commercial weaning foods to make it last for a longer period of time and to make them seem economically feasible. Under these circumstances, children may remain malnourished despite the use of a high quality formula. Many of these foods are produced by large multinational companies. However, even in big markets such as India and Nigeria, multinationals often produce weaning foods locally.

While it is very difficult for small companies to compete with multinational corporations, many entrepreneurs in developing countries successfully produce weaning foods for local and regional sales. In many countries, local companies may receive technical and financial support from their national governments, USAID funded projects, and other funding sources to improve quality factors of local weaning foods.

Traditional and commercial weaning foods may have different nutritional values and cost implications, largely due to differences in the ingredients used. Table 4

compares nutritional value of selected traditional weaning foods used in Africa with popular commercial products. Both types of products provide similar amount of energy on a dry basis, but traditional foods are low in protein. Addition of soy to the weaning foods prepared at home will both increase the nutrient density including protein content.

Table 4. Nutritive Value of Traditional Weaning Foods as Compared with Commercial Weaning Products

Food	Energy (kcal)	Ash (g/100g dry weight)	Protein (g/100g dry weight)	Carbohydrates (g/100g dry weight)
Traditional Weaning Foods				
Guinea corn pap	415	0.5	4	92
Maize pap	417	0.2	6	91
Millet pap	419	0.5	7	88
Millet pap + soya bean milk	420	1.8	19	74
Guinea corn porridge	412	1.0	5	91
Millet porridge + soya bean milk	413	2.2	23	70
Commercial Products				
Lactogen	463	4.8	22	52
Similac	517	3.0	11	56
Cerelac	512	3.3	16	67

Imported weaning foods (for example Ceralac) may be out of the economic reach of poorer populations. The weaning foods made in country (for example, Soy Ugi made in Nairobi, Kenya by Unga Mills) can be nutrient dense, hygienic, and affordable to the middle class of that country. Poor families may need appropriate urban household- or village-scale technology, which will allow for incorporation of soybeans into the weaning food prepared at home.

Local and small scale manufacturers face several challenges in successfully competing with multinationals in the weaning foods arena. These include:

- High packaging costs
- Sanitation and food safety standards
- Quality control for consistent quality assurance
- Lack of consumer confidence
- High marketing costs

The cost differences between domestic and imported products is often not large enough to compensate for consumer concerns about quality.

Role for WISHH in Weaning Food Projects

WISHH has expertise to assist developing countries improve weaning foods, both home made and commercially produced by local processors. Services available through WISHH include:

Food technology: Processors can receive food technology assistance in developing weaning food ingredient mix ideally suited for their nutritional objectives and economic constraints and cultural practices of their consumers. Assistance is also provided in developing the food production process.

Equipment: WISHH can assist processors select equipment suited for the scale of their operations and their production process.

Sanitation and Food Safety: Protocols and training are provided for testing raw materials and monitoring all stages of production and facilities to ensure that products will be safe for consumption throughout their shelf life.

Quality Control: Consistent quality of weaning foods is extremely important to convince parents to buy locally manufactured products. Consistency can be a problem since weaning foods involve blending a variety of ingredients. WISHH can provide processors expertise to ensure their products have a consistent quality.

Packaging and Labeling: Packaging of weaning foods is very important to protect the product from contamination and to keep it in the best possible condition throughout its shelf-life. Quality of packaging and labeling are often used by consumers as proxies for quality. WISHH can assist businesses develop low cost and safe packaging and impressive and informative labels.

Marketing: WISHH can help processors market their products to various consumer segments.

Home Level Weaning Food Training: WISHH has expertise to arrange training foods to teach mothers and care givers how to improve weaning foods they traditionally make with soy protein.

Nutrition Education and Training: Ignorance and food taboos are a major cause of poor nutritional quality. Weaning foods with higher nutritional value may not be easily adopted, unless extensive nutrition education is provided to mothers. WISHH can provide educational materials that can be easily incorporated into primary health care programs. WISHH can also assist processors organize consumer testing programs to demonstrate to parents that their children will like soy enhanced weaning foods.

Policy Maker Education: WISHH assists local entrepreneurs and PVOs develop strategies to educate policy makers about the importance of improved weaning foods for the society. Their buy-in is often critical for large scale acceptance of changes in food products.

Regulations: Weaning foods are well regulated by governments. Weaning foods must not only comply with all relevant food legislation, but are also subject to

additional specific regulations. WISHH can work with entrepreneurs to help them understand government regulations and comply with them.

Research: WISHH can provide technical services to design, implement, and evaluate projects for program understanding, product utilization and acceptability, and health impact.

Monitoring and Evaluation: WISHH can provide technical services to design, implement and evaluate programs for food, nutrition, and health aspects of programs.

Program and Project Design: In collaboration with partners, WISHH can assist in the design of programs that aim to improve nutritional health and incorporate soyfoods.

Summary

Weaning foods and products have been in the limelight over the last few years as childhood malnutrition and mortality continue to be confounding issues in the pursuit of improving global health outcomes. Both ingredients and ready-to-use weaning foods should be developed with social, economic, and health factors in mind. Regulations and guidelines have been recommended by global organizations, such as the World Health Organization, and local regulatory and professional groups. Processors should be aware of the many factors to consider in developing and marketing weaning foods to make sure that the impact is positive and the improvements are purposeful and measurable. WISHH can provide technical services to assist those interested in improving weaning foods for vulnerable and other populations, including education and training, consultation with food processors, and program development, implementation, and monitoring of efforts to improve weaning foods.

Resources

Literature reviews on weaning foods and projects can be found using key words at www.pubmed.com.

Additional reading may include the items in footnotes and the following:

Child Feeding

Suggestions for anthropometric indicator reporting on child nutrition. This scheme could be used when testing effectiveness of weaning foods to maintain and improve nutritional status:

Nandy S, Irving M, Gordon D, Subramanian SV, Smith GD. Poverty, child undernutrition and morbidity: new evidence from India.

Linkages Project: Infant Feeding Options in the Context of HIV. Updated May 2005. Available at:

http://www.linkagesproject.org/media/publications/Technical%20Reports/Infant_Feeding_Options.pdf

Various complementary feeding publications through the Linkages Project. Available at: <http://www.linkagesproject.org/technical/compfeeding.php>

Recommendations for complementary feeding practices.

Optimal complementary feeding practices to prevent childhood malnutrition in developing countries. From the Food and Nutrition Bulletin. WHO. Available at: <http://www.micronutrient.org/idpas/pdf/284OptimalComplementary.pdf>

Food Processing

Food Processing Case Study in Kenya. A description of a project to build local processing industry.

Maretzki AN. Lessons learned through the NutriBusiness Project in rural Kenya. Presentation at 38th Society for Nutrition Education, July 27, 2004. Available at: <http://www.sne.org/documents/GlobalNutritionEducationLessonsLearnedAudreyMaretzki.doc>

Sensory evaluation of selected weaning food formulations.

Onuorah Ce, Akinjede FA. Comparative evaluation of four formulated weaning foods and a commercial product. Nigerian Food Journal. 2004;22:48-53. Abstract at: <http://www.ajol.info/viewarticle.php?jid=231&id=20603&OJSSID=827d7d6fcbfa38bc5dd4c34d153eeb81>

Iron in weaning foods: an evaluation of options.

Davidsson L, Kastenmayer P, Szajewska H, Hurrell RF, Barclay D. Iron bioavailability in infants from an infant cereal fortified with ferric pyrophosphate or ferrous fumarate. Am J Clin Nutr. 2000;71:1597-1602.

Report of banana and soy weaning food in Uganda.

Katebarirwe JG, Nabugoomu F, Muranga FI. Optimisation of soy incorporation in banana based weaning foods. Abstract available at: <http://www.pronutrition.org/archive/200508/msg00061.php>

Soy-fortified weaning foods

Annan NT, Plahar WA. Development and quality evaluation of a soy-fortified Ghanaian weaning food. Available at: <http://www.unu.edu/unupress/food/8F163e/8F163E0f.htm>

Espinola N, Creed-Kanashiro H, Ugaz ME, van Hal M, Scott G. Development of a sweet potato-based instant weaning food for poorly nourished children six months to three years old. CIP Progress Report 1997-1998; 295-302.

Zanna MSH, Milala MA. Effect of supplementation of ogi a pearl millet based Nigerian weaning food, with cowpea, on chemical composition, sensory and *in vitro* protein digestibility. J Biol Sci. 2004;4(5):654-657.

APPENDIX A

The nutritional needs for an infant are met completely through mother's milk or iron-fortified formula until the age of six months. The American Academy of Pediatrics, the World Health Organization and the National Association of Pediatric Nurse Practitioners recommend that all infants be exclusively breastfed for the first six months of life.

When are babies ready for solid foods? Besides when, the other questions commonly asked are how much and which solid foods should be given to infants?

Keeping in mind that each baby is an individual, readiness for introduction of solid foods will be based on age, nutritional and physical needs, and other developmental factors. Babies are ready to begin solid foods when they can hold their head steady when sitting, open mouth when food approaches, able to swallow when food is placed on the tongue and show an interest in food when others eat.

Feeding time is very important for baby and mother or other caretaker. Choose a time when baby is not too tired, hungry or sleepy to begin their initial solid feeding. Baby may be more ready to start a new solid food after a short nursing or formula feeding.

The following guidelines are very helpful in the introduction of solid foods for babies.

- The best first food is a single grain (usually rice) iron fortified cereal. It is easily digested and least allergenic.
- Mix 1 to 2 teaspoons of rice cereal with breast milk or formula to make thin gravy. Begin with 1 to 2 teaspoons and gradually increase to 4 to 6 tablespoons of cereal twice a day.
- Increase thickness after baby becomes used to the consistency and taste of new food.
- Always make sure baby is sitting up to eat. This prevents choking and also enables baby to learn to swallow correctly.
- Always use a small spoon with a rubber coating at the tip and a long handle. Baby must be fed slowly.
- Do not add cereal or any other solid foods in the baby bottle to feed infants.
- Introduce only one new food at a time over a period of 10 to 12 days. This allows time to watch for any allergic reaction to the new food being introduced.
- Monitor signs for possible allergic reactions such as a new skin rash, vomiting or diarrhea. If any such reactions are observed, discontinue the newly introduced food promptly. Allergic reactions to foods must be reported immediately to health care providers.
- Appetite can vary from day to day. Hence, a baby should not be forced eat if they are refuse to eat. Babies know when they are hungry.

Appendix B

Catalogue of Popular Biscuit and Weaning Food Recipes

Product Used

- *Basic Staples*
 - o Avocado
 - o Banana
 - o Bell pepper
 - o Carrots
 - o Collard greens
 - o Corn grits
 - o Corn meal
 - o Dates
 - o Green onion
 - o Oatmeal
 - o Onion
 - o Potato
 - o Rice, raw or puffed
 - o Sorghum molasses
 - o Spinach
 - o Sweet potato
 - o Tomato
 - o Wheat flour
- *Soy Products*
 - o Corn Soy Blend
 - o Defatted Soy Flour
 - o Soy Milk

The following recipes can be adapted to suit the needs of the child and the availability of ingredients. Sweeteners can be added if available and if extra calories are desirable. The consistency of the porridge will vary with the amount of water added and the texture of added foods (onions, greens, grits, fruit, etc.). Be sure that if the food is thick or has large pieces, the child is able to chew and swallow it. Most recipes can be puréed if necessary for younger children.

Each serving listed contains approximately 2 grams protein. This is about one-sixth of the daily protein requirement of a normally healthy toddler, 13 to 36 months, weighing 11 kg (50th percentile weight for an 18-month-old girl or 15-month-old boy, according to charts issued by the U.S. Center for Disease Control). Actual serving sizes will vary depending on the age and weight of the child, availability of other foods, how dilute the weaning food is, etc. If portions are half the indicated size, then the nutrient content will be half as great. Increasing the amount of soy product will increase the protein. Protein content is also given for each recipe if it were made without using soy. Please note that not only is the protein content higher when soy is included, but the protein quality is better.

Use these recipes as a starting place and adapt them to your own needs. Serving sizes and accompanying nutrition analysis are reasonable approximations but not definitive guidelines. References to 'Protein w/o soy' are the protein content of recipes made with the soy ingredient omitted. In some cases it is assumed the soy ingredient would be replaced with another ingredient (i.e. water for soymilk, and corn meal or wheat flour for soy flour).

Note: For recipes that follow, print and cut between rows to fold back into recipe cards.

Collard Soy Porridge

Ingredients

1 cup corn/soy blend
3 cups water
1 Tbsp. soy oil
¼ cup onion, finely chopped
½ tsp. minced garlic
1 cup collard greens, finely chopped

Instructions

1. Add water to corn/soy blend in a pot. Mix well and set aside.
2. Heat the oil in a saucepan. Add onion and garlic. Cook until soft.
3. Add cooked onion to flour mixture. Cook the mixture, stirring constantly, to get a smooth porridge.
4. Add collard leaves. Simmer for 2 minutes. Serve warm.

Makes about 2 cups

Variation: Other vegetables can replace the collard greens as desired.

Collard Soy Porridge	
Recipe:	
Number of Servings:	7
Serving Size:	¼ cup
Nutrients	
Calories:	83 kcal
Protein:	2.1 g
Carbohydrates:	13 g
Fat:	3.0 g
Protein w/o soy	1.6 g

Soy Sweet Potato Baby Food

Ingredients

¾ cup corn/soy blend
1 sweet potato, about 5" long, peeled, cooked and mashed
2 ½ cups water
1 Tbsp. sugar, or as desired

Instructions

1. Mix corn/soy blend, mashed sweet potato and water until well blended.
2. Bring the mixture to a boil, stirring constantly. Reduce heat and simmer for about 5 minutes. Add sugar as desired before serving.

Makes about 4 cups

Soy Sweet Potato Baby Food	
Recipe:	
Number of Servings:	6
Serving Size:	2/3 cup
Nutrients	
Calories:	77 kcal
Protein:	2.1 g
Carbohydrates:	16 g
Fat:	0.9 g
Protein w/o soy	1.6 g

Soy Sweet Potato Baby Food (2)

Ingredients

1 sweet potato, about 5" long, peeled, cooked and mashed
¼ cup defatted soy flour
1 cup water
2 Tbsp. brown sugar, or to taste

Instructions

1. Mix the mashed sweet potato with the soy flour to combine. Gradually stir in the water.
2. Bring the mixture to boil, reduce heat and simmer for a few minutes. Add the sugar as desired before serving.

Makes about 2 cups

Variations: cassava, carrots, corn meal, hominy or potato can be used instead of sweet potato

Soy Sweet Potato Baby Food (2)	
Recipe:	
Number of Servings:	6
Serving Size:	1/3 cup
Nutrients	
Calories:	50 kcal
Protein:	2.3 g
Carbohydrates:	10 g
Fat:	0.1 g
Protein w/o soy	0.8

<p align="center">Soy-Whole Wheat Weaning Food</p> <p><u>Ingredients</u> ¼ cup whole wheat flour 2 Tbsp. defatted soy flour 3 cups water 2 Tbsp. brown sugar 2 Tbsp. molasses</p> <p><u>Instructions</u> 1. Stir together the wheat flour and soy flour. Gradually stir in the water. 2. Bring the mixture to a boil, then reduce heat and simmer a few minutes. Stir in the brown sugar and molasses and simmer another minute. Makes about 3 1/3 cups</p>	<table border="1"> <thead> <tr> <th colspan="2">Soy-Whole Wheat Weaning Food</th> </tr> </thead> <tbody> <tr> <td>Recipe:</td> <td></td> </tr> <tr> <td>Number of Servings:</td> <td align="right">10</td> </tr> <tr> <td>Serving Size:</td> <td align="right">1/3 cup</td> </tr> <tr> <th colspan="2">Nutrients</th> </tr> <tr> <td>Calories:</td> <td align="right">62 kcal</td> </tr> <tr> <td>Protein:</td> <td align="right">2.1 g</td> </tr> <tr> <td>Carbohydrates:</td> <td align="right">13 g</td> </tr> <tr> <td>Fat:</td> <td align="right">0.3 g</td> </tr> <tr> <td>Protein w/o soy</td> <td align="right">1.8 g</td> </tr> </tbody> </table>	Soy-Whole Wheat Weaning Food		Recipe:		Number of Servings:	10	Serving Size:	1/3 cup	Nutrients		Calories:	62 kcal	Protein:	2.1 g	Carbohydrates:	13 g	Fat:	0.3 g	Protein w/o soy	1.8 g
Soy-Whole Wheat Weaning Food																					
Recipe:																					
Number of Servings:	10																				
Serving Size:	1/3 cup																				
Nutrients																					
Calories:	62 kcal																				
Protein:	2.1 g																				
Carbohydrates:	13 g																				
Fat:	0.3 g																				
Protein w/o soy	1.8 g																				
<p>Soy-Rice Porridge</p> <p><u>Ingredients</u> ½ cup raw rice 2 Tbsp. defatted soy flour 2 Tbsp. sugar 2 ½ cups water</p> <p><u>Instructions</u> 1. Grind the rice to a fine particle size in the blender or crush in a mortar. 2. Combine the rice, soy flour, and sugar. Stir in the water. Bring the mixture to a boil, then reduce heat and simmer over very low heat, stirring occasionally, about 15 minutes. Make about 2 cups</p>	<table border="1"> <thead> <tr> <th colspan="2">Soy-Rice Porridge</th> </tr> </thead> <tbody> <tr> <td>Recipe:</td> <td></td> </tr> <tr> <td>Number of Servings:</td> <td align="right">6</td> </tr> <tr> <td>Serving Size:</td> <td align="right">1/3 cup</td> </tr> <tr> <th colspan="2">Nutrients</th> </tr> <tr> <td>Calories:</td> <td align="right">68 kcal</td> </tr> <tr> <td>Protein:</td> <td align="right">2.0 g</td> </tr> <tr> <td>Carbohydrates:</td> <td align="right">15 g</td> </tr> <tr> <td>Fat:</td> <td align="right">0 g</td> </tr> <tr> <td>Protein w/o soy</td> <td align="right">1.0 g</td> </tr> </tbody> </table>	Soy-Rice Porridge		Recipe:		Number of Servings:	6	Serving Size:	1/3 cup	Nutrients		Calories:	68 kcal	Protein:	2.0 g	Carbohydrates:	15 g	Fat:	0 g	Protein w/o soy	1.0 g
Soy-Rice Porridge																					
Recipe:																					
Number of Servings:	6																				
Serving Size:	1/3 cup																				
Nutrients																					
Calories:	68 kcal																				
Protein:	2.0 g																				
Carbohydrates:	15 g																				
Fat:	0 g																				
Protein w/o soy	1.0 g																				
<p>White Corn Meal Porridge</p> <p><u>Ingredients</u> 2/3 cup white corn meal 2 Tbsp. defatted soy flour 2 cups water 1 Tbsp. sugar, or to taste</p> <p><u>Instructions</u> 1. Mix white corn meal with the soy flour. Stir in the water and bring to a boil. Reduce heat and simmer until thickened. 2. Add the sugar and simmer a minute longer. Makes about 2 ½ cups</p>	<table border="1"> <thead> <tr> <th colspan="2">White Corn Meal Porridge</th> </tr> </thead> <tbody> <tr> <td>Recipe:</td> <td></td> </tr> <tr> <td>Number of Servings:</td> <td align="right">6</td> </tr> <tr> <td>Serving Size:</td> <td align="right">3 Tbsp.</td> </tr> <tr> <th colspan="2">Nutrients</th> </tr> <tr> <td>Calories:</td> <td align="right">65 kcal</td> </tr> <tr> <td>Protein:</td> <td align="right">2.1 g</td> </tr> <tr> <td>Carbohydrates:</td> <td align="right">14 g</td> </tr> <tr> <td>Fat:</td> <td align="right">0.5 g</td> </tr> <tr> <td>Protein w/o soy</td> <td align="right">1.1 g</td> </tr> </tbody> </table>	White Corn Meal Porridge		Recipe:		Number of Servings:	6	Serving Size:	3 Tbsp.	Nutrients		Calories:	65 kcal	Protein:	2.1 g	Carbohydrates:	14 g	Fat:	0.5 g	Protein w/o soy	1.1 g
White Corn Meal Porridge																					
Recipe:																					
Number of Servings:	6																				
Serving Size:	3 Tbsp.																				
Nutrients																					
Calories:	65 kcal																				
Protein:	2.1 g																				
Carbohydrates:	14 g																				
Fat:	0.5 g																				
Protein w/o soy	1.1 g																				
<p>Corn Soy Grits</p> <p><u>Ingredients</u> 1 cup corn grits, soaked for 2 hours 6 cups water 2 Tbsp. defatted soy flour 1 tsp. sugar, or to taste</p> <p><u>Instructions</u> 1. Put the corn grits in a pot and add the water. Let soak for 2 hours. Without draining, bring the water and grits to a boil. Reduce heat and simmer until the grits have softened, up to an hour. 2. Stir in the soy flour and sugar. Simmer a few minutes longer. Makes about 2 cups</p>	<table border="1"> <thead> <tr> <th colspan="2">Corn Soy Grits</th> </tr> </thead> <tbody> <tr> <td>Recipe:</td> <td></td> </tr> <tr> <td>Number of Servings:</td> <td align="right">9</td> </tr> <tr> <td>Serving Size:</td> <td align="right">¼ cup</td> </tr> <tr> <th colspan="2">Nutrients</th> </tr> <tr> <td>Calories:</td> <td align="right">73 kcal</td> </tr> <tr> <td>Protein:</td> <td align="right">2.0 g</td> </tr> <tr> <td>Carbohydrates:</td> <td align="right">16 g</td> </tr> <tr> <td>Fat:</td> <td align="right">0 g</td> </tr> <tr> <td>Protein w/o soy</td> <td align="right">1.3 g</td> </tr> </tbody> </table>	Corn Soy Grits		Recipe:		Number of Servings:	9	Serving Size:	¼ cup	Nutrients		Calories:	73 kcal	Protein:	2.0 g	Carbohydrates:	16 g	Fat:	0 g	Protein w/o soy	1.3 g
Corn Soy Grits																					
Recipe:																					
Number of Servings:	9																				
Serving Size:	¼ cup																				
Nutrients																					
Calories:	73 kcal																				
Protein:	2.0 g																				
Carbohydrates:	16 g																				
Fat:	0 g																				
Protein w/o soy	1.3 g																				

Soy Potato Weaning Food

Ingredients

- 1 Tbsp. oil
- 2 Tbsp. chopped green onions
- 1 cup water
- 1 ½ cups mashed cooked potatoes
- 2 Tbsp. defatted soy flour

Instructions

1. Heat the oil in a pan and sauté the green onion in it.
2. Add water, mashed potatoes, and soy flour. Bring to a boil, reduce heat and simmer for 5 minutes.

Makes about 2-1/3 cups

Soy Potato Weaning Food	
Recipe:	
Number of Servings:	7
Serving Size:	1/3 cup
Nutrients	
Calories:	66 kcal
Protein:	2.0 g
Carbohydrates:	9 g
Fat:	2.6 g
Protein w/o soy	1.2 g

Soy-Oatmeal Porridge

Ingredients

- 1 cup oatmeal
- 2 Tbsp. defatted soy flour
- 2 Tbsp. sugar
- 2 ¼ cups water

Instructions

1. Mix together the oatmeal, soy flour, and sugar; stir in the water.
2. Bring the mixture to a boil. Reduce heat and simmer, stirring occasionally, for 5 to 10 minutes. (Coarser oatmeal flakes may take longer and require additional water.)

Makes about 2 cups

Soy-Oatmeal Porridge	
Recipe:	
Number of Servings:	8
Serving Size:	¼ cup
Nutrients	
Calories:	50 kcal
Protein:	2.1 g
Carbohydrates:	10 g
Fat:	0.7 g
Protein w/o soy	1.4 g

Vegetable Weaning Food

Ingredients

- 2 Tbsp oil
- 1 medium onion, chopped
- 1 bell pepper, finely chopped
- 1 tomato, peeled, seeded and chopped
- 2 carrots, finely chopped
- 3 Tbsp. defatted soy flour
- 1 cup water

Instructions

1. Heat the oil in a pot over moderate heat and sauté the onion in it until soft.
2. Add the bell pepper, tomato, carrots, and soy flour. Heat and stir for 1 minute.
3. Add the water. Bring the mixture to a boil, then reduce heat and simmer about 20 minutes, until the vegetables are very soft. Mash or purée for very young children.

Makes about 1 ¾ cups

Vegetable Weaning Food	
Recipe:	
Number of Servings:	7
Serving Size:	¼ cup
Nutrients	
Calories:	67 kcal
Protein:	2.0 g
Carbohydrates:	7 g
Fat:	4.1 g
Protein w/o soy	0.8 g

<p>Soy milk and Avocado</p> <p><u>Ingredients</u> 1 ripe avocado, peeled and mashed ½ cup soymilk</p> <p><u>Instructions</u> 1. Blend or mash together very well the avocado, soymilk and sugar.</p> <p>Makes about 1 cup</p>	<table border="1"> <thead> <tr> <th colspan="2">Soy milk and Avocado</th> </tr> </thead> <tbody> <tr> <td>Recipe:</td> <td></td> </tr> <tr> <td>Number of Servings:</td> <td>5</td> </tr> <tr> <td>Serving Size:</td> <td>3 Tbsp</td> </tr> <tr> <th colspan="2">Nutrients</th> </tr> <tr> <td>Calories:</td> <td>77 kcal</td> </tr> <tr> <td>Protein:</td> <td>1.9 g</td> </tr> <tr> <td>Carbohydrates:</td> <td>5 g</td> </tr> <tr> <td>Fat:</td> <td>6.4 g</td> </tr> <tr> <td>Protein w/o soy</td> <td>0.8 g</td> </tr> </tbody> </table>	Soy milk and Avocado		Recipe:		Number of Servings:	5	Serving Size:	3 Tbsp	Nutrients		Calories:	77 kcal	Protein:	1.9 g	Carbohydrates:	5 g	Fat:	6.4 g	Protein w/o soy	0.8 g
Soy milk and Avocado																					
Recipe:																					
Number of Servings:	5																				
Serving Size:	3 Tbsp																				
Nutrients																					
Calories:	77 kcal																				
Protein:	1.9 g																				
Carbohydrates:	5 g																				
Fat:	6.4 g																				
Protein w/o soy	0.8 g																				
<p>Soy milk and Banana Drink</p> <p><u>Ingredients</u> 1 cup soymilk 1Tbsp. sugar, or to taste 1 ripe banana, mashed until very smooth</p> <p><u>Instructions</u> 1. Combine all the ingredients, mixing very well. Use a blender if available.</p> <p>Makes about 1 ½ cups</p>	<table border="1"> <thead> <tr> <th colspan="2">Soy milk and Banana Drink</th> </tr> </thead> <tbody> <tr> <td>Recipe:</td> <td></td> </tr> <tr> <td>Number of Servings:</td> <td>6</td> </tr> <tr> <td>Serving Size:</td> <td>¼ cup</td> </tr> <tr> <th colspan="2">Nutrients</th> </tr> <tr> <td>Calories:</td> <td>44 kcal</td> </tr> <tr> <td>Protein:</td> <td>2.0 g</td> </tr> <tr> <td>Carbohydrates:</td> <td>8 g</td> </tr> <tr> <td>Fat:</td> <td>0.9 g</td> </tr> <tr> <td>Protein w/o soy</td> <td>0.2 g</td> </tr> </tbody> </table>	Soy milk and Banana Drink		Recipe:		Number of Servings:	6	Serving Size:	¼ cup	Nutrients		Calories:	44 kcal	Protein:	2.0 g	Carbohydrates:	8 g	Fat:	0.9 g	Protein w/o soy	0.2 g
Soy milk and Banana Drink																					
Recipe:																					
Number of Servings:	6																				
Serving Size:	¼ cup																				
Nutrients																					
Calories:	44 kcal																				
Protein:	2.0 g																				
Carbohydrates:	8 g																				
Fat:	0.9 g																				
Protein w/o soy	0.2 g																				
<p>Soy Rice and Dates</p> <p><u>Ingredients</u> 1 cup puffed rice 1 ½ cups soymilk ½ cup pitted dates, finely chopped 1 Tbsp. Sugar 1 tsp. Vanilla (optional)</p> <p><u>Instructions</u> 1. Crush puffed rice using a rolling pin or blender. 2. Mix puffed rice with soymilk. Stir in dates and sugar. 3. Bring to a boil. Reduce heat and simmer, stirring occasionally, until dates are softened. 4. Remove from heat and stir in vanilla, if desired.</p> <p>Makes about 2 cups</p>	<table border="1"> <thead> <tr> <th colspan="2">Soy Rice and Dates</th> </tr> </thead> <tbody> <tr> <td>Recipe:</td> <td></td> </tr> <tr> <td>Number of Servings:</td> <td>7</td> </tr> <tr> <td>Serving Size:</td> <td>¼ cup</td> </tr> <tr> <th colspan="2">Nutrients</th> </tr> <tr> <td>Calories:</td> <td>72 kcal</td> </tr> <tr> <td>Protein:</td> <td>1.9 g</td> </tr> <tr> <td>Carbohydrates:</td> <td>15 g</td> </tr> <tr> <td>Fat:</td> <td>0.9 g</td> </tr> <tr> <td>Protein w/o soy</td> <td>0.4 g</td> </tr> </tbody> </table>	Soy Rice and Dates		Recipe:		Number of Servings:	7	Serving Size:	¼ cup	Nutrients		Calories:	72 kcal	Protein:	1.9 g	Carbohydrates:	15 g	Fat:	0.9 g	Protein w/o soy	0.4 g
Soy Rice and Dates																					
Recipe:																					
Number of Servings:	7																				
Serving Size:	¼ cup																				
Nutrients																					
Calories:	72 kcal																				
Protein:	1.9 g																				
Carbohydrates:	15 g																				
Fat:	0.9 g																				
Protein w/o soy	0.4 g																				
<p>Soy milk Vegetable Mix</p> <p><u>Ingredients</u> ½ cup cooked chopped carrot ½ cup cooked chopped potato ½ cup cooked spinach 1 cup soymilk</p> <p><u>Instructions</u> 1. Mash the vegetables together. Add a little soymilk as necessary to help mash to a paste. 2. Add the remaining soymilk and heat through.</p> <p>Makes about 2 cups</p>	<table border="1"> <thead> <tr> <th colspan="2">Soy milk Vegetable Mix</th> </tr> </thead> <tbody> <tr> <td>Recipe:</td> <td></td> </tr> <tr> <td>Number of Servings:</td> <td>8</td> </tr> <tr> <td>Serving Size:</td> <td>¼ cup</td> </tr> <tr> <th colspan="2">Nutrients</th> </tr> <tr> <td>Calories:</td> <td>30 kcal</td> </tr> <tr> <td>Protein:</td> <td>2.0 g</td> </tr> <tr> <td>Carbohydrates:</td> <td>5 g</td> </tr> <tr> <td>Fat:</td> <td>0.6 g</td> </tr> <tr> <td>Protein w/o soy</td> <td>0.6 g</td> </tr> </tbody> </table>	Soy milk Vegetable Mix		Recipe:		Number of Servings:	8	Serving Size:	¼ cup	Nutrients		Calories:	30 kcal	Protein:	2.0 g	Carbohydrates:	5 g	Fat:	0.6 g	Protein w/o soy	0.6 g
Soy milk Vegetable Mix																					
Recipe:																					
Number of Servings:	8																				
Serving Size:	¼ cup																				
Nutrients																					
Calories:	30 kcal																				
Protein:	2.0 g																				
Carbohydrates:	5 g																				
Fat:	0.6 g																				
Protein w/o soy	0.6 g																				

Biscuits

Ingredients

1 cup all-purpose flour
¼ cup defatted soy flour
¼ cup granulated sugar
1 tsp. baking powder
¼ tsp. salt
3 Tbsp. oil
¼ cup water (add a few drops more if necessary)

Instructions

1. Preheat the oven to 375° F.
2. Stir together the all-purpose flour, soy flour, sugar, baking powder, and salt in a mixing bowl.
3. Mix oil with water in another bowl. Pour the wet mixture into the dry mixture. Mix well.
4. Turn the dough out onto a floured surface. Roll the dough out to 6" x 4" rectangle. Use a knife to cut 12 2"-square biscuits (a 4x3 grid).
5. Transfer the biscuits to an ungreased cookie sheet. Bake for 12 to 15 minutes until golden brown.

Makes 12 biscuits

Recipe: Biscuits	
Number of Servings:	12
Serving Size:	1 biscuit
Nutrients	
Calories:	84 kcal
Protein:	2.0 g
Carbohydrates:	11 g
Fat:	3.6 g
Protein w/o soy	1.3 g

Shortbread Cookies

Ingredients

1 ½ cups butter, softened
1 cup sugar
1 tsp. vanilla extract
2 cups all purpose flour
2/3 cup defatted soy flour
1 ¼ tsp. salt

Instructions

1. Preheat oven to 325° F.
2. Mix butter and sugar in large bowl until well blended. Mix in vanilla.
3. In a separate bowl, mix together the all purpose flour, soy flour, and salt. Add flours to sugar mixture in 2 additions, combining well after each.
4. Pinch pieces from dough and roll into balls about 1-1/4" (6 cm) in diameter. Place on 2 ungreased cookie sheets and flatten balls with fingers.
5. Bake cookies until light and golden, about 25 minutes
6. Cool cookies on baking sheets 10 minutes. Transfer cookies to racks and cool completely.

Makes 30 cookies

Recipe: Shortbread Cookies	
Number of Servings:	30
Serving Size:	1 cookie
Nutrients	
Calories:	143 kcal
Protein:	2.0 g
Carbohydrates:	14 g
Fat:	9.2 g
Protein w/o soy	1.2 g

Appendix C

References

- ¹ Bryce J, Boschi-Pinto C, Shibuya K, Black RE, WHO Child Health Epidemiology Reference Group. WHO estimates the causes of death in children. *Lancet*. 2005;365:1147-1152.
- ² Allen JC, Keller RP, Archer P, Neville MC. Studies in human lactation: milk composition and daily secretion rates of macronutrients in the first year of lactation. *Am J Clin Nutr*. 1991;54(1):69-80.
- ³ Laskey MA, Prentice A, Shaw J, Zachou T, Ceesay SM, Vasquez-Velasquez L, Fraser DR. Breast-milk calcium concentrations during prolonged lactation in British and rural Gambian mothers. *Acta Paediatr Scand*. 1990;79(5):507-512.
- ⁴ Mata JL, Kronmal RA, Garcia B, Butler W, Urrutia JJ, Murillo S. Breast-feeding, weaning and the diarrhoeal syndrome in a Guatemalan Indian village. *Ciba Found Symp*. 1976;42:311-338.
- ⁵ Onofriok, N.O. and D.O. Nnanyelugo, "Weaning foods in West Africa: Nutritional Problems and Possible Solutions," <http://www.unu.edu/unupress/food/V191e/ch06.htm>, Prentice, A.M. and S.E. Moore, Early Programming of Adult Disease in Resource Poor Countries, *Arch Dis Child*. 2005 Apr;90(4): 429-32.
- ⁶ Prentice, A.M. and S.E. Moore, Early Programming of Adult Disease in Resource Poor Countries, *Arch Dis Child*. 2005 Apr;90(4): 429-32.
- ⁷ Panda, S., "Infant and Child Mortality in India: A Comparative Study in Three Selected States," International Institute of Population Studies, Mumbai, <http://www.iipsindia.org/sp05%5Csanghamitra.pdf>.
- ⁸ Valle NJ, Santos I, Gigante DP, Goncalves H, Martines J, Pelto GH. Household trials with very small samples predict responses to nutrition counseling intervention. *Food Nutr Bull*. 2003;24(4):343-349.
- ⁹ Jan A, Rafi M, Mustafa S, Rasmussen ZA, Thobani S, Badruddin SH. Evaluation of dwodo (wheat-milk gruel) in children with acute diarrhea. *J Pak Med Assoc*. 1997;47(1):12-16.
- ¹⁰ Mensah P, Ndiokwelu CI, Uwaegbute A, Ablordey A, van Boxtel AM, Brinkman C, Nout MJ, Ngoddy PO. Feeding of lactic acid-fermented high nutrient density weaning formula in paediatric settings in Ghana and Nigeria: acceptance by mother and infant and performance during recovery from acute diarrhea. *Int J Food Sci Nutr*. 1995;46(4):353-362.
- ¹¹ Lebenthal E. Impact of digestion and absorption in the weaning period on infant weaning practices. *Pediatrics*. 1985;75(1 pt 2):207-213.
- ¹² Weaver LT, Dibba B, Sonko B, Bohane TD, Hoare S. Measurement of starch digestion of naturally 13C-enriched weaning foods, before and after partial digestion with amylase-rich flour, using a 13C breath test. *Br J Nutr*. 1995;74(4):531-537.
- ¹³ Institute of Medicine of the National Academies. "Dietary Reference Intakes: Macronutrients Table". Available at: <http://www.iom.edu/Object.File/Master/7/300/Webtablemacro.pdf>
- ¹⁴ Food and Nutrition Board, Institute of Medicine, National Academies. Dietary Reference Intakes (DRIs): Recommended Intakes for Individuals. Available at: <http://www.nal.usda.gov/fnic/etext/000105.html>.
- ¹⁵ Underwood BA. Weaning practices in deprived environments: the weaning dilemma. *Pediatrics*. 1985;75(1 pt 2):194-198.
- ¹⁶ Anderson AS, Guthrie CA, Alder EM, Forsyth S, Howie PW, Williams FL. Rattling the plate—reasons and rationales for early weaning. *Health Educ Res*. 2001;16(4):471-479.
- ¹⁷ Kimmons JE, Dewey KG, Haque E, Chakraborty J, Osendarp SJ, Brown KH. Behavior-change trials to assess the feasibility of improving complementary feeding practices and micronutrient intake of infants in rural Bangladesh. *Food Nutr Bull*. 2004;25(3):228-238.
- ¹⁸ Stephenson DM, Gardner JM, Walker SP, Ashworth A. Weaning-food viscosity and energy density: their effects on ad libitum consumption and energy intakes in Jamaican children. *Am J Clin Nutr*. 1994;60(4):465-469.

-
- ¹⁹ Cisse D, Guiro AT, Daham B, Souane M, Doumbouya NT, Wade S. Effect of food processing on iron availability of African pearl millet weaning foods. *Int J Food Sci Nutr*. 1998;49(5):375-381.
- ²⁰ De Regil LM, de la Barca AM. Nutritional and technological evaluation of an enzymatically methionine-enriched soy protein for infant enteral formulas. *Int J Food Sci Nutr*. 2004;55(2):91-99.
- ²¹ Mennella JA, Turnbull B, Ziegler PJ, Martinez H. Infant feeding practices and early flavor experiences in Mexican infants: an intra-cultural study. *J Am Diet Assoc*. 2005;105(6):908-915.
- ²² Mennella JA, Turnbull B, Ziegler PJ, Martinez H. Infant feeding practices and early flavor experiences in Mexican infants: an intra-cultural study. *J Am Diet Assoc*. 2005;105(6):908-915.
- ²³ Mosha TC, Vicent MM. Nutritional value and acceptability of homemade maize/sorghum-based weaning mixtures supplemented with rojo bean flour, ground sardines and peanut paste. *Int J Food Sci Nutr*. 2004;55(4):301-315.
- ²⁴ Mugula JK, Lyimo M. Evaluation of the nutritional quality and acceptability of sorghum-based tempe as potential weaning foods in Tanzania. *Int J Food Sci Nutr*. 2000;51(4):269-277.
- ²⁵ Mugula JK, Lyimo M. Evaluation of the nutritional quality and acceptability of finger millet-based tempe as potential weaning foods in Tanzania. *Int J Food Sci Nutr*. 1999;50(4):275-282.
- ²⁶ Baskaran V, Mahadevamma M, Malleshi NG, Shankara R, Lokesh BR. Acceptability of supplementary foods based on popped cereals and legumes suitable for rural mothers and children. *Plant Foods Hum Nutr*. 1999;53(3):237-247.
- ²⁷ Idowu MA, Adeyemi IA, David M. Sensory evaluation and nutrient composition of weaning food from pregelatinized maize-sweet potato mixtures. *Plant Foods Hum Nutr*. 1993;44(2):149-155.
- ²⁸ Solving the weanling's dilemma: power-flour to fuel the gruel? *Lancet*. 1991;338(8767):604-605.
- ²⁹ Mensa-Wilmot Y, Phillips RD, SEfa-Dedeh S. Acceptability of extrusion cooked cereal/legume weaning food supplements to Ghanaian mothers. *Int J Food Sci Nutr*. 2001;52(1):83-90.
- ³⁰ Deliza R, Sgarbieri VC, Rosenthal A. Formulation, nutritive value and sensory evaluation of a new weaning food based on sweet corn (Nutrimaiz) dehydrated pulp. *J Nutr Sci Vitaminol*. 1990;36(6):587-597.
- ³¹ Jirapa P, Normah H, Zamaliah MM, Asmah R, Mohamad K. Nutritional quality of germinated cowpea flour (*Bigna unguiculata*) and its application in home prepared powdered weaning foods. *Plant Foods Hum Nutr*. 2001;56(3):203-216.
- ³² Thathola A, Srivastava S. Physicochemical properties and nutritional traits of millet-based weaning food suitable for infants of the Kumaon hills, Northern India. *Asia Pac J Clin Nutr*. 2002;11(1):28-32.
- ³³ Egounlety M, Aworh OC, Akingbala JO, Houben JH, Nago MC. Nutritional and sensory evaluation of tempe-fortified maize-based weaning foods. *Int J Food Sci Nutr*. 2002;53(1):15-27.
- ³⁴ Mensah P, Tomkins A. Household-level technologies to improve the availability and preparation of adequate and safe complementary foods. *Food Nutr Bull*. 2003;24(1):104-125.
- ³⁵ Ojofeitimi EO, Abiose S. Prevention of nutrient loss during preparation of the most popular weaning diet in Nigeria—practical considerations. *Nutr Health*. 1996;11(2):127-132.
- ³⁶ WHO. International Code of Marketing of Breast-milk Substitutes. Geneva, WHO. 1981. Available at: http://www.who.int/nut/documents/code_english.PDF.
- ³⁷ UNICEF. The Baby-Friendly Hospital Initiative. Available at: <http://www.unicef.org/programme/breastfeeding/baby.htm>.
- ³⁸ Hans, G. Campaign for promotion of breastfeeding: evolution, experience and future directions. *The Indian Journal of Social Work*. 1998;59(2):581-598. Available at: <http://www.hsph.harvard.edu/Organizations/healthnet/SAsia/suchana/0426/hans.html> and provides a summary of the “Innocent Declaration” from the “Convention of the Rights of the Child”

-
- ³⁹ Office of the United Nations High Commissioner for Human Rights. Convention on the Rights of the Child. 1990. Available at: <http://www.unhcr.ch/html/menu3/b/k2crc.htm>. See Article 24, Paragraph 2, Items c, e; Article 27, Paragraph 3.
- ⁴⁰ United Nations. Declaration of the Rights of the Child. 1990. Available at: http://www.abanet.org/humanrights/central/declaration_child.pdf. See Principle 4.
- ⁴¹ WHO. Food Standards (Codex Alimentarius). Available at: <http://www.who.int/foodsafety/codex/en/> with additional information at: http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/w9114e/W9114e00.htm.
- ⁴² Aggett PJ, Agostoni C, Axelsson I, Edwards CA, Goulet O, Hernell O, Koletzko B, Lafeber HN, Micheli JL, Michaelsen KF, Rigo J, Szajewska H, Weaver LT; ESPGHAN Committee on Nutrition. Nondigestible carbohydrates in the diets of infants and young children: a commentary by the ESPGHAN Committee on Nutrition. *J Pediatr Gastroenterol Nutr.* 2003;36(3):329-337.
- ⁴³ Galler, J.R. and L.R. Barrett, Children and Famine: Long-term Impact of Development, *Ambulatory Child Health*, 2001:7 (85-90).