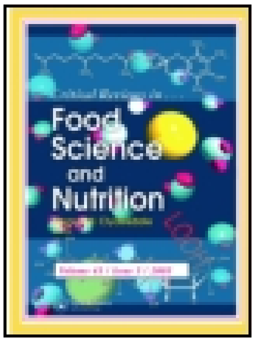

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Nutrient Recommendations for Growing-up Milk: A Report of an Expert Panel

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Title:

Nutrient Recommendations for Growing-up Milk: A Report of an Expert Panel

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Abstract

Utilization of expert recommendations in the development of food and beverage nutritional profiles represents an opportunity to merge science and food manufacturing to deliver nutritionally-optimized products into the marketplace and hands of consumers. This report details expert panel guidelines for the design of a pediatric nutritional product. This interaction demonstrates the essential synergy between academia and food manufacturers in translating nutrient recommendations to food for their delivery to a population. Important factors for such translation are the identification of applicable nutrient recommendations and selection of an appropriate delivery matrix. This report demonstrates the translation of expert nutritional recommendations to a milk-based product for children 1-6 years of age.

Key words: academia; children; growing-up milk; food manufacturer; nutrition recommendation

Introduction

Scientific research is essential to determine the nutritional needs of a population. This research must be received and acted upon by policy makers and be accepted by the consumer to be effective (Underwood, 2003). Recommendations for daily nutrient intake based on daily targets or the intake of foods [food-based dietary guidelines, see (Smitasiri and Uauy, 2007) for a review] are set by national and international authorities. Examples in the United States include the Dietary Reference Intakes from the United States Institute of Medicine (Institute of Medicine, 1997, 2000, 2000, 2001, 2002, 2005) and MyPyramid (United States Department of Agriculture, 2009). Despite the presence of global dietary guidelines the prevalence of nutrition-related chronic disease continues to rise (Smitasiri and Uauy, 2007).

Nutrient profiling is an initiative to improve healthy food selection through front-of-pack labeling. Garsetti and colleagues analyzed 23 nutrient profiling schemes issued by national organizations and food companies (Garsetti et al., 2007). These systems seek to help consumers identify foods based on negative attributes, positive attributes, or both. No one scheme was determined ideal to protect consumers and promote innovation and a competitive market.

Despite the intention of recommendations and profiling systems consumer adoption is low. Additionally, products marketed as providing a nutritional benefit may be of poor overall nutritional quality. A recent survey in Canada exposed high levels of fat, sugar, and sodium in 89% of foods marketed with a nutritional benefit to children (Elliott, 2008).

Discordance exists between the consumer, scientifically-based nutrient recommendations, and foods in the market. We propose that transfer of nutrient recommendations into the appropriate products will positively impact the nutrient intake of consumers, and in particular, children. Recently, an international expert group coordinated by the Early Nutrition Academy published recommendations for follow-up formula for older infants 6-12-months of age (Koletzko et al., 2012). This paper concluded that similar recommendations are needed for young children 12-36-months of age, which is provided herein. Our objective is to summarize the practical transfer of nutrient recommendations into a consumable product as guided by an expert panel of nutrition scientists.

Selecting the Delivery Matrix

The effective transfer of nutrient recommendations into consumable products is dependent on the delivery matrix. This matrix should be inherently nutritious, culturally acceptable, readily available to the consumer, and have a safe history of use.

Bovine milk is a widely consumed nutritious food. A recent survey observed enhanced adequacy of nutrient intakes in 2-18-year-olds consuming milk (Murphy et al., 2008). Fluid milk can be dried into a powder with greater storage stability and convenience. The stability of powdered milk is ideal for promoting nutritional balance through the addition of powdered fortificants such as vitamins, minerals, and essential fatty acids.

In many parts of the world fortified powdered milk is an important source of nutrition for children. This product is often referred to as growing-up milk [GUM], which has been demonstrated to improve the nutritional intake of children compared to low- and standard-fat milk (Svahn et al., 1999). Based on these factors the expert panel focused on GUMs as the matrix for the transfer of nutrient recommendations.

Selection and transfer of nutrition recommendations

In light of existing national and global recommendations the expert panel referred to the joint World Health Organization/Food and Agriculture Organization of the United Nations [WHO/FAO] expert consultation on dietary recommendations in the prevention of chronic disease (World Health Organization, 2003). Guidelines for daily intake are applicable to a product such as a GUM. A broader application allows the product's nutrient contribution to fit into an already balanced diet as well as serve as an important dietary component when nutrient intake is suboptimal. The following sections describe how the joint WHO/FAO expert consultation and other recommendations have been translated into guidance for the nutrient profile of a GUM.

Number of servings

Milk is included in food-based dietary guidelines. MyPyramid recommends 2 cups from the milk group [240 mL for milk] for children 2-8 years of age (United States Department of Agriculture). A WHO Expert Panel guideline for feeding non-breastfed children based on dietary intake data from five countries recommends 200-400 mL of milk per day when animal-source foods are present and 300-500 mL per day when they are scarce (Dewey et al., 2004). The expert panel guidance is 2-3 servings (200 mL) of GUM per day for children 1-6 years of age to provide a total of 400 – 600 mL of GUM compared to approximately 480 mL for two servings of bovine milk.

Energy

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The expert panel guidance is to provide no more energy per serving than that of whole-fat fluid bovine milk [~150 kcal per 240 mL (United States Department of Agriculture, 2008)].

Protein

Protein consumption is generally higher compared to protein reference intakes (Prentice et al., 2004). There are concerns that high protein intakes by children and young adolescents may lead to an increased risk for overweight and obesity (Gunther et al., 2007, Hermanussen, 2008, Rolland-Cachera et al., 1995). Considering the ratio of protein energy to total energy of common foods, diets, and human requirements, protein deficiency is least likely in young children (Millward and Jackson, 2004).

Protein levels in fluid bovine milk in the United States vary from 39% to 21% of energy for nonfat and whole milk, respectively (United States Department of Agriculture, 2008). There is no evidence for a harmful effect of a normal protein intake [12-15% of energy] during the complementary feeding period, which is similar to the protein contribution of the family diet (Michaelsen et al., 2003). The expert panel guidance is for protein to provide 10-15% of energy in a GUM, similar to the daily recommendation by the joint WHO/FAO expert consultation (World Health Organization, 2003).

Fat

The joint WHO/FAO expert consultation recommends a fat intake between 15% and 30% of daily energy for the general population (World Health Organization, 2003). Uauy and colleagues recommend that dietary fat provide 40-60% of energy intake for the first 4-6 months of life, and a gradual reduction to 30-35% of energy intake from 6- to 36-months of age (Uauy and Castillo, 2003, Uauy and Dangour, 2009). Similar recommendations were recently made in an update (Food and Agriculture Organization of the United Nations, 2010) to the 1994 FAO/WHO joint consultation on fat in human nutrition (Food and Agriculture Organization of the United Nations, 1994). The expert panel guidance is that fat in a GUM provide 30-40% of energy for 1-3-year-olds and 20-35% of energy for 4-6-year-olds.

The expert panel guidance included fat quality aligned with the joint WHO/FAO expert consultation and the 2010 FAO update (Food and Agriculture Organization of the United Nations, 2010, World Health Organization, 2003). Specifically, saturated fatty acids should provide no more than 8% of energy and total polyunsaturated fatty acids no more than 10% of energy. The polyunsaturated fatty acids linoleic acid (n-6) and α-linolenic acid (n-3) should account for 4-8% of energy and 1-2% of energy, respectively. The balance of fatty acids should favor monounsaturates. Industrially produced *trans* fatty acids should be avoided.

The ratio of n-6:n-3 dietary fatty acid intake is the subject of continued investigation. Changes in agricultural practices and food processing have resulted in a food supply favoring the presence of n-6 fatty acids (Cordain et al., 2005). This imbalance of fatty acid intake may favor the development of inflammatory-mediated diseases (Patterson et al., 2012). The joint WHO/FAO expert consultation suggests that an optimal balance between n-6 and n-3 fatty acids is approximately 2.5-8:1 as a percent of daily energy intake (World Health Organization, 2003). In the recent FAO expert consultation on fatty acids in human nutrition specific recommendations for distinct n-6 and n-3 fatty acids are provided along with an evaluation of the level of evidence for each recommendation (Food and Agriculture Organization of the United

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Nations, 2010). No specific recommendation for a ratio of n-6:n-3 fatty acid intake is given provided intake is within the recommendations established in the report for each class of fatty acid demonstrating the functional importance of specific fatty acids. The expert panel did not make a recommendation for a specific ratio of n-6:n-3 fatty acids in GUMs outside of those for linoleic acid and α-linolenic acid recognizing that the predominant fatty acids in bovine milk are saturated, and replacement of saturated fatty acids with monounsaturated and polyunsaturated fatty acids to balance fatty acid quality is an important consideration for the diets of young children.

Carbohydrate

The amount of dietary carbohydrate that confers optimal health in humans is unknown. The joint WHO/FAO expert consultation recommends 55-75% of energy intake from carbohydrate (World Health Organization, 2003). The United States Institute of Medicine's acceptable macronutrient distribution range for carbohydrate is 45%-65% of energy intake (Institute of Medicine, 2002). The expert panel guidance is that carbohydrates in a GUM provide 45-60% of energy for 1-3-year-olds and 55-65% of energy for 4-6-year-olds.

Added sugar intake may lead to decreased intake of micronutrients (Bowman, 1999, Gibson, 1997, Institute of Medicine, 2002), increased dental caries (Rugg-Gunn, 1993, Sreebny, 1982), and increased energy intakes and obesity (Bowman, 1999, Lewis et al., 1992, Ludwig et al., 2001). The joint WHO/FAO expert consultation recommends limiting added sugar intake to 10% of daily energy (World Health Organization, 2003), which is the expert panel guidance for GUMs recognizing the importance of organoleptics in delivering nutrition to children.

Vitamins and minerals

Global vitamin and mineral deficiencies continue to be a concern, especially for vitamin A, folate, iron, iodine, and zinc (Black et al., 2008). Growing-up milks are an ideal vehicle for provision of micronutrients in short supply from the typical daily diet. For example, iron is an important nutrient for growth and cognitive function. Bovine milk is a poor source of iron. Growing-up milks could supply iron to populations where dietary sources are scarce. In 12-month-olds with sufficient iron status, feeding of an iron-fortified milk product results in dietary iron intakes similar to recommendations compared to unfortified milk at 15- and 18-months of age (Virtanen et al., 2001).

The expert panel guidance for extrinsic micronutrient levels is 20% of the respective WHO/FAO estimated average requirement [EAR] (World Health Organization and Food and Agriculture Organization of the United Nations, 2006) per serving of GUM, or that of the respective country when an EAR is recommended. Use of the EAR as a reference is appropriate for a product intended to be consumed as part of a diverse diet since intakes in comparison to the EAR are used as a measure of adequacy (Murphy and Poos, 2002, Suitor and Gleason, 2002). Additionally, use of the EAR for fortification is meant to shift the distribution of intake such that a small proportion of the population will be at risk of inadequate intake while minimizing the risk of excessive intake (World Health Organization and Food and Agriculture Organization of the United Nations, 2006).

Conclusion

This document outlines expert panel guidance for the translation of nutrient recommendations to a pediatric nutritional product demonstrating the application of public-private dialog in the development of guidelines with practical food manufacturing implications. The purpose is to provide a meaningful nutritional impact to children 1-6 years of age as previously demonstrated by the international expert group coordinated by the Early Nutrition Academy's recommendations for follow-up formula for older infants 6-12-months of age (Koletzko et al., 2012). This objective involves the use of an inherently nutritious matrix and identification of expert recommendations that best serve the population. The expert panel's recommendations for GUMs are summarized in Table 1.

INSERT: TABLE 1

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Table 1. Expert panel guidelines for GUM intended for healthy children 1-6 years of age

MACRONUTRIENTS			
Nutrient	**% GUM energy**		**g/100 kcal**
Serving size	200 mL		
Energy	60 – 75 kcal/100 mL (ready to feed)		
Protein	10 – 15%		Range: 2.5 – 3.75
Carbohydrate	45 – 65%	Added sugars: < 10%	Range: 11.3 – 16.3
Lipids	1-3 years: 30 – 40%	Saturated fats < 8% Polyunsaturated fatty acids <10% Linoleic acid: 4 – 8% α-linolenic acid: 1 – 2% *Trans* fatty acids < 1 %	1-3 years: 3.3 – 4.4
	4-6 years: 20 – 35%		4-6 years: 2.2 – 3.9
MICRONUTRIENTS			
Vitamin A	Thiamin	Calcium	Per serving: 20% of the Estimated Average Requirement
Vitamin D	Riboflavin	Iron	
Vitamin E	Niacin	Zinc	
Vitamin K	Pantothenic acid	Iodine	
Vitamin C	Vitamin B_6	Potassium	

	Folate Vitamin B_{12} Biotin Choline	Magnesium Phosphorus Chloride Copper Selenium Fluoride	