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Original research article

Generating fatty acid and vitamin D composition data of Indonesian foods

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ABSTRACT

The Indonesian food composition table lacks data on individual fatty acids; data on vitamin D is incomplete. The primary aim of this study was to generate data on individual fatty acid content of Indonesian foods. Secondary objective was to analyze vitamin D content. Based on intake data of 4–12 year old children from a nationally representative Indonesian survey, 120 foods contributing 95% to children's total polyunsaturated fatty acid intake were selected for chemical analysis of fat and fatty acid content. Vitamin D3 was analyzed in a subset of 60 foods. Food samples were collected throughout Indonesia; per food one representative composite sample was chemically analyzed. Of the analyzed foods, sardines (0.97 g/100 g), tempeh (0.62 g/100 g) and tofu (0.56 g/100 g) had the highest n-3 fatty acids content, peanuts (15.9 g/100 g) and palm oil (11.4 g/100 g) were richest in n-6 fatty acids. Vitamin D3 content in foods was limited. This paper significantly contributes to the current knowledge on the fatty acid and vitamin D content of a broad range of commonly consumed Indonesian foods, which can be used in future research to monitor dietary intake and guide policy makers and the food industry to steer nutrient intake in the Indonesian population.

1. Introduction

Food composition tables in developing countries often lack good quality data on the nutritional composition of local foods. Often, food composition data are based on a compilation of nutrient data from other countries with varying sampling and analytical methods (Rand et al., 1991). Moreover, data are estimated from similar foods, or calculated from recipes (Rand et al., 1991). Data may also be outdated as preparation methods may change over time and new products are introduced in the market (Lipoeto et al., 2013). Similarly, the Indonesian food

Abbreviations: ALA, α-linolenic acid; CV, coefficient of variation; DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; FAME, fatty acid methyl esters; FAO, Food and Agriculture Organization of the United Nations; LA, linolenic acid; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; RISKESDAS, Riset Kesehatan Dasar (i.e. Indonesian National Basic Health Survey); SFA, saturated fatty acids.

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composition table ("Daftar Komposisi Bahan Makanan") is a compilation of data, often imputed from food composition tables of other Asian countries, the regional southeast Asian food composition table (i.e. ASEAN), and from non-regional sources, such as the US or New Zealand, some dating back to 1964 (Research and Development Center for Nutrition and Food, 2007). Recently, an international group of scientists from Southeast Asia, Europe and the Food and Agriculture Organization of the United Nations (FAO), assessed the quality of the Indonesian and other national food composition tables in Southeast Asian countries. They concluded that nutritional data on local food items was limited and that there is an urgent need for high quality food composition data for Southeast Asia, with proper documentation of data origin (Doets et al., 2013).

The Indonesian food composition table provides data for 1141 foods and 48 nutrients, including total fat, saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA). Data on the vitamin D content of foods is incomplete, and information on individual fatty acids is lacking entirely. Particularly, the content of the essential n-3 and n-6 fatty acids, i.e. α-linolenic acid (ALA) and linoleic acid (LA), and of the long chain n-3 PUFA eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in foods are of interest as these fatty acids are important for healthy growth and development of children (FAO and WHO, 2010). The availability of foods rich in n-3 fatty acids and the estimated intake of n-3 and n-6 fatty acids in Indonesia, however, are low (Micha et al., 2014; Petrova et al., 2011).

Therefore, the primary objective of this study was to generate data on the individual fatty acid content of Indonesian foods, with the focus to enable evaluation of essential fatty acid intake in Indonesian children. Secondary objective was to generate data on the vitamin D content of Indonesian foods.

2. Material and methods

2.1. Selection of foods

In order to select the most relevant foods for chemical analysis of their fat and fatty acid content, we used dietary intake data of the most recent national Indonesian nutrition and health survey, RISKESDAS (Riset Kesehatan Dasar) from 2010 (National Institute of Health Research and Development, 2010). The protocol of the RISKESDAS study was approved by the Health Research Ethical Commission of the National Institute of Health Research and Development, Indonesia. Because children were considered the population group of primary interest, we rank-ordered foods according to their contribution to total PUFA intake in 4–12 year old children. Foods that contributed up to 95% of children's cumulative total PUFA intake (n = 118), were selected for chemical analysis of total fat and fatty acids. In addition, we analyzed the two most commonly used cooking oils, i.e. palm and coconut oil, on their total fat and fatty acid composition. To generate data on individual fatty acid content of an even broader range of foods, we selected another 151 foods that together contributed up to 99% of children's total PUFA intake. These foods were matched with similar foods from the US food composition table (U.S. Department of Agriculture, 2014) and fatty acid values were imputed. The selection of food for vitamin D analysis was made based on the most commonly consumed foods among children 9–11 months old (Santika et al., 2009).

2.2. Sampling plan

Samples of foods for chemical analysis, among which prepared meals, raw and processed foods were collected across 13 (out of Indonesia's 33) provinces. The 13 provinces represented 78% of Indonesia's population (Statistics Indonesia, 2015) and were selected because they accounted for most, i.e. on average 75%, of the consumption of the analyzed foods, and because they were geographically distributed across the five major Indonesian island groups (i.e. Java, Sumatra, Sulawesi, Kalimantan, Lesser Sunda Islands). The sampling plan was tailored to the individual food item:

a For fresh and prepared food items, we took samples in those of the 13 provinces that contributed ≥5% to the intake of that specific food in 4–12 year old Indonesian children according to the RISKESDAS survey. Thus, food items that were commonly consumed all across Indonesia (i.e. nasi goreng) were sampled in most provinces, while food items that were highly consumed in specific provinces and rarely in others (i.e. cireng, a snack from fried tapioca flour) were only sampled in these specific provinces.
b Industrially manufactured supermarket-sourced foods were only sampled in the three biggest provinces (i.e. Central, West and East Java), because it was assumed that the variation in nutritional composition across Indonesian provinces would be minimal due to standardized processing and distribution by the manufacturer. These three largest provinces represented 47.5% of the Indonesian population (Statistics Indonesia, 2015).
c For each food, we determined the primary type(s) of outlet sources based on the experience of local researches (RA, AS). Therefore, prepared foods were mostly obtained from street vendors, (school) canteens or traditional markets, while raw and processed foods were sampled from traditional markets, supermarkets or local minimarkets.
d For supermarket-sourced foods, we collected samples from the top three brands with the highest market share (Euromonitor International, 2015). An overview of the sampling plan is provided as online supplement material (online table O.1).

Within provinces, we collected food samples from all predefined outlet sources in the capital city, in the most densely populated district. Per outlet source, we obtained one to five samples from different vendors. For supermarket-sourced foods, samples of each brand were taken from two major supermarket chains in Indonesia (i.e. Indomaret & Alfamart). If a food item could not be found in the predefined outlet source or from the predefined brands, samples were taken from another outlet or brand. Overall, we collected between three and 101 samples per food item, with a total of 3459 samples. The weight of the individual samples collected was at least 100 g; for foods with a considerable amount of waste (e.g. bones, peel etc.), and for foods with a particular low fat content (e.g. rice, spinach) larger amounts were taken.

2.3. Sample collection and handling

The collection of food samples was conducted within eight days, in August 2014. Prior to the sampling, staff (n = 16) participated in a three-day training at a central location, which included information about the food items to be collected, the methodology of sample collection, handling and preparation, and muck runs of the sampling procedures. To standardize sample collection in the different provinces, all sampling staff received a booklet with descriptions and pictures of the foods and standardized reporting forms. Deviations from the sampling plan had to be noted. Alternative procedures in case foods could not be found in the intended place, were agreed with the study coordinator.

During sample collection on site, fresh and prepared foods were unwrapped from paper, which may absorb fat and water, and were subsequently wrapped in aluminum foil to prevent fat loss.