Mal J Nutr 16(2) : 271 - 280, 2010

Recommended Nutrient Intake for Dietary Fibre: Bar Set Too High for Malaysians?

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ABSTRACT

This article presents findings from three separate data sets on food consumption in apparently healthy Malaysian adult males and females aged 22-60 years, and secondary data extracted from the Malaysian Adult Nutrition Survey (MANS) 2003. Assessment of food intake by 24-hour recall or the food diary method and use of the nutrient calculator- DietPLUS- to quantify intake of macronutrients and dietary fibre (DF) in the primary data, revealed low mean DF intakes of 10.7±1.0 g/day (Course participants, n=52), 15.6 ±1.2 (University sample, n=103), and 16.1 ±6.1 (Research Institute staff, n=25). An alarmingly high proportion of subjects (75 to 95%) in these three data sets did not meet the national population intake goal of 20-30 g DF/day. A list of 39 food items which contain fibre, extracted from the MANS 2003 report as being average amounts consumed daily by each Malaysian adult, provided 19.2 g DF which meant that >50% of Malaysian adults consumed less than the recommended DF intake of 20-30 g/day. This large deficit of actual intake versus recommended intakes is not new and is also observed in developed western nations. What is of great concern is that the preliminary findings presented in this article indicate that the national population goal of 20-30 g DF/day may be beyond the habitual diets of the majority of Malaysians. Appropriately, the authors propose the inclusion of a daily *minimum requirement* for DF intake in the Malaysian Dietary Guidelines, which would somewhat mimic the Malaysian Dietary Guidelines 1999 for dietary fat, as well as the stand taken by the Scientific Advisory Committee on Nutrition (SACN) of the United Kingdom. This *minimum requirement*, if agreed to, should not be higher than the 16 g DF or so provided by the hypothetical 'high-fibre' healthy diet exemplified in this article.

Keywords: Dietary fibre, minimum requirement, Recommended Nutrient Intake

INTRODUCTION

Several epidemiological studies have shown a protective association of dietary fibre (DF) with diseases such as cardiovascular heart disease (CVD), diabetes mellitus type 2, diverticulosis, breast cancer, and colon cancer (International Life Sciences Institute (ILSI)), 1998; American Dietetic Association, 2008). Despite the wealth of epidemiological information which has accumulated over the last four decades, there is still a paucity of data on DF consumption in several countries, including Malaysia. This has hindered the establishment of a recommended nutrient intake (RNI) for DF based on actual food

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consumption data of the local population concerned.

National recommendations for adult DF intake usually falls in the range of 20-35 g/day but professional bodies sometimes recommend DF intake based on energy intake, for example, 10-13 g/1,000 kcal/day (ADA, 2002). Recently, recommended DF intake appeared to have increased; the World Health Organization (WHO) (2003), the United States Department of Health and Human Services (2005), and ADA (2008) had advocated DF intake of 14 g DF/1,000 kcal or 25-38 g DF/day.

It is pertinent to point out that the recommended DF intake of western nations are way above the reported habitual intake of the respective country's population. For example, habitual intake in the United States is only 15 g/day (IOM, 2002), which is only half the 25-38 g/day recommended for adults. Similarly, young British adults had a mean intake of 11 g NSP/day or 18 g DF/day compared with the recommended population intake of 18 g NSP/day or 30 g DF/day (SACN, 2008).

National drafting committees of dietary guidelines are often faced with the challenge of whether to recommend a guideline consistent with optimal nutrition, or a guideline that is practical and realistic, for a particular nutrient or food factor. Their selection for the former option, that is daily DF intake of >25 g/day, is supported by WHO's report that such population targets are achievable with a diet rich in whole grains and at least 400 g/day of vegetables and fruits, 30g of which should be pulses, nuts, and seeds (WHO, 1990; 2003).

The Malaysian Technical Working Group (TWG) on Nutritional Guidelines had carefully reviewed the literature on the above topic and opted to adopt a RNI for DF intake consistent with WHO's recommendation in 1990, that is 20-30 g/day for all age groups above 2 years (NCCFNM, 2005). The TWG had realised at the time that this RNI was not an easy target to achieve by the general Malaysian population. However, its decision was influenced in part by WHO's assertion that consuming the 400 g of vegetables and fruits a day would meet one's RNI for DF (WHO, 1990). Besides, the Malaysian Adult Nutrition Survey (MANS) 2003 (Ministry of Health Malaysia, 2006) had shown that the average Malaysian adult consumes about 134 g of vegetables and 290 g of fruits a day, and therefore the target of 400 g of vegetables and fruits a day advocated by WHO (1990) seemed realistic.

It is the aim of the authors of the present study to present both primary and secondary data to propose that the RNI of 20-30 g DF/day set for Malaysians is high and therefore, difficult to achieve by most Malaysians. The paper also argues for the adoption of a realistic minimum DF intake for Malaysians which should be considerably *below* 20g/day- the lower limit of the range cited in the RNI 2005.

METHODOLOGY

The primary data in this paper comprised data sets on daily DF intake from three separate studies conducted during 2007 to 2008. The participants consisted of three groups of apparently healthy adult males and females, aged 22-60 years from: (i) a local research institution (n=25), ii) a 3-day Short Course in Diet Therapy (n=52), and iii) the campus population of an International Medical University (IMU) [n=103]. The IMU study was approved by the Research and Ethics Committee of the University in 2008.

The three data sets were collected with different food intake assessment methods and as such, were not grouped together but instead reported separately in this paper. For the first group of 25 adult staff of a local research institute, duplicate weekday (Tuesday-Friday) 24-hour dietary recalls were made for each subject by two research assistants under the supervision of the researcher. Each interview lasted for about 30 minutes.

Table 1. Daily intake of macronutrients, including total dietary fibre (DF), in 3 data sets of Malaysian adults

Subject profile/ Food component	*Research Institute staff (n=25)*	*Participants, Diet Therapy Course(n=52)*	*IMU participants in a research project(n=103)*		
			Combined (n=103)	*Males (n=35)*	*Females (n=68)*
Age (yr)	38.8 ± 7.1	35.2 ± 7.8		32.4 ± 9.9	29.2 ± 8.8
BMI(kg/m^2)	22.9 ± 0.21	24.4 ± 1.1		24.3 ± 3.9	21.7 ± 4.0
Energy(kcal)	2043 ± 529	1927 ± 293		2092 ± 474	1698 ± 443
Protein(g)	70.4 ± 14.1	76.9 ± 14.9		79.1 ± 20.4	67.7 ± 20.7
Fat(g)	67.7 ± 9.7	66.2 ± 8.1		77.5 ± 23.2	64.9 ± 21.8
CHO(g)	291 ± 87.9	259 ± 77.1		265 ± 71.6	214 ± 61.7
DF (g)	16.1 ± 6.1	10.7 ± 1.0	15.6±1.2	17.9 ± 5.9	14.5 ± 5.5

For the second data set of 52 people attending a short course in diet therapy, a single 24-hour recall was made for each participant's *usual* food intake over the past week by the course organisers who were nutritionists or dietitians including the researcher.

A total of 103 volunteers in the third data set kept a food diary in which they recorded in detail, daily food intake for three separate days- 2 week days (Monday-Friday) and one weekend (Saturday or Sunday). The subjects could choose any 2 weekdays or a weekend convenient to them and had 4 weeks to accomplish their task. During this period in the university campus, the research team monitored and checked the dietary entries in the diary. Each food diary consisted of 3 different coloured pages, each for a different day. Food intake for each day was again divided into 6 different meals/snacks (breakfast, mid-morning snack, lunch, afternoon snack, dinner, supper). The food diary had examples of food portions of common Malaysian foods printed on the back cover.

Daily food intake, including DF for all 3 data sets, was analysed with DietPLUS (Ng, 2010) - a rapid nutrient calculator based on the Malaysian Food Composition database (Tee *et al*., 1997) and the Singapore Food database (Health Promotion Board Singapore, 2003). The nutrient calculator contains macronutrient and micronutrient content of 850 food items, with the DF content extracted from the Singapore food database and programmed into DietPLUS. On this last point, it is pertinent to point out that numerous raw food items available in Singapore are actually imported from Malaysia.

RESULTS

The demographic and anthropometric profile of the 3 groups of subjects, as well as their food intake which included DF, are shown in Table 1. The daily energy consumption ranged 1698 to 2092 kcal, with corresponding DF intakes averaging 10.7 to 16.1g/day, which were substantially below 20g/day- the lower value of the DF range cited in the Malaysian RNI (NCCFNM, 2005).

Interestingly, the DF intake of the participants of the Short Course in Diet Therapy, which comprised mainly healthcare-related professionals, averaged only 10.7 ± 1.0 g/day. It may be argued that the single 24-hour recall made on the habitual intake of this group of 52 subjects could have yielded an overall under-

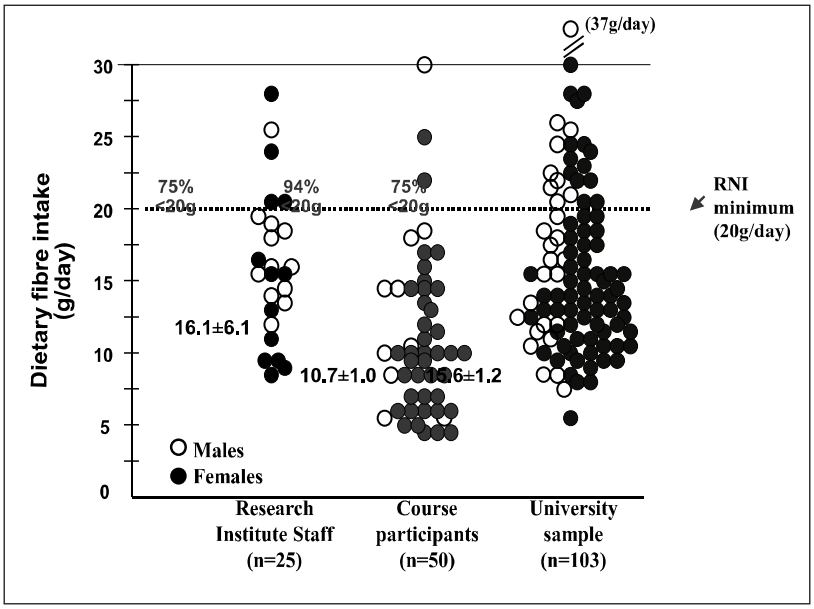

Figure 1. Daily dietary fibre intake in 3 separate Malaysian data sets

estimation of food intake. However, this was unlikely for the 102 participants in the university group whose daily records into the food diary were checked for accuracy during the 4-week period concerned. The three 24-hour dietary records made by each volunteer gave an overall mean of 15.6 ± 1.2 g DF/day, again markedly below the lower value of 20g DF/day in the RNI range (Table 1).

When the mean DF intake of the participants (n=25, 52 and 102) in the three studies were compared against the lower limit (20g DF/day) of the RNI range, 75%-95% of the subjects had daily DF intake which did not meet the RNI concerned (Figure 1). It might be argued that the small number of subjects in the three studies reported here are not representative of the general Malaysian population. The authors are fully aware of this and have included the results of these small studies as "preliminary findings" in the hope that their documentation in this article would play small but useful roles when local findings on DF intake are collated for the revision of the Malaysian RNI on DF in the future.

DISCUSSION

Recommendations on DF intake are largely based on results of early experiments on human subjects which showed that non-starch polysaccharides (NSP) intake is inversely associated with stool output (Cowgill and Anderson, 1932). In British subjects, 22 g of NSP (equivalent to 37 g DF) was required to produce a healthy stool weight above 150 g. As stool output dropped below 100 g/day, there was a problem of constipation which magnified as the stool output dropped further below 100g/day (WHO, 1990).

Subsequently, Cummings and Bingam (1992) reviewed 8 published studies involving Caucasian subjects and found that subjects who suffered a serious constipation problem had average stool weight of only about 50 g/day. Cummings (1993) further investigated the effect of DF

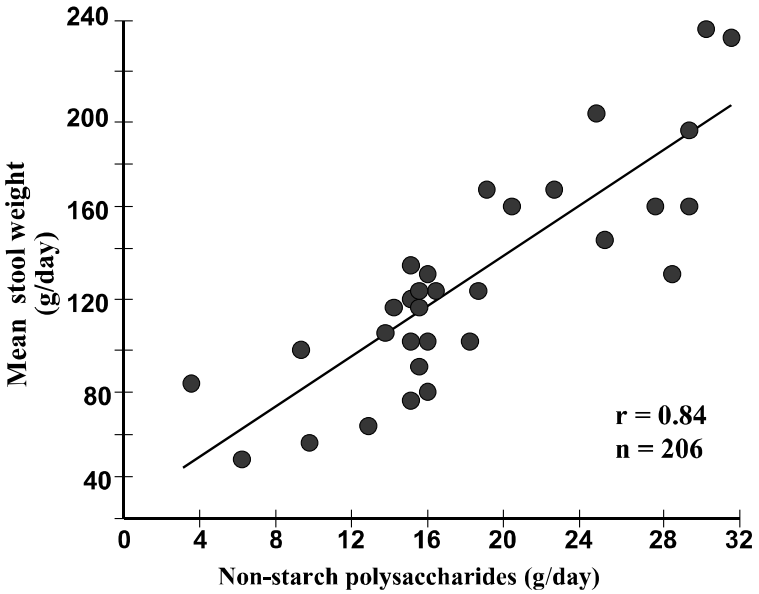

Figure 2. Mean daily stool output and dietary intake of non-starch polysaccharides in healthy subjects on controlled diets (Cummings, 1993)

Table 2. Recommended nutrient intake of dietary fibre (DF) for adults

IOM, USA (2002), ADA (2008)	14 g DF/1,000 kcal (Men= 38 g/d Women= 25 g/d)
Dietitians Association of Australia (2008)	30 g DF/day
WHO (2003):	>25 g DF/d
United Kingdom (UK) [SACN, 2008]	18 g NSP/d (30 g DF/d) Minimum: 12-24 DF g/d
Malaysian RNI (2005)	20-30 g DF/d

type on faecal weight and reported that each gram of DF increased faecal weight by 1.2 to 5.4 g with pectin having the smallest, and wheat fibre, the greatest effect. The association between daily stool output and constipation are summarised in Figure 2 below. Based largely on these findings, the WHO and the Food and Agricultural Organization (FAO) recommended a NSP intake of >20g/day, which is equivalent to >25g DF/day (WHO/FAO, 2003).

Based largely on the above reports on the influence of daily DF on daily stool output and the latter's inverse association with constipation and diverticular disease, the recommended DF intake for adults in several countries, including Malaysia, are as shown in Table 2.

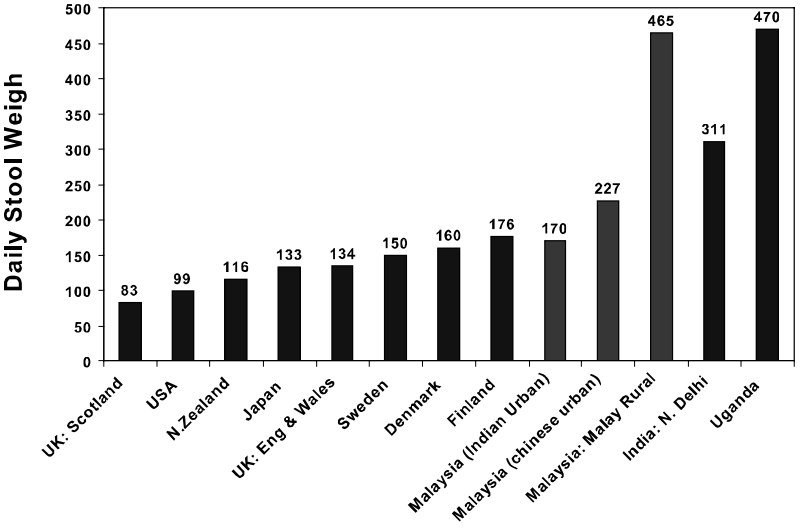

Figure 3. Mean daily stool weight in various population groups

Figure 3 shows the stool output of Malaysians compared with other population groups from different countries (WHO, 1990). Urban Malaysians have more than two-fold, while rural Malaysian have about a five-fold, stool weight compared to United Kingdom subjects. If RNIs of different countries were established based on the association between NSP intake and stool output, then clearly the RNIs for western nations should not be adopted for Malaysians as these western RNIs would be unrealistically high for our local population.

The authors next examined the food consumption data in the MANS 2003 (Ministry of Health, 2008). DietPLUS was used to calculate the mean daily DF intake by Malaysian adults by summing the DF content in the average amounts of different food items supposedly consumed by each adult daily (Table 3). The results showed a comparatively healthier intake of 19.2 g DF/ day by the average Malaysian adult which was much higher compared to the 10.7 to 16.1 g DF/day reported earlier in this article or the estimated intake 16 g DF/day by Malaysians (Ng, 1997). The MANS consumption data obtained by 24-hour dietary recall showed that slightly more than 50% of Malaysian adults are consuming less than 20 g DF/day. The validity of the mean DF intake obtained here for the MANS data is weakened by the observation that the 39 items (which contains DF) consumed by the average adult/day listed in Table 3 is a very long list which somewhat contradicts the low energy intakes of 1722 kcal for men and 1400 kcal for women reported in the study.

Finally, the authors examined the DF provided by a hypothetical healthy diet (Table 4) formulated to provide 1 serving of wheat bran cereals or wholemeal bread for breakfast, 3 servings of vegetables plus 2 servings of fruit for lunch plus dinner, and 2 servings (total 4 pieces) of high-fibre cookies for snacks. Despite the healthy food items, the hypothetical diet provided only 16.4 g DF, again well below 20 g/day- the lower limit of the RNI range of 20-30g DF/day.

Summarising, the authors' emphasise that the current Malaysian RNI for DF of 20-30g/day is too high and that a minimum recommendation for daily DF intake substantially below 20g/day warrants serious consideration. This proposal is supported by the four "pieces of evidence"

Table 3. Mean dietary fibre intake of a Malaysian adult[a] (Estimated from the data of MANS 2003)

Food item	*Amount consumed per day (g)*	*Dietary fibre content (g)**
Cereals & cereal products		
Rice	289.7	1.5
Glutinous rice	28.2	0.3
Mee kuning	66.3	1.2
Mihun/kueh teow	66.6	3.4
Loh shi fun	11.7	0.1
Breakfast cereals	18.3	0.7
Bread	36.1	0.9
Bun	18.2	0.2
Roti canai	21.1	0.5
Capati	15.3	0.5
Tosai	23.5	0.3
Maize	9.0	0.2
Vegetables/legumes		
Green, leafy vegetables	50.7	1.5
Legumes (string bean)	16.4	0.6
Tubers	14.7	0.3
Cabbage	18.2	0.4
Cucumber	13.9	0.1
Ulam-ulam	3.7	0.1
Mushroom	7.0	0.1
Bean sprout ('Taugeh')	9.8	0.1
Fruits		
Papaya	84.6	0.7
Guava	14.4	2.0
Lemon (local)	14.1	0.4
Manggo	10.5	0.3
Pineapple	10.1	0.1
Banana	20.6	0.6
Watermelon	7.6	0.1
Carambola (starfruit)	10.5	0.3
Jackfruit	5.8	0.1
Apple	35.0	0.5
Mandarin orange	24.6	0.5
Pear	23.7	0.3
Grapes	4.3	tr[b]
Durian	4.7	0.1
Rambutan	9.7	tr
Logan, fresh	2.0	tr
Laici, fresh	2.8	tr
Canned fruits	1.5	tr
Dried fruits	3.7	0.2
TOTAL		19.2 g

[a]Only food items with DF considered, groundnuts omitted; [b]traces

Table 4. Example of DF intake from a hypothetical healthy diet

Food item	*No. servings/day*	*Amount DF (g)*
Breakfast		
Bran cereals OR	1 (30g)	3.0
Wholemeal bread	2 (50g)	
Lunch & Dinner		
Vegetables &	3 (60g x 3)	5.4
Fruits	2 (100g x 2)	3.0
Snacks		
Hi-fibre cookies	2 (4 pcs)	5.0
Total DF		16.4 g

reported in this article, namely: (1) the stool output of Malaysians reported by WHO (1990) are two-to-five times that of United Kingdom Caucasians subjects from which the initial high recommendations for daily DF intake were proposed; (2) the DF intake of Malaysian adults from the three data sets reported in the present paper showed low mean DF intake ranging from 10.7 g to 16.1g/day; (3) MANS 2003 showed that more than 50% of Malaysian adults consumed less than 20 g DF/day; and (4) a hypothetical healthy diet proposed by the authors consisting of 1 serving of breakfast wheat cereals or 2 slices of wholemeal bread, 5 servings of vegetables plus fruits for lunch plus dinner, and 2 servings (total 4 pieces) of oat cookies as snacks, provides a total of only 16.4 g DF.

CONCLUSION

The Malaysian RNI 2005 for DF intake mimics the 'old' WHO 1990 recommendation of 20-30 g/day which was markedly lower than current recommended intake of WHO, IOM or ADA which are in the region of 25-38 g/day for adults. This 'adoption', although wisely selecting the lower range of 20-30 g DF/day, should only be temporary and subject to confirmation by local data when this becomes available.

From the information reported in this article, it is common for populations in western nations to consume DF well below their respective national population goals. The recommendation of a daily *minimum requirement* for DF by the SACN of the United Kingdom had added a new dimension to Dietary Guidelines which warrants serious consideration by the Malaysian TWG on Nutritional Guidelines. This need is underscored by the primary and secondary local data on DF intake reported in this article.

Any daily minimum requirement for DF should be reasonably achievable by (i) the average Malaysian practising healthy eating, (ii) by clinical dietitians in menu planning and food preparation, and (iii) by individuals undergoing medical nutrition therapy in the comfort of their homes. This new minimum requirement for DF intake for adult Malaysians, if agreed to, should be *no* higher than the 16 g DF/day estimated for the hypothetical healthy diet in this article, or should approximate the mean intake of a representative healthy population.

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