Original Article

Precision in nutritional information declarations on food labels in Australia

Stefan U Fabiansson BVSc, PhD

NSW Food Authority, 6 Avenue of the Americas, Newington NSW 2127, Australia

Nutrition labels guide consumers in making their food choice. New requirements for mandatory nutrition labelling have been in force in Australia since late 2002. The present study, analysing 350 samples comprising 70 different products for nutritional compounds declared on the label, is the first larger attempt to quantify the precision in nutrition labelling of food products on the Australian market. A significant discrepancy between actual and declared values was detected with an average variation in precision of -13% to +61% for individual nutritional components. There is no tolerance limit established in the Australian food legislation but a ± 20% discrepancy is allowed in some countries and others have separate upper and lower limits and allow a maximum discrepancy of –20% for beneficial nutritional compounds and +20% for unfavourable compounds. Only 16% of the 70 products in the study would fully comply should a leeway of ±20% be introduced for any nutritional compound on the label. With separate upper and lower limits, 51% of products would fully comply. Compliance improved to 27% and 70% of products, respectively, when excluding variations in minor amounts irrelevant to consumers (counting all variations of less than 1g/100g, or 10kJ/100g for energy and 10mg/100g for sodium, potassium, calcium and cholesterol, as compliant). It is proposed that adoption of an upper and lower tolerance limit, excluding minor amounts, be considered as a way of better assisting the consumer in making relevant comparisons of product nutritional value and that any nutritional component should comply with the limit for the product to comply. Applying such a limit, 30% of products in the survey would not be compliant.

Key Words: Australia, nutrition labelling, food standards, analytical precision.

Introduction

Nutrition labels describe the nutrient content of foods and are intended to guide consumers in making the right food choice. Recognising the importance of nutrition labelling as a public health tool, the Codex Alimentarius Commission (Codex) and many food authorities worldwide have established guidelines or regulations on nutrition labelling for consumer protection.[1]

Codex adopted its Guidelines on Nutrition Labelling in 1985 and later amended them in 1993. They state that information supplied should be for the purpose of providing consumers with a suitable profile of nutrients contained in the food and considered to be of nutritional importance. Tolerance limits are not specified but should be set in relation to public health concerns, shelf life, accuracy of analysis, processing variability and inherent lability and variability of the nutrient in the product, and, according to whether the nutrient has been added or is naturally occurring in the product.[2]

Over forty countries/regions have a nutrition-labelling program in place or are in the process of introducing such a system. Three general approaches can be identified, namely mandatory nutrition labelling for all pre-packaged foods (Argentina, Australia/New Zealand, Brazil, Canada, Hong Kong/China - in progress, Israel, Paraguay, the United States of America, Uruguay); mandatory nutrition labelling for specified foods and food with claims (Malaysia, Thailand, Korea, Taiwan); and mandatory nutrition labelling only for pre-packaged foods with claims (Brunei, Chile, Ecuador, the European Union, Hungary, Indonesia, Japan, Mexico, the Philippines, Singapore, South Africa, Switzer-land, Thailand, Vietnam).[3-5]

In Australia, up until a few years ago nutrition labelling had only been compulsory where a food manufacturer made a nutrition claim such as 'low salt' or for food designed for a special purpose such as infant formula or a sports food. Many, but not all, food manufacturers included this information voluntarily because they recognised that there was consumer interest in nutrition and health. However, nutrition information was not appearing consistently in terms of content or format. Australian and New Zealand Health Ministers agreed to changes to food labelling requirements in November 2000. These changes apply to all foods manufactured or packaged after 20 December 2002. From this date nearly all manufactured foods must carry a nutrition information panel.[6]

Correspondence address: Stefan Fabiansson, PO Box 4196, Castlecrag, NSW 2068, Australia
Tel: + 61 2 9958 4918; Fax: + 61 2 9958 2280
Email: sfabians@optusnet.com.au
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Nutrition information panels provide information on the amount of energy (kilojoules), protein, total fat, saturated fat, carbohydrate, sugars and sodium (salt), as well as any other nutrient about which a claim is made. The food manufacturer can use average quantities when describing the nutritional composition allowing for seasonal variability and other known factors that could cause actual values to vary with the quantity determined from one or more of the following:

- the manufacturer's analysis of the food;
- calculation from the actual or average quantity of nutrients in the ingredients used;
- calculation from generally accepted data.

Enforcement of the labelling requirements is the responsibility of State and Territory Governments, the New Zealand Food Safety Authority, and the Australian Quarantine and Inspection Service. In New South Wales, this is the responsibility of the NSW Food Authority. Standards enforcement agencies have discussed the issue of enforceability of the Standard with the leeway given by the definition of 'average values' and how they may be determined for the nutritional information panel.[7] The consensus view seems to be that there are flaws in the way the Standard is worded that hamper enforcement of the requirements and that considerable misinformation could be given to consumers through current labels. This could be particularly serious because of the current obesity debate where consumers now deliberately try to avoid energy dense food. The wrong label information could mislead consumers.

The Authority decided in the second half of 2004 to check the accuracy of nutrition information panels provided on a range of food for sale in New South Wales. The purpose of the study was to ascertain the precision of mandatory nutritional information provided on retail food products to determine if consumers get the intended information to make an informed choice.

Materials and methods

The NSW Food Authority bought quintuplicate samples of 70 different food products from ordinary supermarkets during October 2004 to May 2005. It only bought one sample at a time of each product to increase the likelihood of sampling different batches of the product. It attempted to sample low claim as well as the conventional variety of products where available to check if extra attention was given to low claim labelling. Low claim products are foods that carry claims that they are 'low' in a particular undesirable nutrient such as sodium or fat. The overall sample comprised three bread products, six breakfast products, six dairy products, ten dessert products, four canned fruit products, eight jams and spreads, two noodle products, nine meat products, five condiments, two soup products, three prepared meals and eleven snack products. The Authority was successful in getting five samples from each product except for one where two of the samples were substituted for a closely related product from the same manufacturer of a similar composition.

Samples were submitted to NSW Health's Division of Analytical Laboratories for analysis of all nutritional components declared in the nutrition information panel. All methods used were accredited by the National Association of Testing Authorities and as defined in AOAC or ISO official standards, as specified in the Australia New Zealand Food Standards Code (ANZFSC) or in some cases through systematic in-house validation. The energy value in kJ/100g was calculated by adding 37kJ/g of fat, 17kJ/g of protein and carbohydrate and 8kJ/g of total dietary fibre values (ANZFSC 1.2.8). Total carbohydrate was determined by subtracting from 100 the percentage moisture, protein, fat, fibre and ash (ANZFSC 1.2.8). Total solids and ash (indirectly moisture) was determined by measuring weight loss after drying of the sample in an oven (AOAC 935.36 & 923.03). Protein was determined by combustion (AOAC 935.36 & 923.03). Fat was determined through fat extraction after either acid or alkaline hydrolysis or through Soxhlet extraction depending on the material (AOAC 954.02, 922.06, 960.39 & AS 2300.1.3). Fatty acid composition was determined by gas chromatography of the methylated sample (AOAC 969.33). Cholesterol was saponified before gas chromatography (JAOAC vol. 72, 5, 1989). Total sugars were determined through high-pressure liquid chromatography. Total dietary fibre was determined through a combination enzymatic digestion and gravimetric method (AOAC 985.29). Sodium, potassium and calcium samples were

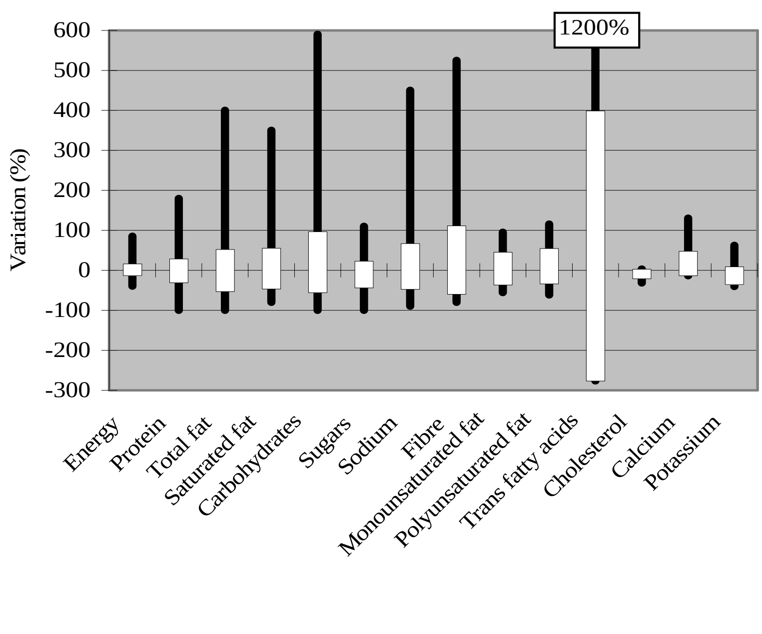

Figure 1. Precision in labelling for individual nutritional components on a sample basis. (The midpoint of the thick white bars indicates the mean with end points indicating positive and negative standard deviation. The thin black bars indicate the minimum and maximum variation.)

digested in nitric acid and quantified using inductively coupled plasma-atomic emission spectroscopy ('modified' AOAC 984.27). Information given on the nutritional information panels was compared with results of the official analyses.

Protein, total fat, total sugar, sodium, energy and total carbohydrate contents were determined for all 350 samples. In addition, when the information was given on the label, sample results for total dietary fibre (118), saturated fat (269), monounsaturated fat (30), polyunsaturated fat (25), trans fatty acids (15), cholesterol (11), calcium (42), and potassium (60) were compared with the label information. All in all 2670 analytical results were recorded for the 350 samples.

Results

Precision in nutritional component information

The overall precision in food label information for individual nutritional components is shown in Figure 1. The thick white bar indicates the mean (midpoint of bar) with positive and negative standard deviation. The thin black bar indicates the minimum and maximum variation detected. The information is based on analysis of the 350 food samples as separate entities and represents the situation that would face a consumer buying the products in the survey.

Of the 2670 individual analytical results, 183 (7%) corresponded exactly with the information given on the sample label. For individual nutritional components the difference between the analytical results and the declared values varied between an average of -13% (potassium) to +61% (trans fatty acids). Most accurate were cholesterol levels with 55% showing full equivalence between the label information and the analytical results with a range of -31.5% to 0%. However, only a minority of labels (11) included cholesterol levels and all of the accurate results related to cholesterol free claims. Least accurate was trans fatty acid information with no label fully correct and a range of -98% to 1200%. Analytical results for a chips product varied between 0.05 to 1.3 g/100g against a. a declared value of 0.1 g/100g. A cookie product varied between 0.05 to 0.42 g/100g against a declared value of 0.5 g/100g. Again only a minority of panels (15) contained information on trans fatty acids. Variations of 19% in total carbohydrates between the analytical results and the label information could be partly caused by the use of the two different methods allowed in ANZFSC 1.2.8 for quantifying the constituent, the differential method used in this study or the additive method.

Product average precision was calculated for the five analytical results for each nutritional component to allow for permitted ingredient and batch variations between samples. There is no indication in the Food Standards Code of the precision expected for the information given in nutritional information panels. Figure 2 illustrates information reliability for individual compounds should a leeway of ±20% be applied (hatched bar), and the same leeway counting all variations of less than 1g/100g (10kJ/100g for energy and 10mg/100g for sodium, potassium, calcium and cholesterol) as compliant (dotted bar).

Overall, 71% of the label information for the individual nutritional components as averaged across products was within ± 20% of the actual results, increasing to 86% when excluding variations in minor amounts as defined above. However, there are large variations between the different nutritional components with compounds compulsory on all labels (the seven compounds to the left in Fig. 2) more accurate than compounds compulsory only when there are nutritional claims in relation to the product (the seven compounds to the right in Fig. 2). Fat seemed to be the most difficult to get accurate, although

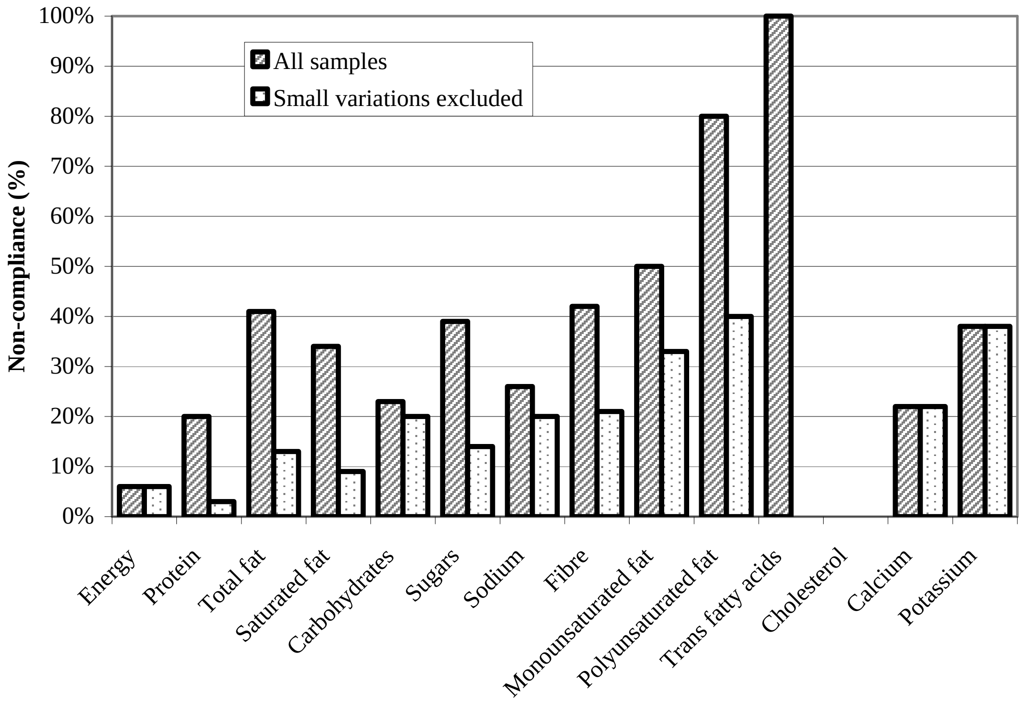

Figure 2. Precision in labelling for individual compounds as product averages applying a ±20% leeway. (The hatched bars represent all samples and the dotted bars represent compounds with variations of less than 1g/100g - 10kJ/100g for energy, 10mg/100g for sodium, potassium, calcium and cholesterol excluded.)

for several products this involved variations in minor amounts only.

Another way of prescribing data precision is to use a maximum/minimum approach. Figure 3 illustrates the same information as in Figure 2 but applying a leeway of -20% of declared values for protein, carbohydrate, fibre, polyunsaturated and monounsaturated fat, potassium and calcium (lower limit compounds) and +20% of declared values for energy, total fat, saturated fat, trans fat, cholesterol, sugars and sodium (upper limit compounds). In other words, there is no upper limit for beneficial nutritional components and no lower limit for unfavourable nutritional components.

As expected, reliability was improved when separately applying either an upper or a lower limit depending on the nutritional component. For compounds with mandatory labelling (the seven compounds to the left in Figure 3) there is 89% conformity with the suggested limit and for compounds where labelling is required only when a claim is made (the seven compounds to the right in Figure 3) the conformance is 80%, giving an average conformance of 88%. Again by excluding variations in minor amounts the conformance increased to 96% and 91%, respectively, with an average of 95%.

Product inferred compliance

The number of products that would fail should a leeway of ±20% or a separate upper limit of +20% or lower limit of -20% be introduced for any or several individual nutritional components on the product label was calculated. Results of this analysis are presented in Figure 4. The results have been split according to the number of compounds on a label exceeding the above limits. Only 16% of the products would fully comply should a leeway of ± 20% be introduced for any nutritional compound on the label. By excluding compounds with variations in minor amounts as described previously, the proportion of compliant products increased to 27%. With separate upper and lower limits, 51% of products would fully comply, increasing to 70% when variations in minor amounts were removed from the analysis.

Low claim products

There were 19 products in the sample with low energy or low fat claims. Of the 19 low claim products tested or 95 samples, 18 samples (19%) exceeded the value given for fat content, 63 samples (66%) exceeded the value given for energy, and 31 samples (33%) exceeded the value given for total sugar. The maximum variation in fat content was 85%, in energy 183%, and in sugar 110%.

A comparison was made between the label accuracy for low claim products compared to all other products without a claim. The number of products that would fail should a leeway of ±20% or a separate upper limit of +20% or lower limit of -20% be introduced for any or several individual nutritional components on the product label was calculated. Results of this analysis are presented in Figure 5. There is no better label accuracy for low claim products.

Discussion

New food labelling requirements for mandatory nutrition labelling have been in force since late 2002 and companies are still finding the optimum way of arriving at accurate information. It seems very reasonable that

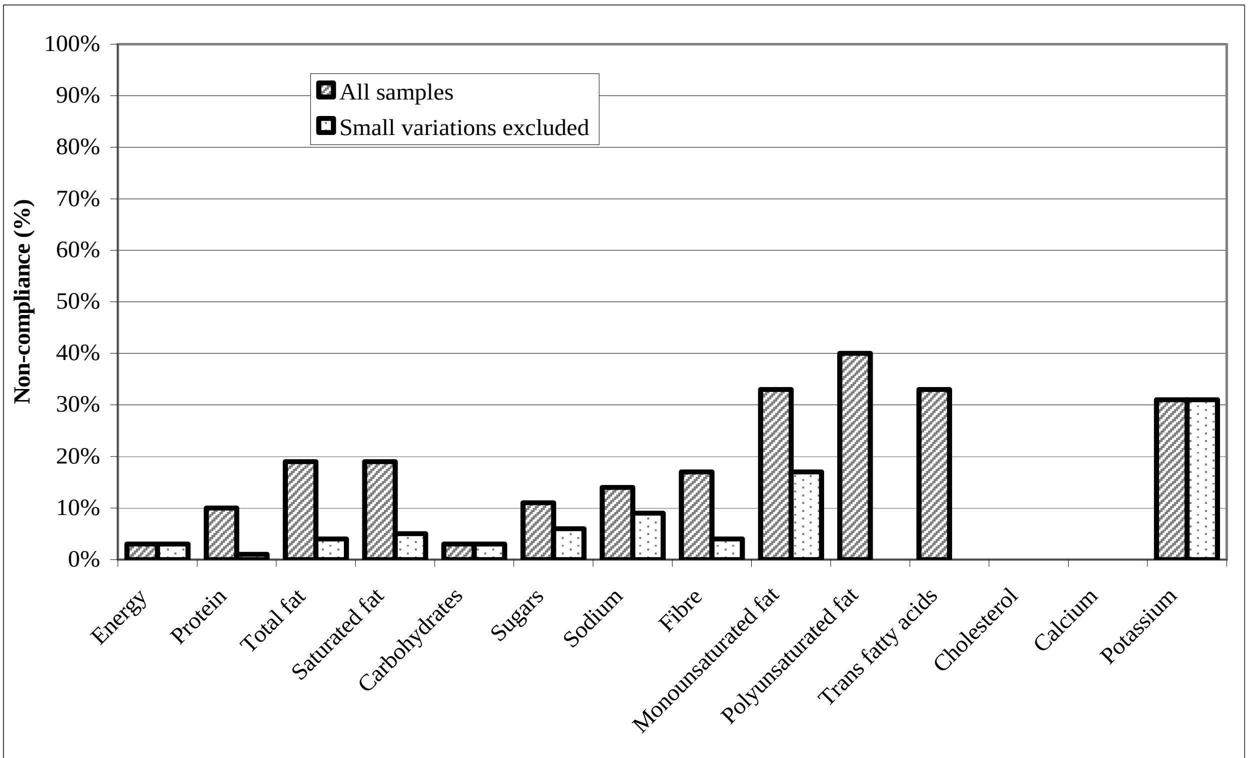

Figure 3. Precision in labelling for individual compounds as product averages applying a maximum of +20% for unfavourable compounds or a minimum of -20% for beneficial compounds. (The hatched bars represent all samples and the dotted bars represent products with variations of less than 1g/100g - 10kJ/100g for energy, 10mg/100g for sodium, potassium, calcium and cholesterol excluded.)

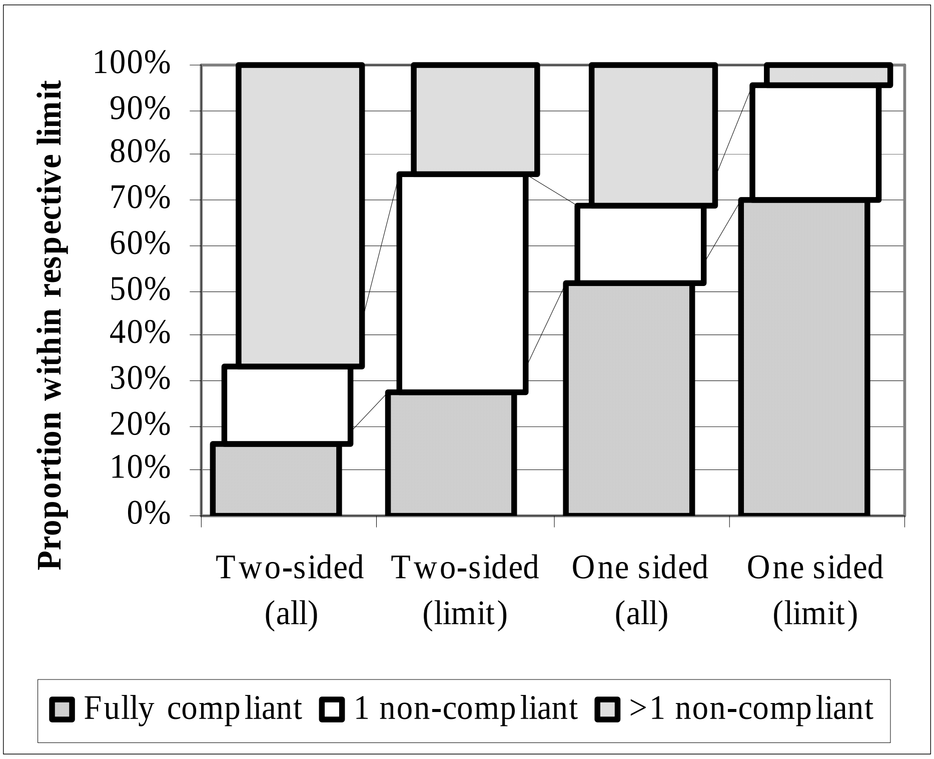

Figure 4. Proportion of products compliant to (thick hatched) or exceeding (open and thin hatched) a leeway of ±20% (two-sided) or a maximum of +20% for unfavourable compounds or a minimum of -20% for beneficial compounds (one-sided). The second set of bars for each pair (marked limit) represents products with major variations (less than 1g/100g - 10kJ/100g for energy, 10mg/100g for sodium, potassium, calcium and cholesterol excluded).

companies are allowed to use an average composition of their food products when calculating the nutrition information to be provided to consumers. However, there are no clear guidelines in the Australian nutrition information legislation of what variations are tolerable between what is declared on the label and the actual content. Tolerance limits can be found in some nutrition labelling regulations/guidelines worldwide.[8] There are two approaches used:

- the label value should fall within a *specified range* (e.g ± 20% of the label value);
- the label value should be equal/less than or equal/ more than a *maximum or minimum* value (e.g ≤ 120% of the label value or ≥ 80% label value).

The European Council Directive on nutrition labelling for foodstuffs[9] is currently as vague as the Australian legislation although a specified range approach of 1.5g if the value is less than 10g/100g, 15% if the value is between 10-20g/100g and 3g if the value is more than 20g/100g for carbohydrates, protein and fat has been discussed and has been incorporated in some country legislation.[10] More common is a specified range of ± 20% as is used in Japan, Taiwan and Thailand for macronutrients.[8]

The maximum/minimum approach is applied so that for nutrients that have a negative impact on health (e.g., total fat, saturated fat, cholesterol, sodium, etc.), the tolerance limit is generally set at ≤120% of the label value. On the other hand, for those that are positive to health (e.g protein, dietary fibre, vitamins, etc.), the tolerance limit is commonly set at ≥80% of the label value.

The United States Food and Drug Administration published final rules codifying the Nutrition Labelling and Education Act in 1993.[11] These rules include compliance provisions stating that declarations of protein, total carbohydrate, other carbohydrate, polyunsaturated and mono-unsaturated fat or potassium must be at least equal to 80% of the value for that nutrient. The nutrient content of a food with a label declaration of calories, sugars, total fat, saturated fat, cholesterol, or sodium shall not be greater than 20% in excess of the value for that nutrient declared on the label.

On January 1, 2003, Health Canada published similar label requirements listing 13 nutrients and calories.[12] Mandatory nutrition labelling for most pre-packaged foods is required by 12 December 2005 for companies with greater than $1M in sales in the 12-month period prior to 12 December 2002. If less than $1M in sales, then the deadline is 12 December 2007. The principal acceptance criterion requires that the analysed nutrient content would have to be at least 80% of declared value for protein, carbohydrate, fibre, vitamins and minerals and not more than 120% of declared value for calories, fat, saturated fat, *trans* fat, cholesterol, sugars and sodium.

The overall precision in nutrition labelling information found in this survey varies considerably from compound to compound. It was disappointing to see that as many as 84% of product labels using the specified range approach or 49% using the maximum or minimum approach missed international targets for at least one compound each. This improved to 73% and 30% when excluding variations smaller than 1g/100g (10kJ/100g for energy, 10mg/100g

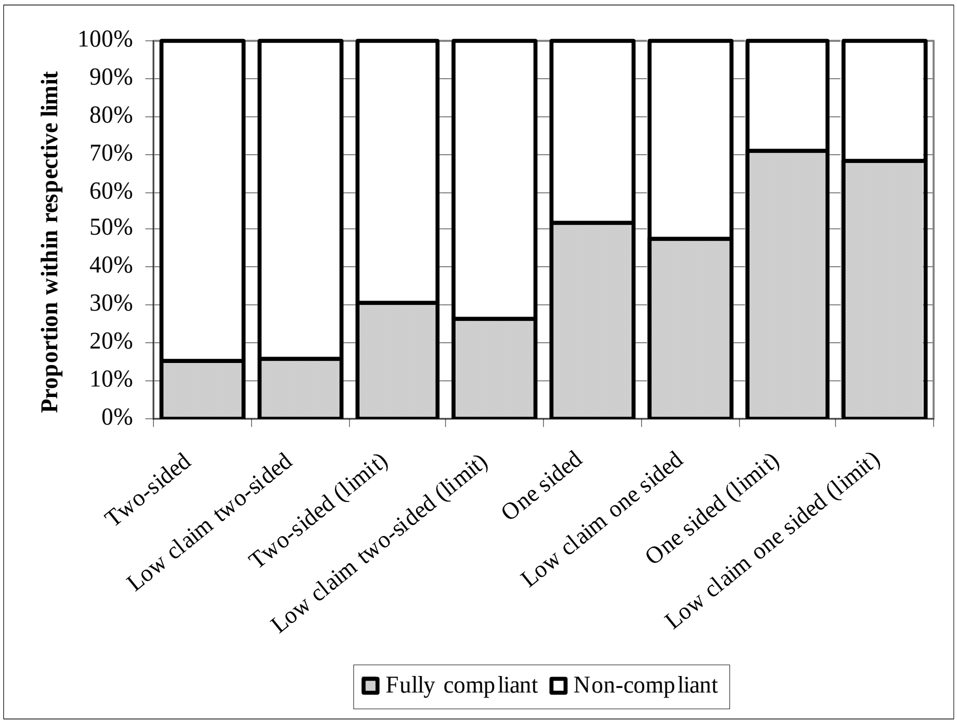

Figure 5. Comparison of low claim and other products compliant to (thick hatched) or exceeding (open) a leeway of ±20% (two-sided) or a maximum of +20% for unfavourable compounds or a minimum of -20% for beneficial compounds (one-sided) with major variations only marked limit (less than 1g/100g - 10kJ/100g for energy, 10mg/100g for sodium, potassium, calcium and cholesterol excluded)

for sodium, potassium, calcium and cholesterol).

In a similar study based on more than 2,000 laboratory tests on 300 samples of food products purchased off retail shelves in the USA, 91% percent of tests correctly listed nutrition information to within the 20% of upper and lower limits.[13] Results varied somewhat for different nutrients between the two studies with the following accuracy (US results in brackets):

- 97 (93) percent for energy
- 81 (96) percent for total fat
- 81 (93) percent for saturated fat
- 86 (90) percent for sodium
- 97 (98) percent for total carbohydrates,
- 89 (95) percent for sugar
- 100 (80) percent for cholesterol
- 83 (80) percent of dietary fibre and
- 100 (88) percent for calcium

There was no indication in the US study of how many of the individual product labels that accurately listed all nutritional components.

Companies must be accurate in the claims they make in relation to their low claim products. However, there was even a slight tendency for the accuracy to be worse in the present study. In several cases where large variations in precision were detected the actual amounts were less than 1g/100g. Such variations could be irrelevant to consumers. However, in many other cases, particularly in relation to low claim products, the label information could seriously mislead the consumer.

Under the current legislation with no tolerance limits specified, there is no compliance role for enforcement agencies in relation to the actual nutrition panel information. It is proposed that adoption of the maximum/ minimum approach be considered as a way of better assisting the consumer in making relevant comparisons of product nutritional value but leeway be given to variations involving only small amounts.

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Original Article

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Stefan U Fabiansson BVSc, PhD

NSW Food Authority, 6 Avenue of the Americas, Newington NSW 2127, Australia

澳洲的食品標籤上的營養資訊聲明的精確性

營養標示導引消費者對食物的選擇。自2002年底，澳洲已經強制要求使用新規範的營養標示。本研究分析涵蓋70個不同產品的350個樣本中的營養標示上所宣稱的營養成分。這是第一個企圖定量在澳洲市場上食品類商品營養標示精確性的大型研究。研究發現實際值與宣稱值存在顯著的差異，平均個別營養成分的平均精確性變異度在-13%到+61%之間。 澳洲食品法 規並未 規範忍受上限，但是有一些國家允許±20%的不一致性，而部份國家則分別規範上限跟下限，並且允許有益的營養成份最大不一致性在-20% 及不 好的 成分 在+20%。在研究的70個產品中只有16%的商品所標示的任一營養成分能完全符合±20%。若有不同的上下限，則有51%的產品能完全遵守規範。當去除與消費者不相關的小量變異(將所有變異小於1g/100g或是熱量100KJ/g及鈉、鉀、鈣及膽固醇10mg/100g記算在內，當作遵從)，則各有27%及70%產品的遵從度獲得改善。本研究建議應採用上下限，但去除小變異者，這樣才是協助消費者做產品與營養相關比較的較好的方式，而且任何營養組成份均應符合該規範。應用這樣的上下限規範，本研究中有30%的產品是不合格的。

關鍵字：澳洲、營養標示、食品標準、分析精確度。