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Accuracy of nutrition labels of pre-packaged foods in Malaysia

INTRODUCTION

A nutrition label is a panel found on food packaging which contains a variety of information on the nutrition value of the food item. There are many pieces of information which are standard on most food labels, including serving size, number of calories, grams of fat, including nutrient and list of ingredients. This information helps people who are trying to restrict their intake of fat, sugar, sodium and other ingredients, or for those individuals who are trying to optimize their intake of healthy nutrients such as calcium or vitamin C. The label provides each item with its approximate percentage of daily value, generally based on 2000 of calories. Therefore nutrition label is acting as a conduit to convey information related to the content of prepackaged food from food manufacturers to consumers.

Other than acting as a communication tool, food manufacturers are using nutrition label as a tool to enhance their products profile where they can highlight the nutritional qualities of their products and let consumers to discern that from competitors. Food manufacturers can enlarge the nutritional values of their products as health claims to draw consumers’ attention as this can strike a chord among consumers. This can allow food manufacturers to use nutrition label as a springboard for sales and marketing promotion.

Nutrition label is also undertaking a crucial role on free trade activity. The international trade barriers are less complicated comparing to olden days but regulations and guidelines of nutrition label should be abided for food safety and health purposes. Some countries require mandatory nutrition label on all prepackaged food whereas some are based on voluntary basis. The guidelines of tolerance limits for nutrition label are different for some countries as well. For
instance, United States has been implementing mandatory nutrition label on all prepackaged food since the year 1994, New Zealand and Australia gazetted the regulations in December 2002 (Hawkes, 2004). Canada, Brazil, Paraguay, Uruguay, Argentina, Hong Kong, China and Israel have made a move to enact the regulations of mandatory of nutrition label since year 2000. In Hawke’s report, she had categorized Malaysia as one of the countries which made nutrition labelling mandatory because a wide range of foods is required to have nutrition information. According to the Food Act 1983 (Act 281) & Regulations in Malaysia, nutrition labelling is on voluntary basis except for food products as specified in regulations 67-75 (Prepared cereal food and bread), 87-87, 89-99 and 113 (Milk products), 135 (Flour confection), 149, 151, 161 & 220 (Canned meat, fish and vegetable), 233-242 (Canned fruit and various fruit juices, 344-345 (Salad dressing and mayonnaise) and 348-358 (Soft drink) (FSQ 2010; Food Act 1983). Producers who produce food under these categories are required to make nutrition labelling as mandatory. The mandatory nutrients information is Energy, Fat, Carbohydrate and Protein (Food Act Malaysia 1983).

ASEAN countries such as Brunei, Indonesia, Philippines and Singapore do not make nutrition label as mandatory but it is only required when nutritional claim is made (Hawkes 2004; Public Health (Food) Act (Chapter 182), Brunei; Government Regulation of the Republic of Indonesia; Guide to Food Labelling and Advertisement, AVA Singapore; Bureau of Food and Drugs Manila). Therefore the appropriateness of nutrition labels and capability of applying it depends on the health status of citizens, public health goals, and dietary patterns of those specific country populations (Wijngaart, 2002).

Even though it is not mandatory for nutrition label to be implemented in all countries, nutrition label is common on prepackaged food. Consumers tend to purchase products with
nutrition label for a healthier diet (Campos & Hammond, 2011). Studies have shown that the risks of cardiovascular diseases and cancer have decreased after the enforcement of nutrition labelling laws in the 1990s (Zarkin et al., 1993). Purchasing intention will be influenced by the availability of nutrition label, thus consumers are able to exercise better control on their health (Wansink & Chandon, 2006). Additionally, consumers also believe that food items with nutrition label can assist them in selecting healthier food choices (Colby et al., 2010). Therefore, food producers are inclined to make nutrition label available on their products as marketing strategy and they are responsible in providing reliable and non-misleading nutrition labels to consumers and ensuring the accuracy of the nutrition label so that they will have no problem to export their products to all countries.

In addition, the accurate nutrition label can increase competitiveness strength of the products. An exporting product which is giving misleading nutrition label will tarnish the export country’s reputation. This is because a products’ origin country is representing the country, the misleading of information on nutrition label reflecting that the slackness of the enforcement practice in the country indirectly.

Since the beginning of the 20th century, worldwide shows drastic demographic changes due to World War I and II, epidemic diseases like AIDS or other contagious diseases like SARS or the current Ebola cases. During this period, malnutrition also plays a role in the demographic change. Today, coronary heart disease becomes a leading killer in the world. One-third of deaths are caused by cardiovascular diseases, and 60% of all mortality is attributed to non-communicable diseases (Pekka et al., 2002).

Globally, obesity has become a pandemic with prevalence statistics escalating rapidly among many levels of society in both developed and developing countries (Prentice, 2006). In
Malaysia, the numbers of obese citizens have increased by 250% from year 1996 to 2006. Then reports from National Strategic Plan for Non-Communicable Disease (NSPNCD) showed dramatic increase of hypertension and diabetes at 43% and 88% respectively in the same period of year. This situation became worse when World Health Organization (WHO) reported that diabetes patients have reached 2.6 million in the year of 2011 whereas the prediction of WHO on the number of diabetes patients in Malaysia are 2.48 million in year 2030; unfortunately diabetes patients in Malaysia have exceeded WHO prediction (Zhang, 2014).

Relating to this, Malaysia has introduced some policies and strategies such as National Plan of Action Nutrition on how to cope with Non-communicable diseases (NCD) issues. This was discussed on Tenth Malaysia plan as well. Food Act 1983 and Regulations 1985 is another strategy to maintain a healthy nation by implementing and controlling the regulation related to food and nutrition labelling.

Therefore, this research aims to investigate the effectiveness of the policies implemented by looking at the accuracy of nutrition label of prepackaged food in Malaysia and to study the compliance of selected prepackaged food products in Malaysia by comparing with different guidelines.
MATERIALS AND METHODS

Prepackaged foods are stratified into eight categories. Five are food which require mandatory nutrition labels as stated in the Food Act 1983 and Regulations 1983 (Malaysia), namely prepared cereal food and bread; flour confection; milk products; canned meat, fish and vegetable; and, canned fruits and various fruit juices. The other three categories are snacks and other indulgence food; coffee, tea and other hot beverages; and lastly jam, kaya and other spreads. There are a total of 300 samples (triplicate samples for same products) from the eight categories of prepackaged food bought randomly from hypermarkets, supermarkets and mini markets in the Klang Valley areas in Malaysia during March 2015 to August 2015. All samples bought are ready-to-eat, ready-to-drink, non-perishable and convenient preparation (only pour hot water prior to consumption).

Samples were then sent to laboratory for analysis. The first step of analysis was samples homogenization. Prepared cereal food, bread, flour confection, snacks and other solid foods were firstly grounded mechanically using a grinder then were divided into four roughly equal parts by separating quarter segments. A pair of opposite segments was combined, whereas the other pair was rejected. The combined segments were thoroughly mixed and the process of quartering was repeated until a sample of about 100g was obtained by the combination of opposite quarter segments. On the other hand, moist solid food such as canned meat was homogenized by chopping. Additionally, oil in canned meat was drained off prior to homogenization. Similarly, the syrup in canned fruits and vegetables was also drained off first before blending. Liquid samples such as milk, yogurt and other fruit juices were analysed directly without any sample preparation.
Analysis commenced by using the official standard method of Association of Official Analytical Chemists (AOAC) or other validated methods. Moisture and ash were analysed by the gravimetric method. Moisture was determined using air oven drying method (AOAC 931.04), ash was determined by incinerating in furnace at 550°C until a constant weight was obtained (4-5 hours) (Pearson’s Chemical Analysis of Foods) and protein was determined by the common Kjeldahl method (AOAC 991.20). Additionally, fat analysis was determined by solvent extraction, whereby the samples required acid or alkaline hydrolysis before Soxhlet extraction (AOAC 936.15). Fat in milk products and juices samples were extracted using ethanol, petroleum ether and diethyl ether in mojonier tube (AOAC 989.05). Subsequently, total carbohydrate was determined by subtracting from 100 the percentage of moisture, ash, protein and fat (Method of Analysis of Nutrition Labelling AOAC). Next, results on total dietary fibre on the nutrition labels were added onto the carbohydrate to make it as total carbohydrate for non-bias comparison. Total energy (in unit kcal) was calculated by adding fat reading multiplied by 9, protein reading multiplied by 4 and total carbohydrate reading multiplied by 4. In addition, correction of total dietary fibre is required when the labels contained reading of dietary fibre. Dietary fibre was multiplied by 2, then to subtract this reading from the energy amount (Method of Analysis of Nutrition Labelling AOAC).

Consequently, average results obtained from the triplicate samples were compared with the information given on the nutritional labels. Then, the compliance of products was determined by referring to the tolerance limit set in the Food Act 1983 (Act 281) & Regulations (Malaysia tolerance regulations), LACORS and leeway ±20%.
RESULTS

A total of 1200 analytical results were recorded for moisture, ash, fat and protein including triplicate results. Conversely, 200 calculated results were obtained for total energy and total carbohydrate.

Overall, most of the products complied with the acceptance tolerance limit of the Food Act (66%). Less than 50% of products were able to meet the tolerance limit of leeway ± 20% and LACORS, there were 73% and 56% of products not complied respectively (Figure 1). By referring to the Food Act 1983, 34% products did not comply with the regulations of the tolerance range. There were 60% of products in the category of canned meat, fish and vegetables which did not comply with the Food Act regulations. Percentages of products which complied and did not comply with the regulations are the same for snacks and indulgence food. Coffee, tea and other hot beverages showed the best compliance; only 8% of products did not meet the acceptance tolerance range. The rest of the food categories showed percentage of non-compliance at 23%, 25%, 42%, 20%, 40% for prepared cereal food and bread, milk products, flour confection, canned fruits and various fruit juices and jam, kaya and other spreads respectively. All categories showed higher non-compliance products in the tolerance limit of leeway ±20%. Canned meat, fish and vegetables did not comply 100% (Table 1) and only 20% of products in jam, kaya and other spreads category complied with leeway ±20%. In addition, 67% of products in the categories of milk products and flour confection did not comply with this tolerance limit. On the other hand, when the LACORS limit was used to measure the compliance of products, the percentage of compliance is better than just solely referring to leeway ±20%. Four categories of products showed more than 50% of compliance; there were milk products (67%), canned fruits and various fruit juices (60%), coffee, tea and other hot beverages (54%)
and jam, kaya and other spreads (60%). On the contrary, canned meat, fish and vegetables were a food category which showed the highest non-compliance among all other categories; which 90% of products in this category did not comply with the tolerance limit in LACORS (Figure 2). Generally, canned meat, fish and vegetables demonstrated poor product compliance (Table 1). Based on Figure 3, protein was the worst nutrient to comply with the tolerance limits according to both leeway ± 20% and LACORS; which the percentage of non-compliance of protein for these tolerance limits were 47% and 32% respectively. However, for the tolerance limit of the Food Act, the percentage of products which failed to comply was 11%. This was better than carbohydrate (17%) and fat (16%). For the total 100 data of energy, percentage of non-compliance when referring to the Food Act, leeway ± 20% and LACORS were 6%, 11% and 11% respectively. In addition, nutrition labels of carbohydrate which failed to comply with the tolerance limits of leeway ± 20% and LACORS when compared to the analytical results were 24% for both. Furthermore, fat was the nutrient which demonstrated higher non-compliance percentage from all three tolerance limits after protein (LACORS and leeway ± 20%) and carbohydrate (Food Act). There were 16%, 34% and 26% of fat content on the labels which did not comply with the tolerance limits of the Food Act, leeway ± 20% and LACORS respectively. Therefore, this showed that the tolerance limit by leeway ± 20% was the most stringent regulation to comply with, followed by LACORS and lastly, the Food Act; which was the most lenient regulations which allows food producers to comply more easily.

Overall, protein demonstrated the highest percentage of non-compliance, followed by fat, carbohydrate and energy. The value of protein analysed in most of the products analysed was not as high as other nutrients, thus the percentage of difference would be more significant compared to the rest. Therefore, energy was the nutrient which showed better compliance (energy is the
DISCUSSION

Reasons That Caused Non-compliance

There are many methods used to determine the nutrient contents in food products, whether it is the standard method such as AOAC or the manufacturers’ in-house method. For instance, fat content of noodle can be determined by using soxhlet extraction with or without acid hydrolysis. If the noodle contains nuts, the fat content determined using direct soxhlet extraction may not be able to extract oil from the sample without acid hydrolysis completely (AOAC 17th Ed., 1982). Some products such as soy sauce are oil-less and in order to increase the smooth mouth-feel sensation, manufacturers will use encapsulation technology to make the soy sauce appeared as light as others with no oil separation as the oil content encapsulated in the soy sauce would not be detected without acid hydrolysis. According to Kleyn et al., 2001, fat concentration was underestimated between 1-2% when sample is taken by weighing instead of pipetting in volume. For instance, sample preparation for ice-cream may vary between two parties, either by melting or not prior for analysis. Instead of the standard methods such as AOAC, some analysts may use other method such as near-infrared reflectance spectroscopy (Albanell et al., 2003) to determine the fat and protein content in dairy products.

For the determination of protein, Kjeldahl method is commonly used by the industries. This method is more cost effective compared to combustion method. Kjeldahl method consists of three steps of nitrogen content determination which are digestion or decomposition of samples.
The second step is distillation and the last step is titration. While combustion method is direct determination of the nitrogen content, thus the errors of analysis will decrease consequently. Therefore, it is crucial to choose the most precise and accurate or standard method to avert false declaration of nutrients.

Sample preparation and homogeneity of the samples are another important factor that will produce false result. Canned meat, fish and vegetables product and canned fruits and various fruit juices showed poor accuracy among the analysed food categories. According to Joslyn, from her edited books of "Method in Food Analysis", solids and liquids portion are required to be separated by draining off prior to homogenization of samples. The canned food samples were prepared in accordance to Joslyn in this study and it was observed that the nutrients content especially protein from the analysis was higher than the label. Food manufacturers might not be using sample preparation method as suggested by Joslyn, hence the protein content on the label was lower than the analysis due to dilution factor (sample is required to be diluted into solution prior to determination using Kjeldahl method).

Some prepackaged food samples contain not only single material. For instance black beans mackerel in can contained mackerel fish and black beans; and beef curry with potatoes in can contained beef, potatoes and chilli paste. The non-homogeneity of samples would also produce inconsistency in analytical results.

**Implications of Accurate Nutrition Labels in Food Packaging**

Rapid increase of NCD is a serious threat towards a country’s economy. The prevalence of NCD patients in a country will reduce the productivity and Gross Domestic Product (GDP) of
the country. Therefore, it is important to ensure that all citizens are taking care of their diets to avoid becoming the victims of NCD and affecting the economic growth of the country.

According to news report from Malaysian Journal of Nursing Online News Portal (MJNeNews) in December 2012, Malaysia could confront a potential shortfall in healthcare financing of US$ 4.1 billion (RM12.46 billion) in 2020, which will require additional fiscal spending. Citizens may need to bear higher out-of-pocket funding in terms of money from insurance, employees provident fund (EPF) or their own saving when our country reduces the medication subsidiaries. In the report, it is also stated that the total healthcare cost in the country is projected to rise by 8.8% yearly to US$ 25.8 billion by 2020. Therefore, it is imperative for consumers to maintain a healthy lifestyle by choosing a healthy diet. Consequently, the productivity of the country will be increased and eventually increase the country’s revenue.

From the study of Campos on the review of nutrition labelling, she found that consumers attended the use of nutrition labels on prepackaged food was generally high. According to the annual report of Malaysia Retail Food 2013 done by the Global Agriculture Information Network, there are 121 hypermarkets, 113 superstores and 133 department stores run by both local and foreign market players in Malaysia. In addition, convenience stores like 7-Eleven, 99 Speedmart, petrol stations and other traditional stores are easily accessed in town. This bulk amount of stores brought total retail sales of food and beverages amounting to US$15 billion today. The reporter forecasted that this sector is likely to grow by around 10 percent per annum over the next three to five years (Malaysia Retail Food Annual 2013). Subsequently, the number of citizens consuming prepackaged food is increasing in parallel. Accordingly, food producers should provide an accurate nutrition label in order to protect citizens living in a healthy nation.
Therefore, the information on the nutrition label must be précised and accurate. Thus, does not mislead the consumers to choose the prepackaged food which are not suitable for their diet.

According to the report of Malaysian Investment Development Authority (MIDA) 2012, Malaysia exported about $4.4 billion of processed food to more than 200 countries. The imported countries have their own authority to inspect the imported processed food to ensure compliance with the regulations, guidelines and standards before the products can be sold freely in the market. For instance, Malaysia exported RM620.3 million processed food to Japan in year 2014, an increase of 32.7% compared to the previous year. On the other hand, from January to October 2015 Japan imported RM 654.7 million of processed foods from Malaysia which illustrated the increase of 25.3% (MARTRADE, 2015). Therefore, food producers must ensure the accuracy of nutrition labels in order to meet the tolerance limit in the import countries to avoid losses because these countries deserve the right to reject non-compliance products. Therefore, it is important to ensure the nutrition labelling is précised and accurate to avert loses.

**Challenges for Food Producers in Providing Compliance Products**

The acceptance range of percentage of difference for analytical results and nutrition labels vary by countries. Some Codex member countries such as Malaysia, Indonesia, United States, Singapore, Canada, Korea and et cetera are using a lenient acceptance range. The analytical values for nutrients which are positive to health such as vitamins, protein, dietary fibre must be $\geq 80\%$ from the nutrition labels, whereas for nutrients which have negative impact to health such as fat, cholesterol, sodium and et cetera; the tolerance limit is set at $\leq 120\%$ (Food
A specific range of ±20% is implemented in countries such as Japan, China, Taiwan, Thailand and et cetera for macronutrients (Fabiansson, 2006). However, in the United Kingdom the Local Authorities Coordinators of Regulatory Services (LACORS) set the tolerance limit in a more statistical approach, specifically for nutrient level in between 2-5%, the tolerance limit is ±30% of the label value; for nutrient level that is more than 5% will have to meet the limit within ±20% and these limits are applied to protein, fat, carbohydrate, sugar and dietary fibre (FSAI, 2010).

It is observed that the development of regulations and guidelines is not consistent internationally. Even though Codex has gained international recognition in setting food-related standards, not all countries adhere to the tolerance limit guidelines which are in line with Codex. That is why the tolerance limit can either be the one way (Food Act or Codex) or two ways approach (leeway ± 20%). However, food producers are required to comply with these tolerance limits or their products may encounter some problems in the free trade activity.

According to Regulation 397 from the Food Act and Regulations 1985 in Malaysia, any person who contravenes or fails to comply with any provisions of these regulations commits an offence. Any person who commits an offence against these regulations for which no penalty is provided by the Act shall, on conviction, be liable to a fine not exceeding five thousand ringgit or imprisonment for a term not exceeding two years.
In addition, the Food Safety and Quality Division from the Ministry of Health Malaysia provides food labelling advisory services and food labelling to industries for ensuring the food labels to be in compliance with the Food Act and Regulations 1985 in order to assist food producers on the compliance of nutrition labelling regulation.

Moreover, food producers are using a few methods to determine the nutritional information. They may do the calculation based on the average or actual quantity of nutrients in the ingredients used or by getting the values from the food composition databases (Cunningham J, & Sobolewski, 2011). However, these two ways may not be suitable to provide accurate values for certain nutrients such as vitamins because nutrients will be varied by the influence of seasons (Cunningham J, Sobolewski, 2011). They cannot assume that the nutritional values will remain the same forever because chemical composition in food changes from time to time depending on the climate (amount of precipitation and sunshine duration) (Gonzalez-Zamora & Sierra-Campos, 2013; Cho et. al., 2004). To ensure the nutrition labels always comply with the regulations, food producers are advised to perform nutritional analysis for every batch of samples. Additionally, food producers are required to send the samples to an accredited laboratory for analysis service in order to obtain accurate and reliable results which can increase the confidence level on their products’ compliance. However, this will burden food producers in terms of reduction of profit margin. Analyzing core nutrients in an analytical laboratory will cost food producers between RM150 to RM200. In addition, they are also required to perform extra tests such as on sodium, cholesterol, saturated fat and trans fatty acid if they intend to export to countries such as China or Hong Kong (depending on the import countries’ requirements). Consequently, they would have to pay more for the analysis cost. If they want to declare more nutrients such as vitamins or fatty acid profile which would involve more sophisticated instruments for analysis, the cost of analysis...
will become more expensive. On top of this, extra cost will be incurred for redesigning and reprinting the labels and packaging.

CONCLUSION

When comparing the compliance with the tolerance limits in the Food Act 1983 and Regulations, the tolerance limit stated in the Food Act 1983 is one-way approach comparison, whereby the declared nutrient values on pre-packaged food for energy, fat and carbohydrate must be \( \leq 120\% \) to comply with and \( \geq 80\% \) for protein for compliance. A total of 100 samples with 3 replicates of each sample were analysed on the core nutrients (energy, protein, fat and carbohydrate). The number of compliance for the products was 66\% when compared with tolerance limits of the Food Act 1983 and Regulation, Schedule 18C.

Other than tolerance guideline of the Food Act 1983, this research has also studied the compliance of pre-packaged food by comparing with tolerance guidelines of leeway \( \pm 20\% \) (two-way approach) and LACORS. Results showed that only 27\% of the products complied with leeway \( \pm 20\% \) and 44\% of the products complied with LACORS. Therefore, these products would encounter difficulties when being exported to countries applying these guidelines. As a result, their products might be rejected from being sold in these countries.

“Dis-moi ce que tu manges, je te dirai ce que tu es”, which means that “tell me what you eat and I will tell you what you are”. This was quoted from a French politician, Anthelme Brillat-Savarin in his book *Physiologie du Gout* (1825). Back to contemporary moment, the American writer, Micheal Pollan posted that American would transform into corn in the future. He raised this because Americans are consuming too much food which is derived from corn such as syrup,
fast food and et cetera. Therefore, whether stretching across geographical regions or transcending over epoch, human’s health is jeopardized by the diet intake or eating lifestyle. All countries’s authority has set regulations on tolerance limits on nutrition labels which are suitable and appropriate to that specific country in order to alleviate the public health issues such as NCD or obesity pandemic. Furthermore, there is no standardization of tolerance limit approach. Food producers must be honest with their products and should have to put extra efforts to provide reliable nutrition labels on their prepackaged food products and to ensure that the nutrition labels complied with the import countries’ regulations. Therefore, they can avoid losses and provide credibility of nutrition information to consumers by sending their products to accredited laboratories to obtain reliable nutritional values.

In addition, policy makers may suggest for the government to draft new regulations such as providing tax relief for food producers on nutrition labelling cost. Governments should be actively involved in international nutritional labelling meeting such as the one organized by Codex to raise the issue on harmonization of nutrition labelling guidelines and regulations (based on scientific evidence) which would reduce production cost by reducing the overall complexity of multi-markets compliance. For instance, governments and international organizations are cooperating harmoniously to ensure that the processed food either for import or export activities carry accurate nutrition information (Kasapila et al., 2013).

Additionally, suitable nutrition labelling awareness programmes should be held in primary or high schools where well known people (celebrities for instance) are invited to give speeches related to the programmes which is to introduce as well as to increase the awareness on nutrition labelling as suggested by Tarabella et al, in 2012.
Subsequently, further investigation regarding the accuracy of other nutrients such as sodium and trans fat which are detrimental to human’s health can also be conducted as well as other supplements where the contents of nutrients or minerals which have been declared on the package must also be tested.

Lastly, provision of clear and accurate nutrition information is one important way to help consumers adhere to the guidelines and make informed choices (Roberto et al., 2014). It is hoped that this research provides some information which can be used by policy makers to draft new policies related to the accuracy of nutrition label in the future. Consequently, consumers can enjoy clarity and credible nutrition labels which are beneficial to their health as well as their daily expenditure.

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