

PREVALENCE OF REPORTED LACTOSE INTOLERANCE AND CALCIUM INTAKE
AMONG YOUNG ADULTS (UNIVERSITY MALAYSIA SABAH, AGED 19-29)

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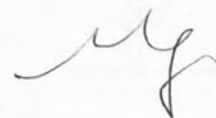
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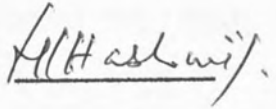
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ABSTRACT**PREVALENCE OF REPORTED LACTOSE INTOLERANCE AND CALCIUM INTAKE AMONG YOUNG ADULTS (UNIVERSITY MALAYSIA SABAH STUDENTS, AGED 19-29).**

This research is on prevalence of reported lactose intolerance and calcium intake among young adults in University Malaysia Sabah students, aged 19-29. A total of 529 of respondents were involved in this research. The objective of this research is to find out the prevalence of self-reported and diagnosed lactose intolerance among University Malaysia Sabah students. It also aims to determine the frequency and types of foods and drinks that are sources of calcium in the diet of self-reported lactose and diagnosed intolerance as compared to those who are lactose tolerant and to estimate the level of calcium intake in the diet of respondents using 3 days food diary in order to determine its adequacy as compared to the Recommended Nutrient Intakes (RNI) for Malaysia 2005 for calcium. This research employed a questionnaire, Food Frequency Questionnaire (FFQ) and 3-days food diary. To analyze the calcium intake of the respondents and the relationship of two variables, program SPSS software version 12.0 was used. Results showed that 33 (6.27%) of respondents reported themselves as being lactose intolerant. The FFQ showed a difference in intake of milk and milk product intake lactose intolerant and lactose tolerant respondents. Moreover, ice-cream was the highest consumption that is sources of calcium in the diet of self-reported lactose and diagnoses intolerance. The Mann-Whitney U test showed a significant difference in average daily calcium intake between lactose tolerant (555.44±61.52mg/day) and lactose intolerant (510.94±81.40mg/day) male respondents. Results also showed significant difference in average daily calcium intake among lactose tolerant female respondents (538.04±62.19 mg/day) and lactose intolerant female respondents (474.52±81.40 mg/day) ($Z=0.00$). However, no relationship was found between lactose intolerance/ lactose tolerance and achieving the RNI for calcium ($X^2=0.148$, $p=0.701$). As a conclusion, there is minority of students in University Malaysia Sabah reported themselves as being lactose intolerant.



ABSTRAK

KEWUJUDAN KETIDAK-TOLERANSI LAKTOSA YANG DILAPORKAN DAN PENGAMBILAN KALSIMUM DI KALANGAN DEWASA MUDA (UNIVERSITI MALAYSIA SABAH, BERUMUR 19-29).

Kajian ini mengenai kewujudan ketidak-toleransi laktosa yang dilaporkan dan pengambilan kalsium di kalangan dewasa muda di Universiti Malaysia Sabah, berumur 19-29). Sejumlah 529 orang responden terlibat dalam kajian ini. Objektif kajian ini bertujuan mencari kewujudan ketidak-toleransi laktosa yang dilaporkan sendiri dan telah didiagnos. Kajian ini juga ingin menentukan kekerapan dan jenis makanan dan minuman di mana ia adalah sumber kalsium dalam diet ketidak-toleransi laktosa yang dilaporkan sendiri dan telah didiagnos dan membandingkan ini dengan toleransi laktosa dengan menggunakan Soal Selidik Kekerapan Pengambilan Makanan (FFQ). Kajian ini juga bertujuan menganggarkan tahap pengambilan kalsium dalam diet responden dengan menggunakan diari makanan 3-hari untuk menentukan kecukupannya dan melalui perbandingan dengan RNI Malaysia 2005 bagi kalsium. Kajian ini dijalankan dengan soal selidik, FFQ dan diari makanan 3-hari. Untuk menganalisis pengambilan kalsium responden dan hubungkait 2 pembolehubah, program SPSS versi 12.0 digunakan. Keputusan menunjukkan 33 (6.27%) responden melaporkan sebagai ketidak-toleransi laktosa. Berdasarkan FFQ, ia menunjukkan perbezaan dalam susu dan produk susu di antara ketidak-toleransi laktosa dan toleransi laktosa. Tambahan pula, ais-krim adalah pengambilan tertinggi di mana ia adalah sumber kalsium dalam diet ketidak-toleransi laktosa yang dilaporkan dan telah didignos. Ujian Mann-Whitney U-test menunjukkan perbezaan signifikan dalam min pengambilan kalsium di antara lelaki yang toleransi laktosa (555.44 ± 61.52 mg/hari) dan ketidak-toleransi laktosa (510.94 ± 81.40 mg/hari). Keputusan juga menunjukkan perbezaan signifikan dalam pengambilan kalsium di kalangan perempuan toleransi laktosa (538.04 ± 62.19 mg/hari) dan perempuan ketidak-toleransi laktosa (474.52 ± 81.40 mg/hari) ($Z=0.00$). Walaubagaimanapun, ia menunjukkan tiada hubungan di antara ketidak-toleransi laktosa/ toleransi laktosa dan memenuhi RNI ($\chi^2=0.148$, $p=0.701$). Kesimpulannya, terdapat minor di Universiti Malaysia Sabah melaporkan sebagai ketidak-toleransi laktosa.



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LIST OF SYMBOLS**Symbols**

*	Significant
**	Not significant
>	More than
<	Less than
%	Percentage
mg	Milligram
cm	Centimeter
kg	Kilogram
g	Gram
ml	Mililiter
kcal	Kilocalorie



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CHAPTER 1

INTRODUCTION

Lactose intolerance (LI) refers to gastrointestinal symptoms such as abdominal pains and bloating excessive flatus, watery stool (Swagerty, Walling & Klein, 2002) or diarrhea (British Nutrition Foundation, 2000) after ingesting a known quantity of milk or milk containing products, experienced by some individuals who have total lack or low levels of enzyme lactase (β -D galactosidase). This is because only this enzyme is able to split lactose into two components, glucose and galactose which are easily absorbed in the intestinal epithelium (Troelsen, 2005).

Lactose (Saccharum lactis), the primary sugar in milk, linked by a β 1, 4 bond, is a disaccharide that comprises equimolar quantities of monosaccharide, glucose, and galactose. Moreover, dietary lactose can be absorbed and used by the body until it is hydrolyzed into monosaccharide in the small intestine by the enzyme lactase (Tolstoi, 2000). As far as is known, lactose has no special nutritional importance for adults however, it is the most important source of energy of a human's life during the first year, giving nearly half the total energy requirement of infants (Vesa, Marteau & Korpela, 2002).

Refer to the study by Sahi (1994) in the journal by Tolstoi (2000) found that, due to the enzyme lactase (β -D galactosidase) contains both lactase and phlorizin hydrolase



activities, so that it is more specifically known as lactate-phlorizin-hydrolase (LPH). Dietary lactose is hydrolyzed by lactase into glucose and galactose while phlorizin hydrolase is contained two enzymatic sites, phlorizin hydrolase and glycosylceramidase, which split phlorizin and β -glycosylceramide.

Studied by Boey (2000) showed the prevalence of lactase deficiency among Malaysian children with recurrent abdominal pain was high. On the other hand, prevalence statistics about lactose intolerance according to the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) (1994), 90% of Asian American adults have lactose intolerance, 70% of African-American adults have lactose intolerance, 74% of Native American adults have lactose intolerance, 53% of Mexican-American adults have lactose intolerance and 15% Caucasian adults have lactose intolerance (Unknown, 2001). The prevalence of high lactase activity levels in adulthood is most common among people of Northern European countries. This is because the climate is favorable to dairy farming and due to this; milk and dairy products have been part of the adult daily diet for centuries. In the Black and Asiatic communities, lactase deficiency (low levels of the enzyme) can be almost 100% because of milk is not habitually consumed as part of the typical adult diet (British Nutrition Foundation, 2000).

The adult enzyme may be high (lactose-digesters), low (hypolactasia) or insignificant or zero (alactasia) (Shukla, 1997). There are 3 types of lactose intolerance, primary lactase deficiency/non-persistence which is decrease in enzyme activity is permanent and cannot be induced by large quantities of lactose. The others types of lactose intolerance is secondary lactase deficiency which is in transient state of lactase deficiency due to damage to the lining of the intestine where the lactase is produced. For the congenital lactase deficiency is an extremely uncommon condition in which the



lactase enzyme is completely absent at birth. This type of lactose deficiency requires complete avoidance of lactose.

However, there are a lot of misperceptions and confusion surround the name, symptom, causes, prevalence, diagnosis of the lactose intolerance due to this; a lot of people claim themselves as “lactose intolerance”. For example, lactose maldigestion, lactose malabsorption, and milk intolerance. Lactase deficiency leads to lactose maldigestion, where a portion of the disaccharide lactose is can not be hydrolyzed into the monosaccharide glucose and galactose (Pribila *et al.*, 2000) due to a low intestinal lactase activity in the brush border membrane of the mucosa and it passes into large intestine, where it is fermented by the colonic microflora (Pribila *et al.*, 2000). On the other hand, when the undigested lactose cannot be absorbed from the intestine into the bloodstream nor transported to the liver, this situation is called lactose malabsorption (Danone World Newsletter, 1996). Milk intolerance is happened due to lactose is characterized by at least one clinical sign of intolerance experienced a few hours after consumed of a known quantity of milk or milk-containing products.

The changes from lactose tolerance to lactose intolerance starts between 2-15 years depending on the cultural and racial (Shukla, 1997). Several factors need to be considered, such as the amount and form in which lactose is given, either whether it is consumed with a meal, or whether the study is double-blinded, when the prevalence of milk intolerance is being evaluated rather than lactose maldigestion because these factors may influence the results (Miller, Jarvis & McBean, 1999).

Refer to the study by Aurisicchio & Pitchumni (1994), diagnosis of lactose intolerance should be based on the patient’s nutritional history, the relationship between



diet and gastrointestinal symptoms and also diagnostic tests (Tolstoi, 2000). There are 2 types of diagnostic tests to diagnose lactose deficiency, which is direct and indirect method. Direct methods comprise intestinal perfusion and intestinal biopsy (British Nutrition Foundation, 2000). Method of intestinal biopsy is to directly assay the lactase activity in the small bowel by taking an intestinal biopsy and to identify populations with primary lactase deficiency, which has been done by researchers (Miller, Jarvis & McBean, 1999). The indirect method includes the lactose tolerance test, a stool acidity test, and the breath hydrogen (H₂) test.

People who believe that they are lactose-intolerant usually lead to self-imposed dietary restriction by the individual of milk and dairy products, which are the major source of dietary calcium (McBean, 1999, Fleming & Heimbach, 1994). Following the clinical symptoms of lactose intolerance, such as abdominal cramps and diarrhea, patients frequently tend to avoid the ingestion of milk and milk products. Therefore, lactose intolerance may lead to a low calcium intake (Kudlacek *et al.*, 2002) and other nutrient supply by milk and milk product such as vitamin D, riboflavin, potassium, phosphorus, and magnesium. An inadequate calcium intake increases the risk of osteoporosis, hypertension, and perhaps colon cancer (Miller, Jarvis & McBean, 1999).

Refer to the Recommended Nutrient Intakes for Malaysia by Ministry of Health Malaysia (2005), the young adult, aged 19-29 years old, both men and women are recommended consumed 800mg calcium per day. However, according to the study by Carroccio *et al.* (1998), it clarified that the impact of self-reported milk intolerance on dietary habits. These subjects did not consume milk, or consumed very low quantities of milk and their daily calcium intake was significantly lower. It should be highlighted due to the result showed that the daily calcium intake was generally much lower than the



recommended level (500 mg vs. 800–1000 mg/day), which could it turn have implications for calcium intake and bone health (Lovelace & Barr , 2005).

Studies demonstrate that lactose maldigesters can consume the amount of lactose in one or two servings of milk, especially in divided doses with meals, without developing symptoms (Miller, Jarvis & McBean, 2001). Drinking milk and eating other lactose-containing dairy foods may improve a person's ability to digest lactose and also yogurt and fermented dairy products can generally be well tolerated by lactose-intolerant persons, and they are valuable foods and a good source of calcium supply for this group.

Individuals who claim themselves as lactose intolerance need to consult doctor or dietician to get more information about lactose intolerance and they need to understand that dairy food such as milk, cheese, and yogurt, need not be eliminated from their diet and non-dairy food such as broccoli, sardine, anchovy, shrimp paste need to be increased from their diet. Such individuals are also advised to check the food labels for ingredients and to look for other ingredients that might contain lactose as a component, such as whey powder and dried skimmed milk.

Since the lactose intolerance group have the risk on calcium deficiency, so the study is focus on prevalence of reported lactose intolerance and calcium intake among young adults in University Malaysia Sabah's students , aged19-29.



Objective:

1. Prevalence of self-reported and diagnosed lactose intolerance in University Malaysia Sabah.
2. Determine the frequency and types of foods and drinks that are sources of calcium in the diet of self-reported lactose and diagnosed intolerance and compare these to lactose tolerance with using Food Frequency Questionnaire.
3. To estimate the level of calcium intake in the diet of respondents with using 3 days food diary in order to determine its adequacy as compared to the Recommended Nutrient Intakes (RNI) for Malaysia 2005 for calcium.



CHAPTER 2

LITERATURE REVIEW

2.1. Lactose and lactase

Lactose (*Saccharum lactis*) or milk sugar is a disaccharide, the primary carbohydrate in milk of mammals. It contains two monosaccharide, glucose and galactose linked by a 1, 4 β -glycosidic bond (Tolstoi, 2000). The chemical structure of lactose is shown in Figure 1. After consumption, enzyme lactase (β -D-galactosidase) hydrolyzes dietary lactose into glucose and galactose in the human small intestine and later is absorbed into the bloodstream (Tolstoi, 2000). Lactose is water-soluble and accumulates in the whey portion of dairy product. Therefore, all hard cheese had a lower in lactose (McBean, 1999).

Lactose has no special nutritional importance for adults; however, it is the most main source of energy during the first year of a human's life, given that it comprises nearly half the total energy requirements of infants (Vesa, Marteau, Korpela, 2000). Moreover, lactose is quite widely used in the food industry for example in sweets, bread, sausages and confectionary. This is because lactose provides good texture and binds water and color. Lactose is less than half as sweet as glucose and about one third as sweet as saccharose (Vesa, Marteau & Korpela, 2000). Lactose is transported to the colon if the hydrolysis of lactose in the small bowel is incomplete. Colonic bacteria



ferment lactose and result in short-chain fatty acids and gas for example hydrogen, carbon dioxide, and methane (Suarez, Savaiano & Levitt, 1995).

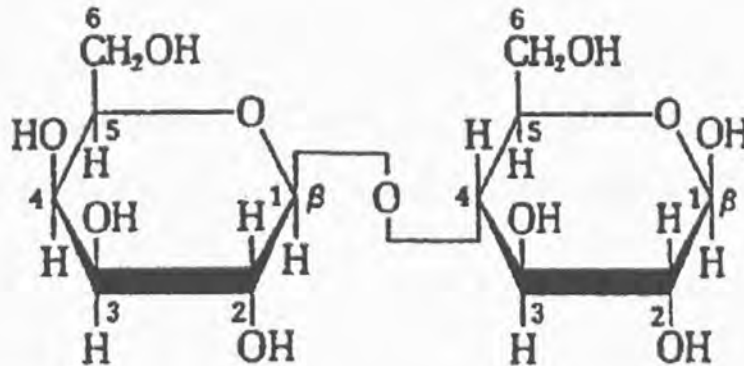


Figure 2.1: Chemical structure of lactose

(Source: Miller, Jarvis, McBean, 1999)

The lactase enzyme is situated in the brush border (microvilli) of the small intestine enterocyte (Swargerty, Walling & Klein, 2002). Lactase enzyme is responsible for the hydrolysis of lactose into glucose and galactose which can be absorbed across the intestinal epithelium. Studied by Sahi (1994) in the journal by Tolstoi (2000) said that, due to the enzyme lactase (β -D-galactosidase contains both lactase and phlorizin hydrolase activities, it is more specifically known as lactate-phlorizin-hydrolase (LPH). Dietary lactose in hydrolyzed by lactase into glucose and galactose, on the other hand, phlorizin hydrolase has two enzymatic sites, phlorizin hydrolase and glycosylceramidase, which break into phlorizin and β -glycosylceramide. Lactase is one of five disaccharides situated on the brush border of the intestinal epithelium and found a lot in the jejunum, which is at the beginning of the small intestine.

Torun, Solomons & Viteri (1979) in the book by Miller, Jarvis, McBean, (1999) reported that activity of the lactase enzyme is very low in the first part of the duodenum and in the terminal ileum however the highest in the proximal ileum. Normally, lactase activity reduces after weaning in most mammals; however, lactase activity can remain into adult life in some human ethnic groups, enabling total digestion of large quantities of dietary lactose (British Nutrition Foundation, 2000). Usually, the activity of lactase starts to decrease between 3 and 5 years of age in many population groups (Rice & Pollard, 2001).

2.2. Definition

2.2.1. Lactose Intolerance (LI)

Lactose intolerance is commonly a lifelong inherited condition but it can be a short-term result of an infection or other insult to the jejunal mucosa. This is the common, generic, name for the condition, but is gets misused and over confused with this name. Usually, lactose intolerance is induced by maldigestion and following malabsorption of lactose. The meaning of “tolerance” and “intolerance” are not synonymous with “digestion” and “maldigestion” and these two words should be used only when in reference to a defined dose of lactose delivered in a specific vehicle for example the subject was intolerant to 50 g of lactose in aqueous solution (Miller, Jarvis, McBean, 1999).

2.2.2 Lactose Maldigestion (LM)

The term “lactose intolerance” is often used synonymously with lactose maldigestion, but this usage is not really correct (Hertzler & Clancy, 2003). Lactase maldigestion is not the same as lactose intolerance. Lactase maldigestion simply describes the incomplete digestion of lactose (Rosado, Allen & Solomons, 1987, Hertzler & Clancy, 2003) into the absorbable monosaccharide by the enzyme lactase. A portion of the lactose load is not



hydrolyzed in the small intestine people with lactose maldigestion and later it passes into the large intestine, where it is fermented by colonic microflora. The most common test for diagnosis of lactose maldigestion is the breath hydrogen test. Most of the people with lactose maldigestion do not experience the gastrointestinal symptoms that those with lactose intolerance do after they consume food contains lactose (Pribila, *et al.*, 2000). Most of the lactose maldigesters are able to tolerate moderate amount of milk without significant symptoms (Johnson *et al.*, 1993).

2.2.3 Lactose Malabsorption

Lactose malabsorption is a normal physiological pattern (Swargerty, Walling & Klein, 2002). It implies a physiological impairment in the hydrolysis of lactose into glucose and galactose (Tolstoi, 2000). Lactose malabsorption happens when the undigested lactose from the intestine cannot be absorbed into the bloodstream nor transported to the liver (Danone World Letter, 1996). Gastrointestinal symptoms such as abdominal pain, bloating, passage of loose, watery stools, and excessive flatus are result from malabsorption of dietary lactose in the small intestine (Swagerty, Walling & Klein, 2002).

2.2.4. Milk Intolerance

Milk intolerance, is the experience of the occurrence of abdominal symptoms following milk intake, may or may not be due to lactose maldigestion (Rosado, Allen & Solomons, 1987). Furthermore, symptoms may be due to other gastrointestinal problems. Moreover, several factors such as the amount and form in which lactose is given, whether it is consumed with a meal, and whether the study is double-blinded are needed to consider when the prevalence of milk intolerance is being evaluated rather than lactose maldigestion. This is because those factors may influence the results (Miller, Jarvis, McBean, 1999).



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