USE OF COCONUT MILK VERSUS DAIRY MILK IN MALAYSIAN CUISINES : COMPARISON OF NUTRITIONAL VALUE

by

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ABSTRAK

Sebahagian besar makanan dalam masakan Malaysia kita menggunakan santan termasuklah hidangan utama dan pencuci mulut. Tetapi, penggunaan susu sebagai pengganti santan dalam masakan sangat kurang digunakan oleh masyarakat. Hari ini, masyarakat kita kurang terdedah tentang fakta santan dan susu juga perbezaan antara mereka. Kebelakangan ini, terdapat cadangan untuk menggunakan susu sebagai alternatif yang lebih sihat untuk digunakan dalam masakan setiap hari sebagai pengganti santan yang dikatakan tidak sihat. Kajian ini dijalankan untuk menentukan nilai-nilai pemakanan dan penilaian sensori masakan Malaysia yang disediakan dengan santan kelapa dan produk tenusu. Puding kastard dan gulai lemak cili padi telah dimasak menggunakan santan kelapa segar (SK), santan kelapa segera (SKS), susu segar (SS) dan susu sejat (SUS). Analisis proksimat telah dijalankan mengikut prosedur AOAC (1996). Penilaian sensori telah dijalankan dengan menggunakan skala hedonik 7 titik untuk menentukan penerimaan pengguna ke atas produk. Data yang diperolehi telah dianalisis dengan menggunakan perisian SPSS 20.0. Keputusan menunjukkan bahawa puding kastard disediakan dengan menggunakan SS mempunyai kandungan kalori paling rendah secara signifikan ($P < 0.05$) (3.855 kcal/g) berbanding dengan puding kastard disediakan dengan SK (4.690 kcal/g), SKS (4.679 kcal/g) dan SS (4.178 kcal/g). Kandungan lemak (0.28%) dalam puding kastard SS adalah paling rendah ($P < 0.05$) manakala kandungan lemak dalam SK adalah tertinggi (11.61%) diikuti oleh SKS (8.50%) dan SUS (2.75%). Kandungan protein tertinggi terdapat dalam SUS kastard puding (2.98%). Gulai lemak cili padi menunjukkan keputusan yang sama yang mana

SS gulai lemak cili padi mempunyai kalori (4.681 kcal / g) dan lemak (5.68%) paling rendah secara signifikan (P<0.05) berbanding sampel lain. Kandungan kalori (6.764 kcal/g) dan lemak (57.46%) tertinggi ditunjukkan dalam sampel SKS. Kandungan protein tertinggi terdapat dalam SS (5.53%) dan kandungan protein yang paling rendah telah ditunjukkan dalam SKS (0.37%). Keputusan penilaian sensori menunjukkan bahawa puding kastard disediakan dengan SK adalah yang paling menarik berbanding yang lain kerana ia diterima dengan skor tertinggi secara signifikan (P <0.05) dalam semua atribut iaitu aroma (6.06), warna (6.06), rupa (5.60), kelemakan (5.30), kelikatan (5.20), rasa (5.84) dan penerimaan keseluruhan (5.96). Gulai lemak cili padi yang menggunakan SK mempunyai penerimaan ketara tertinggi (P <0.05) juga yang menunjukkan aroma (5.22), warna (5.68), rasa (5.20) dan penerimaan keseluruhan (5.48). Ahli-ahli panel secara keseluruhan menerima 'gulai lemak cili padi' yang dibuat dengan SK dan SKS dalam atribut kelemakan dan berminyak. Kesimpulannya, lebih banyak kajian lanjut perlu dilakukan untuk meningkatkan penerimaan masakan Malaysia yang dibuat dengan susu memandangkan pengguna tidak mahu mengorbankan rasa asli santan yang serasi dengan mereka selama ini.

ABSTRACT

Most of the food in our Malaysian cuisine uses coconut milk in their cooking including main dishes and desserts. But, the use of dairy milk as substitute of coconut milk in cooking is very less used by the community. Today, our community has less exposure on coconut milk and dairy milk as well as their different uses. Lately, there has been suggestion to use dairy milk as a healthier alternative to use in everyday cooking as a replacement for coconut milk which is believed to be unhealthy. This study was conducted to determine the nutritional values and sensory evaluation of Malaysian cuisines prepared with coconut and dairy milk. Custard pudding and 'gulai lemak cili padi' were cooked using fresh coconut milk (FCM), instant coconut milk (ICM), fresh milk (FM) and evaporated milk (EM). Proximate analysis was carried out following the procedures of AOAC (1996). Sensory evaluation was carried out using 7 point hedonic scale to determine the consumer is acceptability of the products. Data obtained was analyzed using SPSS 20.0 software. The results showed that custard pudding prepared using FM had a significantly ($P < 0.05$) lowest calorie content (3.855 kcal/g) compared with custard pudding prepared with FCM (4.690 kcal/g), ICM (4.679 kcal/g) and FM (4.178 kcal/g). The fat content (0.28%) in FM custard pudding was also significantly lowest ($P < 0.05$) while FCM showed the highest (11.61 %) followed by ICM (8.50%) and EM (2.75 %). The highest protein content was found in EM custard pudding (2.98%). The 'gulai lemak cili padi' showed similar results, with FM 'gulai lemak cili padi' by having significantly ($P < 0.05$) lowest calorie (4.681 kcal/g) and fat content (5.68%) among others. The highest content of calorie was (6.764 kcal/g) and fat (57.46

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LIST OF ABBREVIATIONS

Symbol	*Abbreviations*
%	Percentage
AOAC	Association of Analytical Chemists
APCC	Asian and Pacific Coconut Community
C	Carbon
Ca	Calcium
DRI	Daily recommended intake
EM	Evaporated milk
FA	Fatty acid
FCM	Fresh coconut milk
FDA	Food and Drug Administration
Fe	Ferum
FM	Fresh milk
g	Gram
ICM	Instant coconut milk
K	Kalium
Kcal/g	Kilocalorie per gram
LDL	Low density lipoprotein
LUTS	Lower urinary tract symptoms
MARDI	Malaysian Agricultural Research & Development Institute
MCFA	Medium-chain fatty acids
MCT	Medium chain trigliseride

Mg	Magnesium
mg	*Milligram*
mL	Mililitre
Na	Natrium
^{o}C	Degree celsius
S	Sulfur
UHT	Ultra high temperature
USDA	US,Department of Agriculture

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Malaysian cuisine is not based on one particular distinction of food but a culinary diversity originating from it's multi ethnic population of Malay, Indian, Eurasian, Chinese, Nyonya and the Indigenous peoples of Borneo. A brief look into the past and how this multi ethnic country came to be, is essential in order to comprehend how such a cosmic array of food, has now come to be known all over the world as *Malaysian Food.*

Since there is such diversity within Malaysia, the food can be classified into three major groups, which are Malay, Chinese and Indian. Malay food, like many Asian countries, consists of rice as staple food, eaten with meat, fish and vegetables. An essential ingredient in most of Malay cuisine is coconut milk. The coconut milk is also important in giving the Malay dishes their rich, creamy character. Coconut milk is the basis of Malay fatty dishes. Fatty dishes are typically not hot to taste; it is aromatically spiced and coconut milk is added for a creamy richness. It has been estimated that 25 % of the world's consumption of coconuts is as coconut milk (Gwee, 1988). Many traditional foods in Thailand and other Southeast Asian countries also contain coconut milk as the main ingredient.

Most Malaysian has been using coconut milk in their daily cooking especially the Malay and Indian community. But, the use of dairy milk as substitute of coconut milk in cooking very is rare by the community. Today, our community has less exposure on coconut and dairy milk and their different uses. They believe that high intake of coconut milk relates to heart disease and obesity. Around 92% of coconut fats are saturated fats. This has lead to the belief that coconut fats are bad for health, particularly in relation to ischaemic heart disease. Yet, most of the saturated fats in coconut are medium chain fatty acids whose properties and metabolism are different to those of animal origin (Amarasiri *et al.*, 2006). Medium chain fatty acids do not undergo degradation and re-esterification processes and are directly used in the body to produce energy (Amarasiri *et al.*, 2006). They are not as 'bad for health' as saturated fats. There is a need to clarify issues relating to intake of coconut fats and health, particularly for most populations that still depend on coconut fats for most of their fat intake (Amarasiri *et al.*, 2006).

Coconut milk is the natural oil-in-water emulsion extracted from the endosperm of mature coconut (*Cocos nucifera L.*) and it plays an important role in many traditional foods in Asia and in Pacific regions. In addition, it has been also used as to being used as main ingredient in food industry as instance in beverage production (Prabawani *et al.*, 2011). Coconut milk is obtained from extraction of coconut flesh with or without added water. It contains fat, water, carbohydrate, protein, and ash with the major components being water and fat. Coconut milk is also the best known product of coconut meat

(endosperm), obtained when grated coconut meat is squeezed through a muslin cloth (Akpan *et al.*, 2006).

The fat content of the coconut milk is about 17% of which between 90-92% of these are accounted by saturated fats. Though coconut milk is more saturated than most other oils and fats, about two thirds of the saturated fatty acids are medium chain fatty acids (Dayrit, 2003). The coconut milk is used in the production of virgin coconut oil by controlled low temperature heating and removal of the oil fraction (Akpan *et al.*, 2006). Coconut milk has been shown to be useful in Ayuverdic medicine and in healing mouth ulcers (Nneliand Woyike, 2008) and in the folk-loric management of lower urinary tract symptoms (LUTS) and gastrointestinal cramps. However, little is known about the effect of its consumption on the cardiovascular risk state of those who consume it.

Milk is the natural secretion of the mammary glands, which plays a fundamental role in nutrition, growth, development and immunity (Woo *et al.*, 1995). The milk from each mammalian species is unique in terms of composition and nutritional value (Kataoka *et al.*, 1991). Cow's milk and milk products play important role in human nutrition growth, and development. Fresh cow milk has been reported to contain about 88% water (Kataoka *et al.*, 1991). Milk and milk products are important food item especially for growing children (Keira *et al.*, 2004) due to its nutrients content. It is an excellent sources of calcium, vitamin D, riboflavin, and phosphorus and good source of protein, potassium, vitamin A, vitamin B 12 and niacin. Milk and milk products supply

three of the five minerals (Mg, Ca, K) that were identified as those most needed in children's diet (American ,US department of Agriculture).

Milk is also a white liquid produced by the mammary glands of mammals. It is the primary source of nutrition for young mammals before they are able to digest other types of food. Furthermore, first milk contains colostrum, which carries the mother's antibodies to the baby and can reduce the risk of many diseases in the baby. Milk is an important drink with many nutrients (Pehrsson *et al.*, 2000).

1.2 Justification of Study

As we can see today, most of the food in our Malaysian cuisine uses coconut milk in their cooking including main dishes and desserts. However, people believe that the use of coconut milk in cooking can lead to obesity and heart disease which is associated with a high fat content. Lately, there has been suggestion to use dairy milk as a healthier alternative to use in everyday cooking as a replacement for coconut milk. Definitely, the invention of this replacement of coconut milk in cooking can bring greatest benefits in promoting population's health and indirectly assist in the prevention of several chronic diseases such as diabetes, stroke, heart disease and hypertention. It is because the incidences of preventable chronic diseases are increasing and becoming a major problem currently.

Recently, the increasing trend of obesity among school children has attracted broad attention from people. Various issues have been are discussed and highlighted by various parties including the type of food sold in the canteen and outside the school. Finally, given the various positions related to *nasi lemak* has simply been pointed as the cause of obesity among schooling children. This burning issue has became the fodder of public debate following the rumours that Ministry of Education is going to restrict the selling of *nasi lemak* at school canteens. The rationale for the ban is not the rice but due to the use of coconut milk in the preparation of *nasi lemak.*

Until now coconut milk misconceptions still persist. This happens also among professionals including dietary specialists in Malaysia. The people were advised to reduce the use of coconut in daily cooking. Based on the belief that coconut milk contains high cholesterol. On the contrary, scientific evidences revealed that cholesterol content of coconut milk was considerably low compared to other sources of fat, especially animal based food. Besides, its cholesterol content is lower than other vegetable oils and animal fats (Kamariah L, 2012). This problem is only refers to cholesterol but actually its coming from fat content in coconut milk. Previous research showed that the fat content of coconut milk is an oil or fat emulsion in water (Clement and Villacorte, 1933), is between 31 - 35% as compared to 3 - 4% in cow milk. The composition of saturated fatty acids in coconut milk comprised mainly of lauric acid (48.2%) and myristic acid (16.6%) followed by linoleic acid with the least/lowest percentage (Weiss, 1970).

Coconut milk has a high content of saturated fat and can be processed to produce coconut oil. Coconut oil contains about 92% saturated fatty acids. In general, the more saturated fat in diet, the more LDL(Low Density Lipoprotein) cholesterol in the body. LDL cholesterol refer to bad cholesterol where is linked to heart disease. But not all saturated fat have the same cholesterol raising effect, however most notable among the saturated fatty acids that raise blood cholesterol are lauric and palmitic acids. However, making such distinctions may be impractical in diet planning because these saturated fatty acids typically appear together in the same foods. In addition to raising blood cholesterol, saturated fatty acids contribute to heart disease by promoting blood clotting. Fats from animal sources (meat and milk products) are the main sources of saturated fats in most people's diet. Some vegetable fats (coconut and palm) and hydrogenated fats provide smaller amounts of saturated fats. Selecting skin less poultry and fat free milk products helps to lower saturated fat intake and the risk of heart disease (McGuire, M., & Beerman, K. A., 2007).

In contrary to popular myth, coconut oil (fat) does not transform into bad cholesterol to clog up arteries. In fact, cultures around the world that depend on coconut as their main source of fat have been found to be free of heart disease. The principal fatty acid in coconut milk is lauric acid, which is the same fatty acid found in abundance in mothers' milk and is known to promote normal brain development and contribute to healthy bones (Timmen and Patton, 1989).

There is different taught of issue regarding coconut milk and dairy milk consumption. There is a trend in Malaysia to substitute coconut milk with dairy milk in everyday meals because coconut milk is said to be unhealthy for health. On the contrary, there is also an increase in research among the western countries in the product development such as cheese, whereby coconut milk is used to substitute the dairy milk (cow milk). This is because dairy milk is originated from animals, whereby coconut milk is originated from plant source, which is perceived to be healthier. In addition, coconut milk would be a better option for those who are vegetarian. Moreover, some people are allergic or have lactose intolerance to dairy milk which limits their dairy milk intake. Therefore, more research has been done to search for dairy milk substitute in western food products and coconut milk is said to be one of the most suitable substitute for dairy milk. Thus, dairy milk and coconut milk can serve as substitute for one another, depending on the purpose of substitution. The present study however was focused on the preparation of Malaysian cuisines with the aim to examine the use of both coconut milk and dairy milk in Malaysian cuisines to determine their nutritional values and acceptability.

1.3 Research Objectives

1) To determine the proximate composition (moisture, ash, fat, protein, carbohydrate and calorie) in Malaysian cuisine prepared with coconut milk and dairy milk.
2) To examine the acceptability of Malaysian cuisine prepared with coconut milk and dairy milk.

1.4 Research Questions

1. Are there any difference in proximate compositions of Malaysian cuisine prepared with coconut milk and dairy milk?
2. Are there any difference in sensory evaluation of Malaysian cuisine prepared with coconut milk and dairy milk?

1.5 Hypothesis

Null hypothesis, Ho :

There are **no significant differences** in proximate compositions and sensory evaluation in Malaysian cuisine prepared with coconut milk and dairy milk.

Alternative hypothesis, H_A :

There are **significant differences** in proximate compositions and sensory evaluation in Malaysian cuisine prepared with coconut milk and dairy milk.

CHAPTER 2

LITERATURE REVIEW

2.1 COCONUT MILK AND ITS PRODUCTS

Coconut milk is a milky white oil-in-water emulsion and it was sold in many forms such as canned, UHT or coconut powder. Many traditional foods for example in Thailand, both curries and desserts were containing coconut milk as a main ingredient. The sweetened coconut milk for desserts is typically prepared by adding salt and sugar to fresh or heated coconut milk and mixed thoroughly. Heated coconut milks are expected to retain their white color, stability and natural coconut aroma. Oil separation of coconut milk after heating is normally unacceptable. For savory dishes, on the contrary, coconut milk is added to a mixture of meat and curry paste and then boiled. After boiling, coconut milk is expected to be creamy where the partial separation of oil is required. However, customers require fresh or commercial coconut products to be white, aromatic and creamy, non-flocculated with a long term stability (Berlin, 2009).

The term "coconut milk" is conventionally defined as the aqueous products, free from fiber, extracted from solid coconut endosperm but optionally may include some coconut water. This certain definition was proposed by the Standard Task Force of the Asian and Pacific Coconut Community (APCC) in the year 1994. Coconut milk is produced by grinding the white coconut meat and then squeezing out the milk which

may include water or liquid endosperm (coconut water). Fresh coconut milk normally contains over 34 % fat content.

By Thailand regulations, commercial coconut milk products are differentiated between coconut milks of low-fat content which contains 5-8 % fat, medium-fat content which contains 12-14 % fat, coconut milk which contains 20-22 % fat and coconut cream which contains more than 30 % fat content.

Coconut (*Cocus nucifera*) is the stone of the drupes borne by the coconut palm, a member of the monocotyledonous family Palmae. It is known as the "wonder food" and is regarded as perfect diet because it contains almost all essential nutrients needed by the human body. It is nourishing, strengthening and fattening food. It has high oil content. The protein is of high quality and contains all amino acids essential for the growth and maintenance of the body. It is rich in K, Na, Mg and S. The energy value of the dried coconut is 662 calories per 100 g (Bakhru, 2000). Coconut milk, the oil-protein-water emulsion obtained when the freshly grated meat (endosperm) is squeezed through a muslin cloth, is a well known product in areas that grow coconut.

Coconut milk is also an intermediate in the preparation of coconut oil in some rural areas, notably in Indonesia (Grimwood, 1975). Coconut milk may be considered as a substitute for dairy milk. It may be used by the people who cannot tolerate dairy milk. The milk of fresh coconut serves as a valuable food for children suffering from nutritional deficiency. It has more vitamin. A content than the coconut itself and has adequate minerals. To extend the shelf-life, coconut milk has been processed in many forms such as UHT and canned coconut milk (Jaruwan *et al.*, 2003).

Coconut milk is one of the popular cooking ingredients in Thailand and other Southest Asian countries. Among the popular Thai food dishes using coconut milk are curries and dessert. The importance of coconut milk to Thai industries has prompted food scientists and food engineers in this country to develop new products from coconut milk for use as ingredients in household recipes both for the Thai market and for export. Generally, food composition and temperature are the important factors affecting thermal properties (Mohsenin, 1980; Sweat, 1995; Rahman, 1995; Saravacos & Maroulis, 2001). Choi and Okos (1986) developed general models for the prediction of thermal properties of food products as functions of contents of basic food components (i.e., fat, protein, moisture, carbohydrate, fiber, and ash) and their thermal properties (i.e., thermal conductivity, specific heat, and thermal diffusivity). In those models, it was assumed that each component had the same thermal properties without considering the structure of the different food materials (Sweat, 1995). Thus, empirical models of thermal properties developed for each specific food material should give a more accurate prediction.

Canned coconut milk or coconut milk in cartoon is produced for long-term storage in which can only be achieved by sterilization. Canned coconut milk can last for at least 24 months under normal storage conditions (Seow and Gwee, 1997). Canned coconut milk can be made by sterilizing bottled homogenized coconut milk at 115 or 121°C more than 45 minute in a rotary retort. Preheating the milk to 90 – 95°C for several minutes, followed by filtration and homogenization prior to retorting, must be done. These processes might cause the denaturation of most of the proteins. Preheating

reduces the microbial load of the milk and eliminates the denatured proteins before the secondary heat treatment. The major problems, however, encountered by those processes in canning whole coconut milk are related to its instability both during heating and on prolonged standing.

2.1.1 Relationship between Coconut Milk and Saturated Fatty Acid

Coconut milk contains a large proportion of lauric acid, a saturated fat that raises blood cholesterol levels by increasing the amount of high-density lipoprotein cholesterol that is also found in significant amounts in breast milk and sebaceous gland secretions (Mesink *et al.*, 2003). This may create a more favourable blood cholesterol profile, though it is unclear if coconut oil may promote atherosclerosis through other pathways. Because much of the saturated fat of coconut oil is in the form of lauric acid, coconut oil may be a better alternative to partially hydrogenated vegetable oil when solid fats are required (Amarasiri *et al.*, 2006). In addition, virgin coconut oil is composed mainly of medium-chain triglycerides, which may not carry the same risks as other saturated fats. Early studies on the health effects of coconut oil used partially hydrogenated coconut oil, which creates trans fats, and not virgin coconut oil, which has a different health risk profile (Marina *et al.*, 2009).

Coconuts and coconut milk are calorie-dense and high in saturated fat. However, the saturated fatty acids found in coconuts are medium-chain fatty acids, which are more quickly metabolized by the liver than the long-chain saturated fatty acids found in low-fat or full-fat dairy milk. Since they are more likely to be used for energy and less likely

to be stored as fat, the medium-chain fatty acids may not contribute to heart disease the way the long-chain fatty acids do. Furthermore, several companies produce coconut milk beverages in a carton, which are lower in fat and calories than their canned counterparts.

Saturated fatty acids can be divided into three levels, namely, saturated fatty acids short carbon chain (C 4:0-C 6:0), medium (C 8:0-C 12:0) and long (C 14:0>). Each of these saturated fatty acids have their respective roles and we need them all. Coconut oil is a source of medium chain triglycerides (medium chain Trigliseride, MCT). Many clinical studies related to these substances carried in developed countries including Europe and Japan. The study found that medium chain fatty acids in the body as soon as glucose was metabolites but it is capable of supplying higher energy. Energy produced from medium chain fatty acids is 7 kcal / g versus 4 kcal / g of glucose. Intake of milk because milk provides instant energy contains 65% medium-chain saturated fatty acids. This discovery sparked coconut milk canning industry there is on the island of Hainan for export to China as a supplier of instant energy drink products (Kamariah L., 2012).

2.1.2 Chemical Composition of Coconut Milk

The chemical composition of fresh coconut milk show very wide variation due to the range of geographical sources, maturity of nuts and methods of extraction. The main carbohydrates present are sugars, primarily sucrose, and some starch. Freshly extracted coconut milk contains small amounts of water-soluble B vitamins and ascorbic acid. Contents that might play an important role in coconut milk are coconut proteins (Seow and Gwee, 1970).

Table 2.1.2 belows shows the proximate composition of undiluted whole coconut milk as reported by different sources (modified from Seow and Gwee, 1997) include Nathaneal, (1954), Popper *et al* (1966), Jaganathan (1970), Anon (1984), Gonzalez (1990) and Tansakul and Chaisawang (2006).

Table 2.1.2:Proximate Composition of Coconut Milk Reported by Different Sources

Proximate Composition Reported by Different Sources						
Composition (%)	Nathaneal (1954)	Popper et al (1966)	Jaganathan (1970)	Anon (1984)	Gonzalez (1990)	Tansakul and Chaisawang (2006)
Moisture	50	54.1	50	53.9	50	55.3
Fat	39.8	32.2	40	34.7	34	35
Protein	4.4	4.4	3.0	3.6	3.5	4.02
Ash	1.2	1.0	1.5	1.2	2.2	1.02
Carbohydrate	6.2	8.3	5.5	6.6	7.3	4.7

Based on the source from Mohd Nordin (1977) and Desrosier (1970), it is shown that composition of coconut milk for protein is 3.5-4.0%, fat 31-35 % and water 50-56 %which are higher than percentage in cow milk. The composition of cow milk for protein is 3.5 %, fat 3.5% and water 87.3 %.

Base on USDA National Database for Standard Reference in 2004, the chemical properties for protein, energy, fat, ash and carbohydrate in 100 grams of edible portion of raw coconut milk in which the results are protein 2.29 grams, energy 230kcal, fat 23.84 grams, ash 0.72 grams and for carbohydrate is 5.54 grams. The results also quite different for canned coconut milk where the results are energy 197 kcal, protein 2.02 grams, fat 21.33 grams, ash 0.97 grams and carbohydrate 2.81 grams. All value in 100 grams of edible portion.

2.2 MILK AND ITS PRODUCTS

2.2.1 Definition of Milk

Milk is defined as lacteal secretion, practically free from colostrums, obtained by the complete milking of one or more healthy cows. Milk that is in the final form for beverage use should be pasteurized, and should not contain less than 8.25% milk solid – not – fat and not less than 3.25% milk fat (FDA, 1998).

Milk is also the natural secretion of the mammary glands, which plays a fundamental role in nutrition, growth, development and immunity (Woo *et al.*, 1995). The milk of each mammalian species is unique in composition and nutritional value. Cow's milk and milk products have played an important role in human nutrition growth, and development. Fresh cow milk is reported to contain about 88% water (Kataoka *et al.*, 1991). Milk and milk products are important components in human food, since milk is one of the basic primary sources of nutrient in diets for growing children (Keira *et al.*, 2004). Milks are excellent sources of calcium, vitamin D, riboflavin, and phosphorus and good source of protein, potassium, vitamin A, vitamin B-12 and niacin. Milk and milk products supply three of the five minerals (Mg, Ca, K) that were identified as those most needed in children's diet (Dietary Guideline for Americans, 2005) .

The qualities of milk obtained from these animals are dependent on the species and the feeding habits. If the cow's diet is primarily forage from green, growing pastures her milk will contain more conjugated linoleic acid, vitamins and minerals, and slightly higher levels of omega 3 fatty acids. This milk is generally more yellow in colour, primarily because of the increased carotene (Auldist *et al.*, 2002). Cow milk which is a very important food stuff consumed by man is one of the major sources. It has been reported that the content of the main elements in milk are fairly constant and undergoes slight changes depending on lactation phase, quality of nutrition and environmental conditions mainly chemical pollutants (Farid *et al.*, 2004).

2.2.2 Sources of Milk

Nature designed milk as food for the young. Thousands of years ago, mankind learned of the possibilities of both milk and milk products as food not only for the young but also for adults. Accordingly, through selection and breeding, man has greatly increased the milk-producing function of those animals best adopted as a source of milk and has used milk of many animals for his own food (Bauman and Davis, 1974). Cross & Overby (1988) reported that the cow is adapted to temperate zones and the people of Europe and in those regions where they have migrated, such as North America, Australia and New Zealand, are the main users of cow milk and its products.

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In Southern Europe the milk of goats and sheep is used, the Lapps of Northern Europe use the milk of reindeer. In Southeast Asia the milk of Water Buffalo is used. Other animals used as a source of milk for human food include the mare, the camel and the Lama. Although species mentioned above are sources of milk, the cow supplies by far the largest proportion of this product. Therefore most scientific information is focused on cow milk as reported by Cross & Overby (1988).

2.2.3 Constituents of Milk

The major constituents of milk are water, protein, fat and lactose. The minor components are vitamins, minerals and salts. Lactose and casein most readily distinguishes milk from other foods. Milk differs widely in composition, the greatest difference being between species of mammals, but within species the composition depends on factors such as race, lactation period, and technique of feeding and milking

frequency (Kaufmann and Hagemeister, 1987). There are differences in composition in the early stages of lactation (from colostrums to mature milk). There is a markedly high protein (immunoglobulin) content, especially during the first six days after calving, whereas the lactose content is reduced. Seasonal influences on composition of milk especially fat content has been attributed to factors such as stage of lactation and date of calving, kind and composition of feed ration (pasture or indoor feeding), energy supply and milk yield. Higher energy supply of rations leads to increased protein synthesis in the rumen (Kaufman and Hagemeister, 1987).

2.2.4 Evaporated Milk

Evaporated milk, also known as dehydrated milk, is a shelf-stable canned milk product with about 60% of the water removed from fresh milk. It differs from sweetened condensed milk, which contains added sugar. Sweetened condensed milk requires less processing since the added sugar inhibits bacterial growth (BBC Worldwide). The product takes up half the space of its nutritional equivalent in fresh milk. When the liquid product is mixed with a proportionate amount of water, evaporated milk becomes the rough equivalent of fresh milk. This makes evaporated milk attractive for shipping purposes as it can have a shelf life of months or even years, depending upon the fat and sugar content. This made evaporated milk very popular before refrigeration as a safe and reliable substitute for perishable fresh milk, which could be shipped easily to locations lacking the means of safe milk production or storage. The process involves the

evaporation of about half the water from the milk, after which the product is homogenized, canned, and sterilized (Harrold, 2004).

Standards require whole evaporated milk contain at least 7.9 percent milk fat and 25.5 percent milk solids. The high heat process gives it a bit of a caramelized flavor, and it is slightly darker in color than fresh milk. The evaporation process naturally concentrates the nutrients and the calories, so evaporated versions are more calorie-laden and nutritious than their fresh counterparts. Low-fat and skim versions are also required to have added vitamin A, while all have added vitamins D and C.

2.3 ADVANTAGE OF COCONUT MILK AND DAIRY MILK IN HEALTH

Some recent studies have suggested that coconut milk has hyperlipidemic balancing qualities, antimicrobial properties in the gastrointestinal tract or by topical application, and it has been used as a home remedy for healing mouth ulcers. In a study with rats, two coconut based preparations (a crude warm water extract of coconut milk and a coconut water dispersion) were studied for their protective effects on drug-induced gastric ulceration. Both substances offered protection against ulceration, with coconut milk producing a 54% reduction versus 39% for coconut water. In addition, the saturated fat in coconut milk is mostly lauric acid, which was found to have positive effects on the cardiovascular system (Mensink *et al.*, 2003).

While it is important to note that there is conflicting evidence on the claimed health effects of consuming significant amounts of coconut milk, coconut is rich in medium-chain fatty acids (MCFAs), which the body processes differently than other saturated fats. MCFAs promote weight maintenance without raising cholesterol levels. They work best for preventing weight gain if you're not overweight or maintaining your new weight after a successful diet (St. Onge *et al.*, 1999-2002). Fats in coconut milk are also very helpful in the development of the brain and strengthens of the bone. Beside that, it is the most important essential fatty acid in building and maintaining the body's immune system (the same as the fat in breast milk). Coconut milk provides an excellent source of nutrition to absolutely those who are undergoing the process of weight loss. This is because MCFA quickly assimilated into the body. That is, these fatty acids are not into fat in the body as it does to the long-chain fatty acids in cow's milk.

Recently published research has shown that natural coconut fat in the diet leads to a normalization of body lipids, protects against alcohol damage to the liver, and improves the immune system's anti-inflammatory response. Clearly, there has been increasing recognition of health- supporting functions of the fatty acids found in coconut.

Factors such as the type of protein; the proportion of protein, fat, and sugar; the levels of various vitamins and minerals; and the size of the butterfat globules, and the strength of the curd are among those than may vary (Goff, Douglas, 2010). Processed cow's milk was formulated to contain differing amounts of fat during the 1950s. One cup (250 ml) of 2%-fat cow's milk contains 285 mg of calcium, which represents 22% to 29% of the daily recommended intake (DRI) of calcium for an adult. Depending on the age, milk contains 8 grams of protein, and a number of other nutrients (either naturally or through fortification) including biotin, iodine, magnesium, pantothenic acid, potassium, riboflavin, selenium, thiamine, vitamin A, vitamin B12, vitamins D, vitamin K.

The amount of calcium from milk that is absorbed by the human body is disputed (Jones, 2002). Calcium from dairy products has a greater bioavailability than calcium from certain vegetables, such as spinach, that contain high levels of calcium-chelating agents but a similar or lesser bioavailability than calcium from low-oxalate vegetables such as kale, broccoli, or other vegetables in the Brassica genus (Brody *et al.*, 1999).

CHAPTER 3

METHODOLOGY

3.1 Research Design

Experimental study design was carried out to compare the nutritional value of Malaysian cuisines prepared with coconut milk and dairy milk. In addition, the acceptability of Malaysian cuisines prepared with coconut and dairy milk was investigated.

3.2 Collection of Sample

Fresh coconut milk was purchased from local grocery store. Chicken was obtained from the local slaughterhouse. Other ingredients including instant coconut milk and fresh coconut milk were purchased from hypermarket.

3.3 Sample Preparation

The recipe for 'gulai lemak cili padi' was prepared according to Chef Hanieliza (2010). The ingredients used for 'gulai lemak cili padi' was given in Table 3.3.1. First, shallot, garlic and chili were blended together. Next, the paste was heated in a pot on a medium

heat and slowly stirred until fragrant. Then, turmeric powder, crushed lemon grass, and tamarind were added into the pot. Next, fresh coconut milk was added and continued to cook until boiling. Lastly, seasoning was added. The procedure was repeated for other formulations by replacing fresh coconut milk with instant coconut milk, fresh milk and evaporated milk. The "gulai lemak cili padi' was served hot together with rice as a carrier.

Table 3.3.1 Formulation of "Gulai Lemak Cili Padi"

Items	Ingredients	Quantities (gm)
1	Shallot	46
2	Garlic	10
3	Chili	14
4	Tamarind	4
5	Lemon grass	13
6	Turmeric powder	3
7	Coconut milk/ dairy milk	500
8	Salt/ seasoning	8
9	Ginger	3
10	Breast chicken (without skin)	250

(Source : Chef Hanieliza, 2010)