



**UNIVERSITI PUTRA MALAYSIA**

**PHYSICAL AND CHEMICAL ANALYSIS OF DIFFERENT TYPES OF MILK  
IN RELATION TO THE PRESENCE OF MILK ADULTERATION**

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ADULTERATION



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BY

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A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfilment of the requirement of SHW 4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture (Animal Science)

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## CERTIFICATION

This project report entitled Physical and Chemical Analysis of Different Types of Milk in Relation to the Presence of Adulteration is prepared by Siti Nor Atiqah binti Masarudin and submitted to the Faculty of Agriculture in fulfilment of the requirement of 4999 (Final Year Project) for the award for the degree of Bachelor of Agriculture (Animal Science)

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## ABSTRACT

The immense rely of Malaysia on imported products caused the tariff rates on dairy products to be much lower as compared to other foods and dairy imports licenses became more readily obtained. The general objective of this research is to determine the presence of milk adulteration of milk from different types while specific objectives include; determining the physical characteristics and chemical analysis of milk samples performed for detection of signs of adulteration. Samples were divided into three categories namely Fresh milk, UHT milk and Imported Fresh milk based on their packaging labels. The physical analysis includes the determination of pH using a pH meter and the measurement of specific gravity through the use of lactometer. Chemical analysis incorporates the detection of formalin with the addition of concentrated sulphuric acid, detection of starch using iodine solution and the detection of skim milk powder by testing milk samples with nitric acid. Results showed that majority of milk samples acquired an alkaline pH and a low specific gravity related to the addition of water in milk as well as having a significant difference between milk samples with a value of ( $P < 0.05$ ). Detection of formalin showed a 100 % for both Fresh and Imported Fresh milk while 87 % for UHT milk. Starch and skim milk powder detection was 100 % negatively tested for samples of all three milk types.

**KEYWORDS:** Milk, Physical analysis, Chemical analysis, milk adulteration

## **ABSTRAK**

*Kadar kebergantungan Malaysia yang besar kepada produk yang diimport menyebabkan kadar tarif ke atas produk tenusu menjadi jauh lebih rendah berbanding dengan makanan lain serta lesen mengimport bahan tenusu menjadi lebih mudah diperolehi. Objektif umum kajian ini adalah untuk menentukan kehadiran pencemaran susu dari jenis yang berbeza manakala objektif khusus termasuk untuk menentukan ciri-ciri fizikal dan analisis kimia sampel susu dilakukan untuk mengesan tanda-tanda pencemaran. Sampel telah dibahagikan kepada tiga kategori iaitu susu segar, susu UHT dan susu segar yang diimport berdasarkan label pembungkusan mereka. Analisis fizikal termasuk penentuan pH menggunakan meter pH dan pengukuran graviti tentu susu melalui penggunaan alat laktometer. Analisis kimia menggabungkan pengesanan formalin dengan tambahan sulphuric asid pekat, pengesanan kanji menggunakan larutan iodin dan pengesanan serbuk susu skim dengan menguji sampel susu dengan asid nitric. Hasil kajian menunjukkan bahawa majoriti sampel susu yang diperolehi mempunyai pH alkali dan graviti tentu yang rendah berkaitan dengan penambahan air dalam susu serta mempunyai perbezaan yang signifikan di antara ketiga jenis susu dengan nilai ( $P < 0.05$ ). Pengesanan formalin menunjukkan 100% pada kedua-dua susu segar susu segar diimport manakala 87% bagi susu UHT. Pengesanan kanji dan serbuk susu skim pengesanan adalah 100% negatif untuk ketiga-tiga jenis susu.*

**KATA KUNCI:** *Susu, Analisis fizikal, Analisis kimia, Susu dicemar.*



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## 1. INTRODUCTION

Milk is a common component in our diet where it would be consumed on its own or is incorporated into the food we eat. The composition of milk varies considerably with the breed of cow, stage of lactation, feed, season of the year, and many other factors. Although, some relationships between constituents are very stable and can be used to indicate whether any tampering with the milk composition has occurred (Swathi and Kauser, 2015). Milk, if present in its natural form, has high food value and supplies good quality nutrients like energy providing lactose and fat, body building proteins, bone forming calcium, health promoting vitamins and minerals in significant amount than any other single food (Neumann et al., 2002). Naturally, milk has always been a part of a mammal's diet in order to facilitate a healthy body growth due to all of the factors previously mentioned. Other than that, Mehari (1988) stated that milk is considered as one of the most important diet items of many people due to its high nutritive value. The trend that surrounds the concern of drinking milk products are experiencing strong demand from consumers due to improving health awareness as these beverages have a high calcium content. The Malaysian Ministry of Health has indicated in 'The Malaysian Dietary guidelines for Children and Adolescents' that it is recommended to consume milk and milk products every day. Therefore, it is seen as a norm to have dairy products incorporated into daily meals as the Malaysian demography are suggested to be exposed to it at an early stage of their lives.

There are many types of milk that could be found in the markets nowadays such as fresh milk, Ultra High Temperature (UHT) milk, skim milk, condensed milk and imported milk to name a few. Among these milk variants, three types are the most abundant and is well known in the market which are fresh milk, UHT milk or imported

milk. Normally, the most sought after form of milk would be fresh milk as consumers view it as being pure and does not contain any harmful chemicals or preservatives. Most of the fresh milk sold in Malaysia are at least pasteurized as the sale of raw milk without heat treatment is an offence under regulation 51 (1A), the Food Hygiene Regulations 2009, the Food Act 1983. This solely implies that raw milk will be banned for direct consumption in Malaysia by the Ministry of Health effective on the 1<sup>st</sup> December 2016. The process of pasteurization is where harmful bacteria are killed by heating milk to a specific temperature for a set period of time. It has been stated by the U.S Food and Drug Administration (FDA) that pasteurized milk does not cause lactose intolerance and allergic reactions. Both raw milk and pasteurized milk can cause allergic reactions in people sensitive to milk proteins, does not reduce milk's nutritional value, does kill harmful bacteria as well as saves lives. The standard form of UHT milk in Malaysia is UHT Recombined milk where it refers to milk that is heated to 135°C through a process known as Ultra High Temperature (UHT) pasteurization. This process modifies the flavor more than the standard and usual pasteurization as it also allows the milk to be packed in boxes without refrigeration for a very long period of time. The term recombined implies that the milk has first been dehydrated and separated into milk fat powder and non-fat milk solid then these two components are remixed with water.

Milk happens to be the most commercially sold commodity both by local vendor's as well super markets. However, the self-sufficiency level of the dairy industry in Malaysia was a mere 5% recorded on 2012 as Malaysia greatly relies on imports in order to fulfill the domestic demands for dairy products (Lin Sim and Suntharalingam, 2015). Due to this, there is an abundance of imported milk available in the market that mostly originates from Australia and New Zealand. Most consumers are attracted to

the idea of consuming milk from these countries with the thought of it having a top notch quality and rivals the locally produced fresh milk that could be obtained. Putting the claims made on the labels of these imported milk in focus, some may not seem as fresh as it is made to be. Due to milk being a highly sensitive and perishable food product, there is a need for the milk to be turned into powder in order to survive the journey from the country of origin to Malaysia. This is more feasible since milk that has been turned into powder has a far longer shelf life compared to liquid milk and does not need to be refrigerated, due to its low moisture content. The trade strategy has previously been adopted due to the local milk production was not up to par with milk demand from consumers. When initiatives were set up to increase milk production, the government supported the dairy sector by posing restrictions on entry of imported milk and milk products (Malcolm, 1999). However, as a result of inadequate government support that began around the 1980s, dairy processors have started to rely deeply on imported products. Consequently, tariff rates on dairy products were much lower as compared to other foods and dairy imports licenses became more readily obtained (Lin Sim and Suntharalingam, 2015). The applied tariff for some dairy products such as skim milk and whole milk powder were as low as zero in Malaysia (Warr et al., 2008). Unfortunately, there are not many emphases on the possibility of milk adulteration in the milk that is marketed in Malaysia.

According to the Food Safety and Standards Authority of India (FSSAI, 2012), food is declared adulterated if a substance is added which depreciates or injuriously affects it, it is an imitation, it is coloured or otherwise treated to improve its appearance or if it contains any added substance injurious to health as well as for whatever reasons its quality is below the standard. Adulterated milk can contain preservatives or chemicals that may be harmful to the public's health in the long term that includes heart problems,

renal and skin disease while some may even lead to cancer. In order to keep milk temporarily fresh, some unethical activities are usually adapted to prevent the financial losses due to the spoilage of milk during its transportation and sale (Swathi and Kauser, 2015). Some examples of milk adulteration are the addition of water to increase volume of milk, thickening agents such as starch, flour, skimmed milk powder, whey powder or other ingredients to counter the dilution and extend the solids content of the milk. Some chemicals such as hydrogen peroxide, carbonates, bicarbonates, antibiotics, caustic soda and even the most lethal chemical formalin to increase the storage period of milk, ice to enhance the shelf life of milk; detergents to enhance the cosmetic nature of milk which diminishes foamy appearance and whitening of milk or calcium thioglycolate/ potassium thioglycolate/ calcium salts of thioglycolic acid and urea for whitening of milk and giving it a genuine look (Soomro et al., 2014). As stated by the Food Safety and Standards Authority of India (FSSAI, 2012), formalin enhances the life of milk and thus is added for preservation purposes. Starch, cereal flours or arrowroot are added to make up the density of milk to prevent detection of added water (Makadiya et al, 2015). In addition, starch is used as an adulterant and if high amounts of starch are added to milk this can cause diarrhea due to the effects of undigested starch in colon (Makadiya et al, 2015). Another form of measuring the quality of milk is to assess the physical qualities of milk such as the pH and specific gravity. In normal circumstances, the pH of a fresh milk should be slightly acidic measuring between 6.6 to 6.8 (O'Connor, 1995; FAO, 1999). The pH values higher than 6.8 indicates mastitis milk and pH values below 6.6 indicates acidity increase of milk due to bacterial multiplication (O'Connor, 1995). Milk pH is affected by temperature, generally decreasing with increasing temperature, due to changes in dissociation of ionizable groups (Zagare et al., 2014). Water is an adulterant in milk

which is often always added to increase the volume of milk which in turn decreases the nutritive value of milk which if contaminated poses a health risk especially to infants and children (Makadiya et al, 2015). This is because the milk adulterated with contaminated water is a serious health hazard because of potential waterborne diseases.

The general objective of this research is to determine the presence of adulteration in milk from different types while the specific objectives includes to determine the physical characteristics of milk samples for the detection of adulteration as well as to conduct chemical analysis of milk samples for detection of adulteration.

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