



The Concentration of Syrup in Making Foi Thong, Med Kanoon, Thong Yip and Thong Yod

Porndara Ketthongkam*

Department of Home Economics, Faculty of Education Ramkhamhaeng University, Bangkok, 10240, Thailand

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Abstract

The concentration of syrup that uses egg yolk, boiled into the syrup, as the main ingredient requires the right amount of thickness to make Thai desserts. In this article, Foi Thong, Med Kanoon, Thong Yip and Thong Yod are used and arranged according to the concentrations of syrup with low to high. Starting with Foi Thong which is at 55-57°Brix is round, sticky and glazed. Med Kanoon at 65-66°Brix and is glazed and non-crystalline sugar. Thong Yip is at 70-72°Brix is fluffy, sticky and juicy with syrup. The last one, Thong Yod is at 72-74°Brix has droplet-shape and is non-flat, fluffy, soft and juicy with syrup. The clear syrup is used for soaking Thong Yip and Thong Yod as well as to use to dilute the Foi Thong's sweetness in cases where the usage of condensed syrup occurs. The above clear syrup should have a concentration of 36-38°Brix. In addition, white sugar applies to this clear syrup. Moreover, using syrup that had a concentration of 60 to 70 g of white sugar to 100 mL of syrup will help enhance osmotic pressure and reduce water activity (α_w) which could prevent microbial growth. Most people prefer to use duck egg yolk rather than hen egg yolk for preparing the desserts, due to the greater luster of color, viscosity and oiliness. However, some prefer both duck egg yolk and hen egg yolk mixed, to add a soft texture and lessen the fishy smell of duck egg yolk.

Introduction

Thai egg dessert is usually called "Golden Dessert" during the Ayutthaya period. In the reign of King Narayana the Great, there were many foreigners who migrated to Ayutthaya and served as courtiers, including a Portuguese named Maria Guyomar de Pinha (Tao Thong Keep Mah), who followed her husband (Constantine Phaulkon or Chao Phra Ya vichayen) who migrated to Thailand and was promoted to a courtier. She served as the head chef in the department of dessert in

the royal court. At that time, she created desserts from a fusion between European desserts and Thai desserts. Hence, several desserts acquired their various original tastes and changes in appearance. Moreover, she innovated new methods in making desserts. As a result, she was honored as a dame and played a major role in influencing the development of Thai desserts.

Tao Thong Keep Mah introduced innovative methods in making Thai desserts by introducing baking as an addition to other primary methods: boiling, steaming, toasting, coating in sugar and stirring.

* Corresponding Author
e-mail: porndara.kk@gmail.com

Additionally, she introduced egg white and egg yolk into the preparation of the Thai desserts. As a result, these desserts developed into desserts used in important ceremonies. These egg-based desserts include Foi Thong, Med Kanoon, Thong Yip, Thong Yod, Thong Ek, Jah Monggud and Saneh Chand.

Various Thai desserts need different concentrations of syrup in their preparation. The concentration of syrup will affect the characteristics of the desserts like glossiness, softness, sweetness and shape, along with maintaining their sponginess. Hence, Thai desserts require appropriate concentrations of syrup to achieve the desirable characteristics.

When the concentration of syrup is inappropriate, it will affect the texture and the characteristics of the desserts. If the concentration of syrup is too high, it will cause early coagulation in the egg before the syrup diffuses into it which makes the dessert's texture rough. In contrast, too low concentrated syrup causes a low rate of diffusion of sugar into the desserts, which is less than a highly concentrated syrup, making the desserts flat and non-fluffy. Practically, the diffusion of the solution will diffuse from high to low concentration. (Mongkonworawan et al., 2002). The concentration of syrup at 60-70% will prevent microbial growth which can extend the shelf life of the desserts, due to the sugar gathering with the free water. The above process causes the water to evaporate, resulting in not enough moisture for microbial growth in food. Moreover, the sugar can remove water from the microbial cell.

This article focuses on Foi Thong, Med Kanoon, Thong Yip and Thong Yod because these desserts apply the same concentration of syrup theory and have been popular among Thai and foreigners. According to the Suan Dusit's Poll, the survey indicated that the top 5 Thai desserts Thai people would like to learn to make are Thong Yod with 22.89%, followed by Thong Yip with 21.76% (Suan Dusit Poll, 2021). This type of dessert needs knowledge and understanding of the syrup used because the concentration of the syrup will not be the same for each dessert. Therefore, syrup for making Foi Thong is not suitable for making Med Kanoon, Thong Yip and Thong Yod. Some people may ask why these desserts are too sweet. The author will answer that these desserts require white sugar and the taste is supposed to be very sweet. However, there are methods to reduce the sweetness.

The author demonstrates the concentration level of syrup in making egg desserts or "Golden Desserts"

from low to high. Firstly, Foi Thong, uses the lowest concentration of syrup. Followed with Thong Yip and Thong Yod because the remaining syrup from making Foi Thong can be used to make Thong Yip and Thong Yod, again as the concentration of the syrup will increase from the boiling process. The author has always used this concentration sequence in making Thai desserts throughout 22 years of experience as an instructor. Lastly, although Med Kanoon uses less concentrated syrup than Thong Yip and Thong Yod, it is still possible to prepare it at the end by adding water to the remaining syrup from making Thong Yip and Thong Yod, which will become diluted by water and is now suitable for making Med Kanoon. However, some people may arrange the sequence by starting with Foi Thong, Thong Yod, Thong Yip and Med Kanoon. (A Cuisine, 2019; Chemistry of Textiles, Food and Surroundings, 2016). However, this type of dessert is not popular among people who are concerned about health, due to its low nutrition, most of them come from carbohydrates, protein and a little fat. It has high cholesterol, so it is not recommended for oldery and those who have atherosclerosis.

Water

Water is a macronutrient making up a large percentage of meat (up to 75%), fruits and vegetables (up to 95%). In food, it is a medium for chemical reactions and transportation of other food components. It also adds structure by imparting turbidity to cells. In the food industry, water content is generally referred to as moisture. A number of functional properties of water are important in food processing such as the ability to dissolve and disperse other food components, the ability to be bound by other food components, the ability to transfer heat, the ability to sublimate, and its ability to transport materials (Simons, 2022).

Sugar

Sugar for cooking, scientifically named "Sucrose", is classified as a disaccharide which consists of 2 kinds of monosaccharide, glucose and fructose, which are connected through glycosidic linkages. A syrup infused desserts have white sugar as the main ingredient to provide a sweet taste. It performs various functions in different foods and desserts. However, this article will only discuss how sugar functions in syrup-infused desserts. White sugar, which is used to prepare Med Kanoon, Thong Yip and Thong Yod, refers

to highly purified sucrose crystals of clear white to light yellow with slight moisture content. It has granulated particles which do not stick together and a small amount of molasses mixed within. White sugar is manufactured by bleaching sugarcane with sulfur or carbon dioxide. It is used mainly for household consumption and sugar-related industry.

1. Properties in Sugar

1.1 Sweetness is a distinctive property of sugar, which is the primary purpose of its use in cooking. The sweetness occurs from taste receptors stimulation in the tongue and other areas within the mouth. The perceived sweetness depends on the type of sugar. Sugar's sweetness has a standard form of comparison based on sucrose which has 100 points of sweetness. The other types of sugar that are sweeter than sucrose will have more than 100 points of sweetness, while less sweet sugar, on the other hand, will have less than 100 points of sweetness.

1.2 Solubility - Each type of sugar will dissolve differently by nature. Fructose has the best water-soluble properties, followed by sucrose and the lowest soluble is lactose. In cooking, most of the sugar used is sucrose. Hence, when sugar is involved in a solubility experiment, sucrose is often used in the test. When sugar is put into the water, the point at which sugar can be dissolved at maximum is called the "saturation point"; sucrose at 25°C will dissolve by 68%. If you raise the temperature, the solubility increases, becoming a supersaturated solution, for example, if you raise the temperature to 100°C, the sugar will dissolve by 82% and when left to cool down at room temperature, without any interference or vibration, you can get a concentrated solution that is in an unstable state. However, if there is shaking or disturbing in other ways, such as having a residue falling into it, the sugar part which occurred by the saturation point will immediately crystallize.

1.3 The boiling point of the sugar solution-The dilution of the sugar solution results in a higher boiling point of the syrup. When the temperature increases, the solution becomes more soluble since the dilution does not reach the saturation point. As a result, the boiling point of the syrup is used to measure the concentration level of the sugar solution (as shown in Tables 1 and 2). As the concentration increases, the water in the sugar solution evaporates, the ratio of sugar to water increases further and the syrups respectively become stickier. Therefore, a principle is applied to prepare syrup at different concentrations for making candy and Thai desserts according to the level of the syrup boiling temperature.

Consistent control of the syrup boiling temperature is required because, at different temperatures, the syrup will have physical characteristics difference, due to the control of the temperature of the syrup. Therefore, control of the syrup temperature will produce diverse types of products with unique characteristics, so it is always necessary to have a varied set of temperature levels.

1.4 Sugar crystallization happens when a reduction in the saturated syrup's temperature is lower than the saturated point resulting in the syrup being in an extreme saturated state. As the temperature drops, the more dissolved sugar will exceed the saturated point and begins to crystallize. In contrast, if the syrup is in an oversaturated state after it has cooled down, it would harden immediately without crystallization. As a result, the above principle was applied to produce many kinds of desserts, such as crystalline candy, which contains sugar crystals within its texture. The candy uses syrup that is saturated at the time of crystallization, while non-crystalline candy (hard candy) syrup must be highly saturated and not crystallized when cooled.

Table 1 Boiling points of sugar solutions at different concentrations

Concentration (percent by weight)		Boiling point (degrees Celsius)
Percentage of sugar	Percentage of water	
30	70	100
50	50	102
70	30	106
90	10	123
95	5	140
97	3	151
99.5	0.5	166
99.6	0.4	171

Source: Dhovitayakhun (2013)

1.5 Sugar melting-When sugar was melted with fire, it was found that each type of sugar has a different melting point. Sucrose will melt at 160°C, giving a liquid with a clear appearance, but when the temperature is raised to 170°C or higher, caramelization (burning of sugar) occurs producing a unique smell and color and if heated further, the substance will turn a brown color. Melting of sugar can be used to make various products such as food coloring in black-colored drinks, making caramel-scented candy, etc.

1.6 Sugar gives volume and weight to the product, for example, foods that contain sugar around 70% of the total weight, such as candy, concentrated fruit juice and many more. Sugar helps the product gain weight and provides larger body volume. The use of a large amount

of sugar in a solvent helps the product gain more viscosity and meatiness, which are generally appreciated by consumers. When sweetening agents are used instead of sugar, the amount used will be small because they have 100 to 1,000 times more sweetness than sugar. The product will lose viscosity and volume, so a bulking agent must be used instead of sugar.

1.7 Osmotic pressure-A high concentration sugar solution can draw water out from cells of vegetables, fruits, and meats. It is found in the preservation of foods that utilize sugar. When fruit is covered in a high-concentration syrup, the fruit will become wrinkled as the juice in the fruit is pulled out of the cell by osmotic pressure, which depends on the concentration of the sugar used. The property of osmotic pressure is applied to remove moisture from the food, before being dried by applying sugar mixtures and stored for about 24 hr. A portion of the fruit meat is spread out until the concentration of the syrup is the same as the amount of sweetness of the fruit, so the fruit dries faster.

1.8 Decomposition with acid, When disaccharide is mixed with acid, breakage occurs, especially when exposed to high temperatures (speed up the process). Sucrose breaks down to glucose and fructose, causing changes in sugar properties. Decomposition using acid will depend on the heat used. The type of sugar like monosaccharide often has little to no effect on the decomposition using acid. Decomposition will occur earlier and faster when the concentration of acid is high. Heating time also plays a factor in this process. When the heat is low but given a long heating duration, the decomposition will happen more thoroughly than when the heat is high but given a shorter time.

2. Function of sugar in food

2.1 As a sweetener-Sugar is used commonly in desserts such as Thai desserts, various drinks, etc. Proper use of sugar as a sweetener has many factors to consider, for example, sugar type, concentration, temperature, the acidity of food and other ingredients added to the food, which will affect sugar properties.

2.2 Give food a tasteful smell-Adding sugar to the can make the food smell different, and sugar helps enhance the taste of the food. As seen in the past, it was popular to use sugar instead of MSG to help the food have a rounder taste and reduce undesirable flavors, such as using sugar in sour food to counteract the acidic taste, offering a rounder flavor. The caramelly aroma in milk chocolate products is from the Maillard reaction between the protein in milk and the reducing of sugar in the food.

2.3 It gives texture to the food (body)-Sugar gives a meaty sensation when eating the food, called “mouth feel”, pertaining to the feeling in the mouth. It is often present in drinks that contain sugar.

2.4 Color the food in the so-called caramel color, which is light brown to dark brown. It is formed by heating the sugar until it reaches a temperature of 170°C or higher.

2.5 It allows food to be stored longer-Putting 60-70% sugar concentrated solution will prevent microbial growth. When sugar and “Free” water are combined in the food, there will not be enough water or moisture for microorganisms to grow and sugar can also draw water out of microbial cells. Therefore, sugar was classified as one of the most popular methods of preserving food with fruits and juices such as yam, juice, fruit in syrup., Meanwhile, Foi Thong, Thong Yip and Thong Yod have a shelf life of 3 days at room temperature. However, if you refrigerate it, it can be extended for more than 7 days.

2.6 As a dispersant-many foods use sugar as a dispersant, such as fruit drinks or powdered herbs, powdered gelatin.

2.7 As a lubricant-The sugar solution is an excellent lubricant in food such as salad dressing or a mixture of cake dough. When sugar is added, it makes it easier for food to flow. Similarly, syrup helps act as a lubricant to prevent desserts such as Foi Thong, Med Kanoon, Thong Yip and Thong Yod from sticking together.

3. Factors that may affect the properties of sugar-based food

3.1 The type of sugar used-the difference in sugar’s structure will give different characteristics to the end products. For example, sucrose, a crystalline sugar, should be used to prepare foods that require crystallization, for instance, crispy jelly, pumpkin in syrup, Foi Thong Krob, and Thong Yod Krob. On the other hand, foods that do not require crystallization should utilize fructose because it is difficult to crystallize or may cause sucrose to break down into invert sugar (glucose and fructose) which has reduced crystallinity.

3.2 Food flavor-Each sugar has a unique scent and flavor suitable for different products. Jaggery, for example, is ideal for Thai desserts with a mixture of coconut milk, but not suitable for mixing with bakery products.

3.3 Food color-Some foods do not need an opaque look or distorted color, such as Foi Thong, Thong Yip, Thong Yod, Med Kanoon, candy, juice, ice cream., Therefore, it is preferable to use sugar that does not cause a change in the color of the product, such as white sugar.

However, some products, such as ginger ale tofu, require a caramelly brown color to look more appetizing. Additionally, ginger ales often obtain an appealing color from red sugar.

3.4 The temperature used for cooking-In Maillard reactions, the relatively reactive carbonyl group belonging to the reducing sugar undergoes a chemical reaction with the nucleophilic groups of the amino acid. This reaction triggers the change in colour and facilitates the formation of many flavour compounds. The use of high temperature will result in darkened color and an increase in susceptibility to being burnt. Therefore, it is suitable for some foods that require brown coloration, such as roasted coffee and fried food. However, it may not be ideal for foods that do not require color changes, such as powdered milk.

The temperature which can cause brown coloration is 160-170°C. However, making Foi Thong, Med Kanoon, Thong Yip and Thong Yod will not cause this reaction, due to their temperatures are less than 160°C.

3.5 The amount used-Using large quantities of sugar will help preserve foods or increase their storage time. However, if used in small amounts, it may accelerate the degradation because microorganisms consume sugar as their main energy source.

3.6 Food ingredients - Acidic and basic (pH value) properties in food ingredients, if they are high, may result in sugar breaking, causing changes in food characteristics. In making mango jam, if the usage of conserved mango

is the main ingredient, then the resulting product is non-crystallized. While using other mangoes with sourness or acidity, the resulting product is similar but crystallized. Syrup for making Thong Yip and Thong Yod, have a similar result. Some manufacturers add lemon juice to the syrup to prevent crystallization due to syrup making these two desserts have a concentration of 72°Brix (Ketthongkam, 2014), which is high in concentration.

3.7 Time spent heating-If food containing sugar content is cooked for a long time, the resulting product will become darkened in color. On the other hand, Cooking starch-based food products containing sugar content, for a long time will result in reduced viscosity in the food.

3.8 Product storage period-Sugar can enhance osmotic pressure and reduce water activity (α_w) which affects the inhibition of microbe.

a) Enhancement of osmotic pressure: If the concentration of syrup is low, the microbe will grow by using sugar as a carbon resource. But, if it is high, the microbe cannot grow further because its cell will lose water and cause the cell to die. If it is a spore, the microbe will neither grow nor die. When the osmotic pressure decreases to an appropriate level, it can continue its growth. After the sugar dissolves in water, it causes an increase in osmotic pressure depending on the type of sugar's concentration, whereas monosaccharides will give the osmotic pressure value greater than disaccharides at a higher 10% concentration.

Furthermore, an acidity without nitrogen in sugar solution can enhance bacteriostatic and mycostatic, which are attributes that prevent and inhibit the growth of bacteria and fungi. A concentration of 60-65% is enough for preserving food such as jam, scrambled fruit and acidic fruit syrup. But, non-acidic syrup such as malt extract and honey need 75-80% of sugar concentration. So, the food will be safe from osmophilic yeast and mold (Kyzlink, 1990).

b) attribute of water activity (α_w) when adding sugar into the water, sugar will capture with water's molecule by hydrogen bond, then the α_w decrease. The sugar solution which has $\alpha_w = 0.90$, will affect normal microbe not to grow, but yeast and mold can do well. Increasing of sugar concentration make α_w decrease which cause microbe to grow less.

However, some microbes can endure high concentration of sugar, such as *Aspergillus glaucus*, *Saccharomyces roaxii* and *Torulopsis* sp. Moreover, a

Table 2 The physical characteristics of sugars at boiling points are different

Boiling point (°C)	Physical characteristic name	The appearance of syrup
103	Thread (gloss) ¹	A thin, clear line
104	Large thread ¹	The lines are thicker and harder.
105	Small pearl ²	Sugar gathers in small drops.
106	Large pearl ²	Sugar gathers in large drops.
110	Blow (soufflé) ³	There's a syrup bubble.
111	Feather ²	It has a feather-like split line.
116	Soft ball ²	Sugar lumps together into soft lumps.
120	Hard ball ²	A hard lump of sugar
129	Light crack ²	It's thin.
133	Medium crack ²	It's a fragile sheet.
143	Hard crack ²	It's a hard disk very fast, easily broken.
168	Extra hard crack ²	The hard plate is brown.
180	Caramel ²	A crisp brown solid, very fragile.

Remark: 1 Use a test method by using your thumb and index finger to soak it in water, grasp the boiled sugar, and then stretch out your fingers

2 Use a test method by using a spoon soaked in water, dipping the boiled sugar, and dipping it in cold water

3 Use a test method by using a spoon to scoop the boiled sugar and bring it up to blow

Source: Dhovtayakhun (2013)

yeast in the *Zygosaccharomyces* group can endure and grow well in high concentration of sugar.

Brix Refractometers

When light enters a liquid at an angle, it changes direction. This phenomenon is called refraction. Light will refract more when travelling through a liquid with dissolved or suspended solids. Therefore, refraction can be used to measure the concentration of dissolved or suspended solids within a solution. Refractometers are scientific instruments that measure refraction angles and correlate them to an already established refractive index.

Degrees Brix ($^{\circ}\text{Bx}$) is the sugar content of an aqueous solution. One degree Brix is 1 gram of sucrose in 100 g of solution and represents the strength of the solution as percentage by mass. If the solution contains dissolved solids other than pure sucrose, then the $^{\circ}\text{Bx}$ only approximates the dissolved solid content. There is a direct relationship between the refractive index and the final Brix percentage. The Brix Scale calibrates the number of grams of pure cane sugar (sucrose) contained in 100 mL of water. A refractometer uses the refractive index to convert the raw Brix scale measurement into a weight percentage of sucrose content, and this displays as % Brix (Anonymous, 2020).

The raw materials used to make Foi Thong, Med Kanoon, Thong Yip and Thong Yod

The raw materials are the egg yolk and watery part of egg whites in duck eggs, which are thick, dark, and greasier than hen eggs. However, it has a strong fishy smell compared to hen eggs, which is a disadvantage when using duck eggs. The following paragraphs will explain several things related to eggs in the mentioned desserts.

1. Egg yolk

Its volume is about 31% of the total egg weight and has different parts: the vitelline membrane, the germinal disc, the Latebra, and the yolk, which divide into dark layers alternating with the pale layers. Essential proteins in the yolk are ovovitellin, which is about $\frac{3}{4}$ of the total protein in the yolk., Glyceride, lecithin, and cholesterol make up the fat within the egg yolk. The yolk color is mostly xanthophylls from green plants and yellow corn the hen ingested. The yolk contains various crucial vitamins, everything except vitamin C. The yolk

membrane is a protein similar to egg white protein, and the water can pass in and out of it well enough. The yolk's concentration allows outside water to enter and causes it to expand. When an egg is stored for a long time, the yolk inside will become less swollen. The older the yolk, the flatter and the thinner it becomes. All the minerals in the egg are essential nutrients for the human body, these include iron, phosphorus, sulfur, copper, potassium, sodium, magnesium, calcium, choline, and manganese.

When making Thong Yip and Thong Yod the egg has to be beaten until foam appears. The force from beating will insert air into the egg, it makes the structure change from liquid to a little foam embody together. This foam is the air which enters the protein's structure and other components of the egg. When the beaten egg is brought to a boil in high concentrated syrup or bake, the heat will make the air in the foam expand and give the dessert fluffiness. Mostly, beating the egg causes foam for the dessert to be soft and fluffy. In addition, when the foam is formed a quantity is increased and can rise to 3 times before beating.

2. Egg White (Albumen)

raw egg whites have a slightly yellow-green color. The word "egg whites" comes from when the egg white is slitted and the above slit has a white color (Allus-White). Hence it is called "egg whites". In addition, the egg white may be divided into five categorized layers.

2.1 Outer liquid layer is the outermost layer of the egg white, attached to the eggshell membrane, and is transparent and runny. It is also called "Thin egg white". This part is used as an ingredient to make Foi Thong but uses only a little bit. The purpose is to reduce the yolk's viscosity so that the yolk flows through the small cavity of the sprinkled container and makes it look like a long line.

2.2 The thick egg white (middle dense layer) is light gray, the most common part, next to the outer liquid layer, and it is wrapped around the outer liquid layer and the yolk, preventing the danger of external concussion to the yolk.

2.3 Inner liquid layer is the layer adjacent to the yolk as the part where the yolk membrane holds the yolk in the middle of the egg.

2.4 The chalaziferous membrane is a part of the egg white, which acts as a wrap around the egg yolk and where the yolk attachment pole holds the ligament. It keeps the yolk balance in the middle.

2.5 The yolk attachment pole (chalazae) is a twisted,

glial cord protruding from the yolk membrane on both the oblique and acute sides of the egg, helping to hold it from moving back and forth, but if the egg is kept for a long time, this part will weaken, making it more mobile.

3. Property of hen eggs and duck eggs in Thai cuisine .

Hen eggs and duck eggs can be used differently. In other words, duck eggs are often used for making Thai food and Thai desserts, depending on the purpose of the use. Duck egg yolk is often used for Thong Yip, Thong Yod, Foi Thong., On the other hand, whole duck eggs are used for cooking Thai custard, egg custard pudding., The yolk of a hen egg is used for bakery, and salad dressing, while whole hen eggs are for common foods and sweets. The difference in the usage of egg components is a result of different types and amounts of protein in each egg, which affect food characteristics differently. The components of duck eggs and hen eggs are shown in Table 3.

3.1 Protein-Most egg proteins are water-soluble. Whole eggs contain about 10.7-12.9 g of protein per 100 g. The amount of protein in the yolk and egg white is different because the yolk protein is lipoproteins while the egg white protein is a glycoprotein, each containing the following components:

3.1.1 The protein in the yolk, vitellin, is composed of large molecules attached to lipoprotein, so it is named “lipovitellin” and “ovovittin”.

3.1.2 Proteins in egg white are mostly water-soluble, second-most to water, and proteins in egg whites have various properties. Each has different properties, as the author will soon explain in paragraphs under Table 3.

Table 3 Food Composition of Thai Foods

Nutrient	Components of duck egg			Components of hen Egg		
	a whole egg	White eggs	Egg yolk	a whole egg	White eggs	Egg yolk
Moisture (g)	70.6	87.8	47.5	73.7	87.4	52.1
Energy (Calorie)	188	50	368	163	52	336
Fat (g)	14.2	0.1	32.3	11.5	0.2	29.0
Carbohydrate (g)	0.7	0.8	4.8	0.8	1.1	0.9
Fiber (g)	0	0	0	0	0	0
Protein (g)	13.2	10.7	13.6	12.9	10.7	16.3
Calcium (mg)	64	6	146	61	10	154
Phosphorus (mg)	220	8	328	222	13	479
Iron (mg)	3.6	Tr.	5.6	3.2	0.4	6.3
Vitamin A (I.U.)	1,541	0	6,575	1,950	0	4,025
vitamin B1 (mg)	0.16	Tr.	0.94	0.10	0.01	0.24
Vitamin B2 (mg)	0.40	0	0.94	0.40	0.32	0.47
Niacin (mg)	0.2	0.2	0.2	0.1	0.1	Tr.

Source: Origin, Bureau of Nutrition, Department of Health, Ministry of Public Health (2018)

1) Ovalbumin is the most common protein in egg whites, accounting for 75% of the total protein content in egg whites. Ovalbumin is composed of carbohydrates and phosphates. It has properties that help gel formation and foam formation; this protein changes properties when heated.

2) Ovomuroid is a glycoprotein containing 14% glucosamine and 7% mannose, which will change in properties upon exposure to heat, but is more heat-resistant than ovalbumin and Ovotransferrin (conalbumin).

3) Ovomucin is a protein that forms the gel form of the condensed egg white by forming a mesh structure, and the amount of ovomucin in the clear egg white is differentiated by 5.11% ovomucin. The inner part of the clear egg contains 1.91%, about four times more ovomucin in the thick egg white than in the clear egg white. Ovomucin has water-insoluble properties, each soluble in a saline solution at pH 7.2-10.4. And when stored for a long time, the pH of the egg increases, causing ovomucin to secrete, the condensed egg white becomes liquid egg white and another important property of ovomucin is that it is a substance that helps stabilize the foam generated by beating.

4) Ovoclalbumin or “ovotransferrin” has the property of inhibiting bacterial growth and when heated, it is easier to change its properties than ovalbumin and coagulation occur at 63°C, which is the same temperature at which the egg whites coagulate.

5) Ovoglobulin is a protein with a property that helps cause foam in the egg white.

3.2 Fat is abundant in about 29-32.3 g in 100 g of yolk, while very little fat is found in egg white, around 0.1-0.2 g in 100 g of egg white. Most of the fat in the yolk is a saturated fatty acid and partly cholesterol. One large egg consists of 5 g of fat, 2 g is saturated fat and 213 mg of cholesterol. The type and number of fatty acids will change according to the food used to feed animals.

3.3 Carbohydrates are rarely found in eggs. They are often found in free forms, such as glucose, with proteins in the form of glycoproteins found in egg whites.

3.4 Water is present in all parts of the egg. An egg has a 65.5% water content of the whole egg weight. The amount of water varies according to each part of the egg. The egg white has the largest amount of water, causing osmosis pressure, which creates movement from the egg white into the egg yolk. When stored for a long time, egg yolk size will increase. The yolk will not be in the

middle, and when you poke it out, the yolk becomes flat and breaks easily.

3.5 Minerals, essential minerals in eggs, consist of sulfur, potassium, sodium, calcium, magnesium, and iron. The number of minerals will also change according to the animal environment, the food used, the season, and the age.

3.6 Vitamins in eggs, vitamins both dissolve in fat and water. Most vitamins are dissolved in large amounts of fat found in the yolk. Vitamin B2 and niacin are also found in the yolk. All water-soluble vitamins were found within egg whites except vitamin C.

Dessert type boiled in syrups using egg as a component

1. Foi Thong

Foi Thong is a dessert made of yolk and an outer liquid layer (Thin egg white). In the past, only duck eggs were used. Hen eggs were rarer because Thai people did not usually raise a chicken to get eggs. Duck eggs had a stronger smell than hen eggs, so when baking using duck eggs, jasmine flowers are put into the syrup, or pandan leaves are boiled to make the syrup to cover the smell of the eggs. When using the eggs, they need to be washed and dry. The egg then is cracked into a bowl and the eggshell is kept because the eggshell can be used to purify the syrup. When cracking an egg, separate thin egg white from every egg, and the storing of thin egg white is done by quickly turning the eggshell upside down when the clumpy egg white and yolk go down, you will see a little bit of clear water left over, pour all thin egg white into a cup together. However, the author has an easier way of storing thin egg white: First, cracking the egg into a container. Second, separate the yolk using both hands. Third, separate the yolk, and gently remove the stuck egg white on the yolk. Fourth, remove the yolk. Fifth, pour the egg white through a sieve (no need for a spoon or stirring with a ladle). The eggs that can flow through the sieve are thin egg white and the remaining eggs on the sieve are thick eggs white. Sixth, separate the thin egg white and keep them for making Foi Thong. Then put the yolk ironed through a thin white cloth to separate the yolk membrane. Lastly, mix the yolk and the thin egg white lightly. Do not beat until foam, or else the Foi Thong will not form long lines.

In the old days, syrups were prepared by putting small pieces of eggshells together with sugar, jasmine float and pandan leaves then put on the stove. Eggshells help the syrup to have a clear color. The reason why it helps the syrup to obtain a clear color can be scientific

explained. That is the egg white attached to eggshells catches sediment and dust particles attached to sugar. The syrup at the end of the process will need to be filtered through a cloth to get a clear color syrup as the final product. After the syrup has been made, it needs to be put on a heated stove and sprinkled in the Foi Thong, which requires banana leaves to be made into cones for sprinkling. Few cones may be made and then sewn together with a brooch and then lap the prepared egg into a cone, allowing the egg to flow out in a continuous, uninterrupted line. Sprinkle over boiling syrup into a circle, and when you have enough Foi Thong, stop sprinkling, and when the eggs are cooked, use sharp sticks, chopsticks, or long small bamboo to lift them from the syrup and fold it.

The early versions of Foi Thong are made by using the banana leaves cone to have a large plate shape. These versions of Foi Thong are not as finely shaped as they are today because the latter developed tools, stainless steel cones, or brass cones that make the Foi Thong simple, easy, more beautiful, and more delicate. The complicated methods of making Foi Thong make it unpopular for home cooking and are often made for various merit works.

When the author makes syrup for making Foi Thong, the ratio of white sugar to water is 1: 1.5, boiling at the highest boiling point. Temperature and sweetness measures are 103°C and 55-57°Brix, respectively and the viscosity of the syrup is only slightly thickened. When scooped up, it forms a thin, straight, and soft line (thread/gloss), consistent with Dholvitayakhun (2013). The Foi Thong made by the author, on the other hand, forms into thin smooth circular thin straight lines, sticky, soft, silky, glossy, nicely coated in syrup, and not very sweet. However, Foi Thong made without adding any water, Foi Thong will still be round and sticky, as the sugar coat and grips on to the Foi Thong more than usual, but the glossiness will decrease due to the high concentration of sugar, which from crystallizing sugar, the softness will decrease and turn crispy instead, and has a sweeter taste. Therefore, syrups at high concentrations are used to make Foi Thong Krob (crispy Foi Thong), so they are not suitable for soft Foi Thong. The sweetness of such syrup is not consistent with the data of the study, Mongkonworawan et al. (2002) found that Foi Thong made in 68±1°Brix concentration syrup is rich and the Foi Thong is formed into soft round lines, but Foi Thong production method of Mongkonworawan et al. (2002) was stirred in clear syrup to reduce sugar concentration,

but Foi Thong line is still round and soft.

2. Med Kanoon

Syrups for making Med Kanoon has white sugar to water ratio at 1: 1, boiling for about 5-7 minutes until measured temperature and sweetness are at 104°C and 65-66°Brix, respectively. The characteristics of syrup are thicker and harder (Large thread) consistent with Dholvitayakhun (2013). The reason why the syrup of Med Kanoon is more saturated than Foi Thong is that the high-concentration syrup increases osmotic pressure to cook the yolk until pea conserved coat is tightened to maintain the shape of a coating film, this will not break the pea conserved, creating beautiful pellets, and a smooth yolk coating surface. But if the concentration of syrup is greater than this, Med Kanoon from the syrup will not be as glossy when the temperature drops, because the sugar will crystallize.

3. Thong Yip

Egg preparation is done just like Foi Thong, and the only difference is that yolk does not use thin egg white, do not have to filter through a thin white cloth (there are two types of syrup used: a very strong syrup for the egg to be cooked, and the other is a very low concentration syrup with a normal temperature for soaking the cooked egg, used to lower the temperature of the egg so that it can be picked without burning the hands.) and the yolk needs to be beaten until foaming. In the past, brass with a spring-like appearance was used and there were three lines with a long handle for holding. The eggs must be beaten until the foaming is smooth. Drip the egg in syrup into a small circular sheet and when the egg is cooked, the edges are inflated, not flattened. After a minute or two, use a skimming ladle to flip the other side of the egg into the syrup and when the egg meat is cooked, lift it from the syrup and soak it in the cooled clear syrup. When the temperature of the egg drops enough for the hand to endure, quickly grasp the petals, the grip of the petals ranges from 3, 5, 6, 7, 8, 12 and 16 and the more the petals, the more skilled the maker is.

In the early days when Thong Yip was made, only three petals were caught. Later, the petals were added, because the more the petals, the more they showed effort, intention and creativity, which was a common practice to elevate Thai desserts in that period. In general, only five Thong Yip pedals are made for each Thong Yip because it is not too difficult to make and gives the Thong Yip a beautiful petal shape. When you get the petals to be as pretty as you prefer, put them in a lattice or bottle cap to achieve the shape of a cup, let it cool and when

you serve it, use a stick to pull out it from a bowl, put it in a plate, cup or another container.

Condensed syrup to make Thong Yip has a white sugar to water ratio of 1.5: 1, boils, and continues to boil for about 10-15 min, temperature and sweetness are measured at 110°C and 70-72°Brix, respectively. Syrup, while boiling, will foam into small bubbles throughout the pan. The syrup when flowing down from a scoop will form a thread-like line about 1-2 inches long (Thread) following Sinthawalai (1982). The concentration of syrup at different boiling points was said to be at 110-112 °C, the syrup boils up to medium-sized bubbles and the color is clear, the syrup is in the form of a thread, a line or spout about 2 inches long. It was used for making Thong Yip, Thong Yod, Foi Thong, and Krobkam. Meanwhile, A Cuisine (2022), Mongkonworawan et al. (2002) and chemistry of textiles, food, and surroundings (2016) provided information on the syrup concentration of 74±1°Brix stating that it gives softer Thong Yip and makes it so that yolks in the syrup will not spread as much, making it easier to be shaped into petals. However, this information did not match the concentration the author uses. The author's syrup concentration to make Thong Yip is at 71-72 °Brix, which gives Thong Yip a fluffy, dripping syrup, and soft characteristics, and the shape stays when formed into petals.

4. Thong Yod

Preparation of eggs and syrup are like those of Thong Yip. The syrup of Thong Yod when boiling is a pan full of fine bubbles (like boiling coconut milk or boiling milk). Boiling syrup helps to hold the Thong Yod into round and fine grains. The eggs are beaten slightly more than Thong Yip. Mix the rice flour baked in candle smoke until fragrant (now there are Thong Yod prebaked in candle smoke. The aroma of the flour depends on the brand of the flour.) then slowly knead lightly with a spoon to mix until the whole mixture is uniform, but do not stir for long or the ingredients will be sticky. If a person beats the egg too fast until the foam is dissolved, the dessert will not get a pretty drop shape., The shape of the drop of Thong Yod must be like a drop of water. The drop is made using the index finger, the middle finger and the thumb to scoop the dessert out of the index finger to drop into the boiling syrup. Some people may use the tip of a short spoon to spread the ingredients from the edge of the cup and then push the mixture into the syrup. When Thong Yod is ripe, there is no white part seen in the center, soak up the clear syrup to reduce the sweetness.

As for the concentrated syrup used to make Thong Yod, the ratio of white sugar to water is 1.5: 1, boil and continue to boil for about 15-17 minutes, temperature and sweetness are measured at 112°C and 72-74 °Brix, respectively. Syrup, while boiling, will foam into small bubbles throughout the pan. The flow characteristics of syrup are thread-like, about 1 to 2 inches long (Thread) same as the one for Thong Yip, consistent with Ketthongkam (2014). The concentration of syrup used for making Thong Yod is 72 °Brix, and the Thong Yod will be syrupy, soft and has a droplet-shaped. If less concentration of syrup was used, the Thong Yod will not have a rounded shape, it will be flat, and roughened. While the excessively high concentration will result in a Thong Yod that does not carry syrup and the gel of protein will be formed before the syrup is penetrated to the center of Thong Yod. On the other hand, the data of A Cuisine (2020), Mongkonworawan et al. (2002), and “The chemistry of textiles, food and surroundings” (2016) provided information on the concentration of syrup in making Thong Yod equivalent to 71±1°Brix. Mongkonworawan et al., (2002) found that Thong Yod using such syrup concentration has a droplet-like shape, syrupy and had less hardness than at concentrations of 68±1 and 74±1°Brix.

5. Clear syrup - There are 2 parts of syrup for making Thong Yip and Thong Yod: clear syrup and concentrated syrup. The clear syrup is used to soak the dessert after they are cooked in the concentrated syrup. The purpose of soaking dessert in it is to reduce the sweetness of the syrup within the dessert using the osmosis principle and to reduce the temperature of the dessert so that it can be picked by hand, in the case of Thong Yip. The ratio of white sugar to water in the clear syrup is 1: 2. Boil until peak boiling point and temperature and sweetness measure reached 100°C and 36-38°Brix, respectively. The sweetness of this clear syrup will dictate how much sweetness is given to the dessert. It is found in Ketthongkam (2014), A Cuisine (2020), Mongkonworawan et al. (2002) and “The chemical physics of textiles, food and surroundings” (2016) mentioned the concentration of clear syrup at the sweetness of 48±1°Brix. At the present, there is a campaign to reduce sweetness and reduce salt. As a result, the author was frequently asked when teaching how to make Thong Yip and Thong Yod whether it would be possible to lower the sweetness of this kind of dessert. The answer is that we can't lower the sweetness of the concentrated syrup, but we can lower the sweetness

of the clear syrup. Therefore, it is the origin of the clear syrup concentration of 36-38°Brix.

Conclusion

In conclusion, the concentration of syrup has an effect to give desirable attributes to each dessert. Foi Thong should have the concentration of syrup at 55-57 °Brix, the dessert is a round thread, sticky and glazed. Med Kanoon should be at 65-66°Brix, it is glazed, sugar non-crystalline sugar. Thong Yip should be at 70-72°Brix, it is fluffy, sticky, and juicy with syrup. Thong Yod should be at 72-74°Brix, it has a droplet-shape and is non-flat, fluffy and juicy with syrup. The concentrated clear syrup at 36-38°Brix which is used to soak Thong Yip and Thong Yod may be reused to dilute Foi Thong's sweetness.

However, to make these kinds of desserts, the maker must be relatively skilled, especially to produce different kinds of syrup needed for different types of desserts. The author, practiced making Thong Yod and Thong Yip many times before achieving the intended shape, flavor, uniformity, and other desired characteristics. These experiences led the author to conclude that the sweetness of the clear syrup determines the sweetness of Thong Yip and Thong Yod. When the strong syrup is used to make Foi Thong, one should stir it in clear syrup first to reduce sweetness because consumers have become more health-conscious.

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