

# The Development of High Protein Diet “Tab Tim Krob” from Egg White for Cancer Patients

## การพัฒนาท๊บติมกรอบโปรตีนสูงจากไข่ขาวสำหรับผู้ป่วยโรคมะเร็ง

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### Abstract

Cancer patients have a high risk of energy and protein deficiencies. Eggs are known as a high protein source that can improve health benefits for humans. This descriptive study aimed to develop four high protein formulae of Tab Tim Krob from steamed egg white instead of water chestnuts for cancer patients with different types of syrup (coconut milk, cereal cream, cow milk, and soy milk formula). The nutritional composition was determined. The calorie contents of coconut milk, cereal cream, milk, and soy milk formula was 233.9, 222.6, 186.7, and 195.2 kcal respectively, which were less than those of the original one. All formulae contained more protein (4.8-5.8 g) than the traditional one (0.99) which could benefit cancer patients. The sensory evaluation was conducted. The appearance, color, odor, taste, texture and overall satisfaction was tested by 30 nutritionist volunteers. There were no significant differences in appearance, color, texture, and overall satisfaction for all formulae. Cereal cream and soy milk formulae achieved a lower odor score than the others, while only soy milk formula had the lowest taste score. The high protein Tab Tim Krob that developed from egg white from all formulae are acceptable and could improve cancer patients' health conditions.

**Keywords:** egg white, Tab Tim Krob, cancer patients

## บทคัดย่อ

ผู้ป่วยโรคมะเร็งมีความเสี่ยงสูงต่อการขาดพลังงานและโปรตีน ไข่เป็นที่รู้จักกันว่าเป็นแหล่งโปรตีนสูงที่สามารถเพิ่มประโยชน์ต่อสุขภาพสำหรับมนุษย์ การศึกษาเชิงพรรณานี้มีวัตถุประสงค์เพื่อพัฒนาสูตรขนมทับทิมกรอบโปรตีนสูงจากไข่ขาวหนึ่งทดแทนแก้วสำหรับผู้ป่วยมะเร็ง จำนวน 4 สูตร ซึ่งมีน้ำตาลที่แตกต่างกัน (กะทิ กะทิธัญพืช นมวัว และนมถั่วเหลือง) องค์กรประกอบทางโภชนาการถูกประเมิน ปริมาณแคลอรีของสูตรกะทิ กะทิธัญพืช นมวัว และนมถั่วเหลือง คือ 233.9 222.6 186.7 และ 195.2 กิโลแคลอรี ตามลำดับ ซึ่งมีค่าน้อยกว่าสูตรดั้งเดิม ทุกสูตรมีปริมาณโปรตีน (4.8-5.8 กรัม) มากกว่าสูตรดั้งเดิม (0.99) ซึ่งอาจเป็นประโยชน์ต่อผู้ป่วยโรคมะเร็ง การประเมินทางประสาทสัมผัสถูกทดสอบด้านลักษณะปรากฏ สี กลิ่น รสชาติ เนื้อสัมผัส และความพึงพอใจโดยรวม โดยอาสาสมัครนักโภชนาการ จำนวน 30 คน ไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางด้านลักษณะปรากฏ สี เนื้อสัมผัส และความพึงพอใจสำหรับทุกสูตร สูตรกะทิธัญพืชและสูตรนมถั่วเหลืองได้คะแนนด้านกลิ่นต่ำกว่าสูตรอื่น ๆ ในขณะที่มีเพียงสูตรนมถั่วเหลืองได้คะแนนต่ำสุดด้านรสชาติ ทับทิมกรอบโปรตีนสูงที่พัฒนาจากไข่ขาวทุกสูตรเป็นที่ยอมรับและอาจช่วยฟื้นฟูสุขภาพของผู้ป่วยโรคมะเร็งได้

**คำสำคัญ:** ไข่ขาว ทับทิมกรอบ ผู้ป่วยโรคมะเร็ง



## Introduction

Cancer is a dangerous disease that normal cells were stimulated to malignant tumors and any cells of the body can be affected. Cancer is the second cause of death worldwide, approximately 70% of deaths from all cancers occur in low and middle-income countries (Arends et al., 2016; World Health Organization, 2020). Cancer cases in ASEAN are spreading rapidly with aging and changing in lifestyles. Breast cancer was the highest incidence among woman (Ferlay et al., 2015; Virani et al., 2017). The most three common cancers among men were lung, liver, and colorectal cancers. (Kimman, Norman, Jan, Kingston & Woodward, 2012). In Thailand, the pattern diversity of cancer differs between urban and rural areas. Demographic changes affect the trends in all-cancer incidence and rates, that is expected to rise over the next 20 years (Sangrajrang, Laversanne, Bausom, Mery & Bray, 2020). Cancer patients have a high risk for energy and protein deficiencies. Good nutrition

can improve skeletal muscle, immune system, and respond to chemical treatment (Donohoe, Ryan & Reynold, 2011). Muscle protein depletion is a prominent point of cancer. Studies found that cancer patients loss skeletal muscle which is the main cause of malnutrition that predicts high risk of physical impairment, operative complications, and mortality (Baracos & Kazemi-Bajestani, 2013; Martin et al., 2013; Arends et al., 2016). In general, most of the hospital snacks are milk, fruits or desserts, which must be adjusted to be healthy food, such as reducing sugar, increasing nutrients or high protein for improve patients during the radiotherapy or chemotherapy. Eggs are known as high protein food source that improve health benefits for human. Eggs contain excellent nutrients for embryo developing, antioxidant, antimicrobial, immunomodulatory activities and anticancer (Huang et al., 2012; Kim et al., 2012; Lee et al., 2017; Mahanta et al., 2015). Egg white is rich in proteins (ovalbumin (54%), ovotransferrin (12%),

ovomucin (3.5%), ovomucoid (11%), lysozyme (3.4%), IgY, and phosvitin) with a specific focus on anticancer (Lee & Paik, 2019). The hospital has developed a multi-choice menu of egg white for cancer patients such as boiled egg white, poached egg white, Larb egg white, Stir fried basil, and egg white. Variety menu of egg white should be provided on food for cancer patients in order to reduce undernutrition (Iyakeaw & Lowirakorn, 2015). Tab Tim Krob is a Thai dessert made from water chestnuts which can be eaten in any season, but most popular in summer. The flavours include sweet, cool, delicious, and refreshing. Its special feature is bright red ruby beads or beautiful pink ruby beads (Dholvitayakhun & Pumpho, 2018). It is a Thai dessert that has been consumed for a long time and can also be developed into a more nutritious dessert. There are plenty of main dishes from egg white that being developed in the hospital for cancer patients, while little is it found in dessert. The cancer patients had attitude strongly agree (80%) toward hospital diet which made from egg white (Iyakeaw & Lowirakorn, 2015). As a result, it is quite challenging to develop alternative milk in substitution of coconut milk as healthy desserts. (Kusump, Maneesilasun & Wonganutthara, 2011; Charoenphun, Kiawvijit & Deeharing, 2018). Therefore, the researcher aimed to develop high protein formulae and healthier syrup formulae.

## Objectives

To develop 4 formulae of high-protein Tab Tim Krob from egg white.

To assess the sensory evaluation and nutritional composition of high-protein Tab Tim Krob from egg whites by using different syrup.

## Research Methodology

Tab Tim Krob was a kind of the original Thai-style dessert that Thai people had often consume (30%) (Kulkalyuenyong, 2018). Traditional recipe of Tab Tim Krob consisted of water chestnuts 60 g, tapioca flour 10 g, food colour (pink), white cane sugar 100 g, coconut milk 5 g, water 100 g, pandan leaves 1-2 leaves, and small ice cubes (Chitralada Technology Institute, 2021).

The recipe was modified to have more protein by using egg whites instead of water chestnuts. The steamed egg white technique also made it soft and easy to eat that was suitable for all ages. The cooking method of Tab Tim Krob is; (1) steamed egg white and cut into small cubes, (2) mix the steamed egg white with tapioca flour and flavoured syrup, (3) shake off any excess flour, (4) boil in boiling water 1 minute and drop in cold water, (5) add alternative syrup instead of concentrated coconut milk, (6) add salt and sugar. Moreover, Tab Tim Krob with different formulae of syrup: coconut milk, cereal cream, cow milk, and soy milk were evaluated. All of 4 formulae were analysed for the energy and nutrient components (energy, carbohydrate, sodium, protein, and fat) by INMUCAL V.4.0 (Institute of Nutrition, Mahidol university, 2018). In addition, all 4 formulae were tested and evaluated by thirty nutritionists and staff of nutrition at Pathumthani Hospital. The sensory evaluation was tested by using 9-point hedonic scale. The scale comprises of nine verbal categories ranging from 'dislike extremely=1' to 'like extremely=9' (Lawless & Heymann, 2010; Wichchukita & Mahony, 2015). The One-way ANOVA was used to compare significant different between formulae. Results were considered statistically significant at  $P < .05$ .

There were 4 formulae of Tab Tim Krob with different syrups: coconut milk, cereal cream, cow milk, and soy milk. All of the 4 formulae consisted of egg white 45 g, tapioca flour 30 g, flavoured syrup 15 g, salt 0.1 g, and sugar 3 g. The ingredients of 4 formulae per serving were shown in Table 1

## Results

### Energy and nutritional compositions

The coconut milk, cereal cream, cow milk, and soy milk formulae contained 233.9, 222.6,

186.7, and 195.2 kcal of energy, respectively, which were less than the original formula. Cow milk formula had lower energy than the others. Similarly, sodium levels of all 4 formulae were also halved than the original formula. All formulae had higher protein content (4.8-5.8 g) than the original one (0.9 g), which presenting benefit to cancer patients. The carbohydrate content was approximately the same in all 4 formulae which less than the traditional formula. Moreover, Cow milk formular had the least in fat content when compare with the others. Data was shown in Figure 1.

**Table 1**

*Ingredients of four formulae*

Ingredients	Ingredients per 1 serving			
	Coconut milk (g)	Cereal cream (g)	Cow milk (g)	Soy milk (g)
Egg white	45	45	45	45
Tapioca flour	30	30	30	30
Flavoured syrup	15	15	15	15
Salt	0.1	0.1	0.1	0.1
Sugar	3	3	3	3
Coconut milk	30	0	0	0
Cereal cream	0	30	0	0
Cow milk	0	0	30	0
Soy milk	0	0	0	30

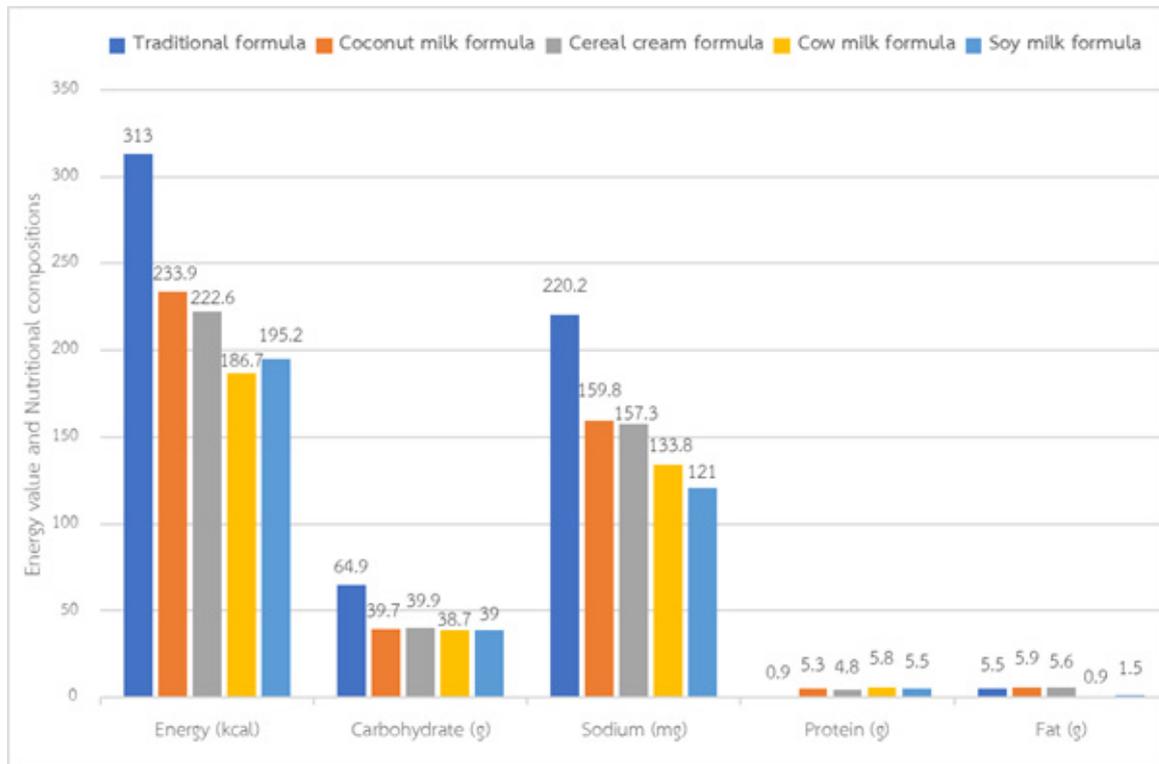


Figure 1 Energy and nutrients of all 4 formulae compared to the traditional formula

### Sensory evaluation

The developed formulae were tested by 30 nutritionist volunteers. The sensory evaluation consisted of appearance, colour, odor, flavor, taste, and overall satisfaction by using 9-point hedonic scale. All formulae were no significant difference in appearance, colour, texture and overall satisfaction among the 4 formulae ( $p > 0.05$ ). However, the cereal cream and soy milk formula, had scores in

odor less than the others. Similarly, lower score was found in taste of soy milk as compared to other formulae. The data of sensory evaluation was shown in Table 2.

**Table 2***Sensory evaluation of 4 formulae (n=30)*

Formula	Sensory scores					
	Appearance	Colour	Odor	Taste	Texture	Overall satisfaction
Coconut milk	7.5±1.9 <sup>a</sup>	7.7±1.1 <sup>a</sup>	7.2±1.6 <sup>a</sup>	6.9±1.6 <sup>a</sup>	6.7±1.7 <sup>a</sup>	7.4±2.0 <sup>a</sup>
Cereal cream	7.6±1.6 <sup>a</sup>	6.7±1.5 <sup>a</sup>	5.3±2.2 <sup>b</sup>	5.8±2.0 <sup>a</sup>	5.7±2.0 <sup>a</sup>	6.0±2.1 <sup>a</sup>
Cow milk	7.8±1.5 <sup>a</sup>	7.3±1.1 <sup>a</sup>	6.1±1.4 <sup>a</sup>	6.6±1.6 <sup>a</sup>	6.9±1.4 <sup>a</sup>	6.8±1.2 <sup>a</sup>
Soy milk	7.4±1.3 <sup>a</sup>	6.4±1.8 <sup>a</sup>	5.1±2.0 <sup>c</sup>	4.9±2.4 <sup>b</sup>	6.1±1.8 <sup>a</sup>	5.8±1.7 <sup>a</sup>

mean±SD, <sup>a-c</sup> means within each column indicate significant differences (p<.05) using Duncan's multiple range test

## Discussion and Suggestion

The present study of the nutritional value of Tab Tim Krob with high protein from egg whites in 4 formulae compared to the conventional formula found that the modified recipes had higher protein content and lower of calories, carbohydrates, and sodium content than the conventional formula. Most number of cancer patients had an anorexia and protein breakdown. Therefore, the cancer patients need an excellent nutritional diet, especially high protein foods, which increased protein requirements 1-1.5 g/kg BW/d (Bruera & Sweeney, 2000; Tisdale, 2003; Donohoe, Ryan, Reynold, 2011). Moreover, The different of protein content in each formula was a result of different syrup choices which were a commercial product and can be purchased easily.

By the nutritional evaluation, it was found that all 4 high protein Tab Tim Krob formulae had a good of nutritional values (high protein) which could be also an alternative choice for people who are health concern. For the soy milk formula, which had the lowest of odor sensory score, this might be due to the bad smell of the soybeans

and, as a result, the taste perception scores also decreased. This is in consistent with previous research, which was found that the satisfaction assessment of Tub Tim Krob (Dusit Thani formula) from 30 instructors, staff and students at Dusit Thani College had satisfaction scores: 4.73±0.52 (Ragmai et al., 2019). In Mock Pomegranate Seeds Dessert (Tab Tim Grob) Production using Frozen Reverse Spherification Technique product was accepted in a range of like moderately level in color, shape and overall likeness of product (Dholvitayakhun & Pumpho, 2018). In recent study indicated that the modification of Thai desserts to be suitable for health was limited especially Thai desserts with coconut milk as an ingredient in large quantities. However, volunteers accepted these three desserts; Kanom Krok (4.03±0.99), Kanom Tuay (3.96±1.07), and Kluay Buach She (4.16±0.69) (Singhato, Boornasuksakul, Daroonpant & Rueangsri, 2019).

However, the satisfaction of all 4 formulae was not significant difference in our results. Analysis showed that all four formulae were acceptable and could be an alternative dessert for cancer

patients which can be another option to help the recovery and increase protein intake as well. These Tab Tim Krob formulae can be supplement meal for cancer patients who anorexia nervosa.

In the future, we suggest to test the significant difference between Tab Tim Krob that made from water chestnut and egg white. It is possible to test these 4 formulae in the cancer patients.



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