NUTRITIVE VALUES OF LOCAL FOODS AND NUTRITIONAL STATUS IN PEOPLE WITH DIABETES AT DOI TUNG DEVELOPMENT PROJECT AREA

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NUTRITIVE VALUES OF LOCAL FOODS AND NUTRITIONAL STATUS IN PEOPLE WITH DIABETES AT DOI TUNG DEVELOPMENT PROJECT AREA

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ABSTRACT

The Doi Tung Development Project area was established by Her Royal Highness Princess Srinagarindra to carry out development activities to increase the quality of life. The incidence of type 2 diabetes in the ethnic minorities of the Doi Tung Development Project area is rising. A cross sectional study was conducted to determine the nutritional status of type 2 diabetes and the nutritive value of most commonly consumed local foods by diabetic subjects.

The data were collected between November 2008 to July 2009. Ninety-two type 2 diabetics aged 38-80 years in 6 different ethnic groups including Tai Yai, Tai Lue, Lawa, Haw, Lahu, and Akha were recruited and their anthropometric data, blood glucose levels, and lipid levels, and 24 hour dietary recall were recorded. As well, A food frequency questionnaire was used to determine the most commonly consumed food items. Most study subjects (84.8%) had a body mass index $\geq$ 23 kg/m^2 with 90.2% having abdominal obesity and the mean percentage of body fat was 34.9 $\pm$ 6.1%. Their systolic blood pressure and diastolic blood pressure were 131.6 $\pm$ 19.8 mmHg and 80.9 $\pm$ 11.8 mmHg, respectively. The results of biochemical parameters showed that the average of FBG, HbA_{1c}, total cholesterol, triglyceride, HDL-cholesterol, and LDL-cholesterol were 132.3 $\pm$ 37.3 mg/dl, 8.3 $\pm$ 1.8 %, 185.6 $\pm$ 44.9 mg/dl, 213.4 $\pm$ 177.4 mg/dl, 44.6 $\pm$ 12.0 mg/dl, and 100.3 $\pm$ 34.5 mg/dl, respectively. The average energy intake was 930.5 $\pm$ 414.3 kcal/day with 66.2 $\pm$ 10.5 %, 15.9 $\pm$ 3.7 %, and 17.8 $\pm$ 13.4 % of energy derived from carbohydrates, protein, and fat, respectively. The intake of cholesterol, dietary fiber, sodium and sugar were 63.2 $\pm$ 56.8 mg/day, 6.1 $\pm$ 3.6 g/day, 3021.0 $\pm$ 1167.1 mg/day, and 11.3 $\pm$ 10.9 g/day, respectively. The 10 most commonly consumed food items were tomato chilli paste, Chinese cabbage curry, flower Chinese cabbage curry (Jor puk kad), Khao Ram-Fhuen, Num-Ngyo, mungbean noodle soup, Namprik Tooa-Nao, Laab-Moo, Moo-Tod, fried seasoning pork, and Namprik Noom. The means of nutritive values per serving were as follows; energy 181.9 $\pm$ 144.2 kcal, carbohydrate 17.6 $\pm$ 10.7 g, protein 10.2 $\pm$ 8.2 g, fat 38.5 $\pm$ 22.9 g, cholesterol 42.3 $\pm$ 29.0 mg, sugar 2.8 $\pm$ 1.8 g, fiber 0.8 $\pm$ 0.7 g, and sodium 1245.8 $\pm$ 1146.9 mg.

The majority of type 2 diabetes in the Doi Tung Development Project area had an overnutrition problem with inappropriate food consumption leading to an increase risk of diabetes complication. Nutrition education should be conducted to control blood glucose and prevent diabetes complications. This study is useful for managing an appropriate treatment of diabetes and to fulfill the objective of the Doi Tung Development project of developing the health promotion campaigns to improve the quality of life.

KEY WORDS: DOI TUNG DEVELOPMENT PROJECT/ TYPE 2 DIABETES/ NUTRITIONAL STATUS/ LOCAL FOODS

200 pages

คุณค่าทางโภชนาการของอาหารพื้นบ้านและสภาวะโภชนาการของผู้ที่เป็นโรคเบาหวานบนพื้นที่โครงการพัฒนาดอยตุง

NUTRITIVE VALUES OF LOCAL FOODS AND NUTRITIONAL STATUS IN PEOPLE WITH DIABETES AT DOI TUNG DEVELOPMENT PROJECT AREA

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บทคัดย่อ

โครงการพัฒนาดอยตุง เป็นโครงการอันเนื่องมาจากพระราชดำริในสมเด็จพระศรีนครินทราบรมราชชนนี มีวัตถุประสงค์หลักเพื่อยกระดับคุณภาพชีวิตให้ประชาชนสามารถพึ่งพิงตนเองได้และสร้างจิตสำนึกในด้านการอนุรักษ์ธรรมชาติและสิ่งแวดล้อม ตลอดจนส่งเสริมและพัฒนาทั้งทางด้านเศรษฐกิจและสังคมอย่างเป็นรูปธรรมโดยไม่ทำลายสิ่งแวดล้อม พื้นที่โครงการพัฒนาดอยตุงมีจำนวนผู้ที่เป็นเบาหวานเพิ่มขึ้นอย่างต่อเนื่อง ดังนั้นการศึกษานี้จึงมีวัตถุประสงค์เพื่อประเมินสภาวะโภชนาการของผู้ที่เป็นเบาหวานในพื้นที่โครงการพัฒนาดอยตุงและคุณค่าทางโภชนาการของอาหารพื้นบ้านที่ผู้เป็นเบาหวานนิยมบริโภค

การศึกษาภาคตัดขวาง (cross-sectional study) เก็บข้อมูลระหว่างเดือนพฤศจิกายน 2551 ถึง เดือนกรฎาคม 2552 ผู้เข้าร่วมวิจัยซึ่งเป็นผู้ที่เป็นเบาหวานประเภทที่ 2 ในพื้นที่โครงการพัฒนาดอยตุงจำนวน 92 คน เป็นชาย 17 คนและหญิง 75 คน อายุระหว่าง 38-80 ปี อยู่ใน 6 ชนเผ่าได้แก่ ไทใหญ่ ไทลื้อ ลัวะ จีนฮ่อ ลาหู่และอาข่า โดยศึกษาสัดส่วนของร่างกาย ระดับน้ำตาลและไขมันในเลือด การบริโภคอาหารย้อนหลัง 24 ชั่วโมงและความถี่ในการบริโภคอาหารที่มีอยู่ในท้องถิ่น ผลการศึกษาพบว่า ผู้เข้าร่วมวิจัยส่วนใหญ่ (84.8%) มีค่าดัชนีมวลกาย ≥ 23 กิโลกรัมต่อเมตร^2 และ 90.2%ของ ผู้เข้าร่วมวิจัย มีภาวะอ้วนลงพุง โดยมีค่าเฉลี่ยระดับไขมันในร่างกายทั้งหมด 34.9 ± 6.1 เปอร์เซ็นต์ ค่าเฉลี่ยของความดันโลหิตซีสโตลิกและระดับความดันโลหิตไดแอสทอลิกเท่ากับ 131.6 ± 19.8 mmHg และ 80.9 ± 11.8 mmHg ตามลำดับ ระดับชีวเคมีในเลือดของผู้เข้าร่วมวิจัยพบว่า ค่าเฉลี่ยของระดับน้ำตาลขณะอดอาหาร (FBG) และระดับน้ำตาลสะสมในเลือด (HbA_{1c}) มีค่าเป็น 132.3 ± 37.3 mg/dl และ 8.3 ± 1.8 % ตามลำดับ ส่วนระดับไขมันในเลือดคอเลสเตอรอล (total cholesterol) ไตรกลีเซอไรด์ เอชดีแอล-คอเลสเตอรอล แอลดีแอล-คอเลสเตอรอล มีค่าเป็น 185.6 ± 44.9 mg/dl 213.4 ± 177.4 mg/dl 44.6 ± 12.0 mg/dl และ100.3 ± 34.5 mg/dl ตามลำดับ การศึกษายังพบว่าค่าเฉลี่ยของปริมาณพลังงานจากอาหารที่ผู้เป็นโรคเบาหวานบริโภค มีค่าเป็น 930.5 ± 414.3 kcal/day โดยมีการกระจายพลังงานจากคาร์โบไฮเดรต โปรตีนและไขมัน เท่ากับ 66.2 ± 10.5% 15.9 ± 3.7% และ 17.8 ± 13.4% ตามลำดับ ค่าเฉลี่ยของการบริโภคคอเลสเตอรอล เส้นใยอาหาร โซเดียมและน้ำตาล เท่ากับ 63.2 ± 56.8 mg/day 6.1 ± 3.6 g/day 3021.0 ± 1167.1 mg/day และ 11.3 ± 10.9 g/day ตามลำดับ นอกจากนี้อาหารพื้นบ้าน 10 อันดับที่ผู้เป็นเบาหวานนิยมบริโภคได้แก่ น้ำพริกมะเขือเทศ แกงผักกวางตุ้ง แกงผักกวางตุ้งดอก (จอผักกาด) ข้าวแรมฟืน น้ำเงี้ยว แกงจืดวุ้นเส้น น้ำพริกถั่วเน่า ลาบหมู หมูทอดและน้ำพริกหนุ่ม โดยมีคุณค่าทางโภชนาการอาหารเฉลี่ยต่อหนึ่งที่คือ พลังงาน 181.9 ± 144.2 กิโลแคลอรี่ คาร์โบไฮเดรต 17.6 ± 10.7 กรัม โปรตีน 10.2 ± 8.2 กรัม ไขมัน 38.5 ± 22.9 กรัม คอเลสเตอรอล 42.3 ± 29.0 มิลลิกรัม น้ำตาล 2.8 ± 1.8 กรัม เส้นใยอาหาร 0.8 ± 0.7 กรัมและโซเดียม 1245.8 ± 1146.9 มิลลิกรัม

ผู้เป็นเบาหวานส่วนใหญ่มีปัญหาด้านโภชนาการเกินและบริโภคอาหารไม่เหมาะสมกับสภาวะโรคเบาหวาน จึงอาจทำให้มีความเสี่ยงต่อการเกิดโรคแทรกซ้อนของเบาหวาน ดังนั้นผู้ที่เป็นเบาหวานในพื้นที่โครงการพัฒนาดอยตุงควรได้รับความรู้ด้านการบริโภคอาหารและโภชนาการที่เหมาะสม เพื่อควบคุมระดับน้ำตาลในเลือดและป้องกันโรคแทรกซ้อนจากเบาหวาน การศึกษานี้จะเป็นประโยชน์ต่อการจัดการรักษาโรคเบาหวานได้อย่างเหมาะสมและเพื่อส่งเสริมสุขภาพและพัฒนาคุณภาพชีวิตของคนในพื้นที่ให้ดียิ่งขึ้น

200 หน้า

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CHAPTER I
INTRODUCTION

The Doi Tung developments project under the patronage of Somdej Phra Srinagarindra Boromarajajonani, Her Royal Highness the Princess Mother, was established under royal initiative in year 1988. The principle objectives of project are to solve the social, economic and environmental problems to carry out the activities development and to increase the quality of life. The Doi Tung area is located in Mae Fah Luang district and some part of Mae Sai district in Chiang Rai, the northernmost province of Thailand, which encompasses a total of 27 villages of various ethnic minority groups and hill-tribes including Akha, Lahu, Haw, Tai Yai, Tai Lue, and Lawa (1).

Bureau of Policy and Strategy, Office of the Permanent Secretary, Ministry of Public Health, Thailand reported that the hospitalization rate of diabetes population and the numbers of people who suffering from diabetes and other chronic disease are increasing every year in 1996 to 2005 (2). Whereas Non-Communicable Disease information Center, Bureau of Non-Communicable Disease, Department of Disease Control reported that the incidence of diabetes was 3.7% in 2005 and raising to 3.9% in 2007 (3). According to the study of Aekplakorn WI., *et al.* (4), the national prevalence of diabetes in Thai adults aged ≥ 35 years was 9.6% (2.4 million people), which included 4.8% of previously diagnosed and another 4.8% of newly diagnosed.

The Second National Health and Nutrition Examination Survey of Thais by Anthropometry Measurement in 1996 - 1997 (5) revealed that the highest incidence of diabetes was found in Bangkok (6.1%) following by the northern region of Thailand (5.3%). The hospitalization rate of diabetes in Chiang Rai was approximately 778.6 per 100,000 population or 9,547 cases in 2008 (6). In 2008, Thailand has the death rate of diabetes per 100,000 population was 12.2, whereas Chiang Rai had the

death rate of 7.99 (7, 8). The Doi Tung Development Project area has 83 people with types 2 diabetes in 2006 and rising to 105 people with type 2 diabetes in 2009 (9).

Diabetes is a disease resulting from a deficiency of an insulin production or an ineffective use of the insulin to compensate the blood glucose. Approximately 90 to 95 percent of diabetes is type 2 diabetes which is associated with both insulin resistance and relative insulin deficiency (10). In Thailand a survey study of diabetes management and complication in the urban primary health care clinics (11) reported that 94% of diabetes is type 2 diabetes, these subjects had the uncontrolled diabetes with 53.5% and 58.1% of the subjects having Fasting Plasma Glucose (FPG) more than 7.8 mmol/1 and Glycolated Hemoglobin (HbA_{1c}) more than 8%, respectively. According to the result from the survey study, people with diabetes who had poor glycemic control may be effected to long term hyperglycemia. The conditions of diabetes are shown with chronic hyperglycemia leading to development of both macrovascular and microvascular complication. Therefore to prevent or delay the diabetes complications, American Diabetes Association (ADA) recommended that blood glucose level, lipid profile and blood pressure level should be controlled and maintained to nearly normal level (12).

Data from US National Health and Nutrition Examination and Survey in 1999-2002 (13) compared the glycemic control in different antidiabetic treatment among subjects with diabetes, it was shown that patients with diabetes who had only dietary treatment could reach the best glycemic control (65.9%) when compared to the ones (15.2%), who had only insulin treatment. Dietary pattern seems to be a significant factor on the glycemic control in type 2 diabetes patients (14). Rivellese AA., *et al.* (15) studied the dietary habits of patients with type 2 diabetes in Italy which is revealed that type 2 diabetes has high BMI (Mean ± SD; 29.7 ± 5.2 kg/m^2), the high intake of saturated fat and the low intake of fiber.

The National Health and Nutrition Examination Surveys (NHANES) in USA examine the obesity prevalence among adults with and without Type 2 diabetes during 1996-2006. The study is concluded that the Obesity prevalence is rising rapidly among adults with and without Type 2 diabetes. The adults with Type 2 diabetes have mean of BMI is increased from 29.2 kg/m2 to 34.2 kg/m2, percentage of total obesity (BMI ≥ 30 kg/m2) and obesity stage class III (BMI ≥ 40 kg/m2) increase by 58 and

141 respectively (16). As well as the third report of NHANES reported that most of U.S. adults with type 2 diabetes are overweight and could not approach to the physical activity recommendation and dietary guidelines for fat, fruit and vegetable consumption (17).

Hoffmeister M, Lyaruu I.A, Krawinkel M.B from northern Tanzania, Africa has studied the glycemic control and nutrition status of people with type 2 diabetes. The study found 72 percent of Tanzania people with type 2 diabetes have BMI more than or equal to 25 kg/m^2, 64 percent have blood glucose level more than 7.8 mmol/l (140 mg/dl), 47 percent have blood glucose level more than 11.1 mmol/l (199 mg/dl), and 59 percent of people with type 2 diabetes have elevate urinary glucose level beside high blood glucose level. The food staple of Tanzania people with type 2 diabetes most frequently consumed were stiff porridge, plantains, bread, rice, beef, milk, amaranth leaves, orange, and sunflower oil. The main beverages were water, tea and milk (18).

Thailand Diabetes Registry Project in 2006 showed that only 38.2% of patients with diabetes have FPG less than 130 mg/dl and 30.7% of patients with diabetes achieved HbA_{1c} less than 7%, while 73.3%, 63.3% and 52.6% of type 2 diabetes have dyslipidemia, hypertension and obesity respectively (19). A cross-sectional study for the dietary intake had been conducted among 109 patients with type 2 diabetes at Khon Kaen hospital during May to June 2005. The result showed that type 2 diabetes people basically received energy intake about 1075.9 kilocalories (59.7 of RDA). The percentage of energy distribution of protein, carbohydrate, and fat was 18.6, 64.7, and 16.7, respectively. In addition, this research also showed that sticky rice, vegetables and fishes are commonly consumed food items found in this group of people (20).

According to the local research study in elderly with diabetes and hypertension at Mae Rai sub-district and municipality of Chan Chawa sub-district, Mae Chan district, Chiang Rai province (21), reported that the sticky rice is the most commonly consumed starch among diabetic people in the research area. The people with diabetes restricted sweet, salty and fatty diet but still put monosodium glutamate in their foods. Moreover they consumed the ready to eat foods that contain high content of monosodium glutamate.

The number of type 2 diabetes in the ethnic minorities of Doi Tung project area is now raising. However the nutritional status of people with diabetes at Doi Tung area and as well as the nutritive value of local food which diabetic patients commonly consumed are not yet available. These data are extremely useful to manage an appropriate treatment of diabetes among people in Doi Tung Development Project area. Therefore, this thesis has been conducted to fulfill the objective of the Doi Tung Development project in order to develop the health promotion campaigns to improve the quality of life.

CHAPTER II
OBJECTIVES

General Objective

The general objective of the study is to determine the nutritive values of local foods and the nutritional status among people with type 2 diabetes who reside in the Doi Tung Development Project area.

Specific Objectives

1. To assess the nutrition status of type 2 diabetes by determining body mass index, waist circumference, total body fat, blood glucose level, and serum lipid profiles.
2. To determine the most common local foods consumed by type 2 diabetic people.
3. To assess the dietary intake and the nutritive values of local food consumed by type 2 diabetes by analyzing energy, carbohydrate, protein, fat, cholesterol, fiber, sodium, and sugar.

Research Question

What are the nutrition status and dietary intake of people with type 2 diabetes at Doi Tung Development project area ?

Benefit of the Study

The results of this study can be used to recommend the appropriate local foods intake to people with diabetes. This study will provide a guideline for health eating to control blood glucose level which can prevent, delay the diabetes complication and promote personal health care, and also reduce the hospital cost. In addition, the healthy eating guideline will also applicable to general population who reside in Doi Tung Development Project area.

CHAPTER III
LITERATURE REVIEW

3.1 Diabetes Mellitus and Information Implicated Diabetes Mellitus

3.1.1 Definition and Description of Diabetes Mellitus

Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism. The abnormalities of carbohydrate, fat and protein metabolism are due to deficient action of insulin on target tissues resulting from insensitivity or lack of insulin. The pathogenetic processes include destroy the beta cells of the pancrease with consequent insulin deficiency, and others that is result to resistance on insulin action. These phenomenons resulting from either an absolute decrease in the amount of insulin produced by the β-cell of the islet of Langerhans within the pancrease, or a relative deficiency of insulin hormone in people with diabetes who have tissue are resistant to the hormone. Consequence of diabetes mellitus are high glucose level in blood vessel leading to long term damage, dysfunction and failure of multi-organs (22, 23).

The characteristic symptoms of diabetes mellitus are presented with polydipsia, polyuria, polyphagia, weight loss, and blurring of vision. The severe symptoms of uncontrolled diabetes present the acute complication of diabetes mellitus including hyperglycemia with ketoacidosis or a non-ketotic hyperosmolar state which may lead to coma, incurable and death eventually. Often symptoms are not severe or absent, consequently hyperglycemia sufficient to cause pathological and functional changes may be present for a long time before the diagnosis is made (23, 24).

The chronic complication of diabetes mellitus include progressive development of the specific complications of retinopathy with potential blindness, nephropathy leading to renal failure, neuropathy with risk of foot ulcers, amputation, Charcot joints, and features of autonomic dysfunction, including sexual dysfunction (25). People with diabetes are increased risk of macrovascular and microvascular complications include cardiovascular, peripheral vascular and cerebrovascular disease.

3.1.2 Classification of Diabetes Mellitus (26)

Diabetes mellitus can be categorized by etiological types into 4 clinical classes includes type 1 diabetes, type 2 diabetes, other specific types of diabetes, and gestational diabetes mellitus which is diabetes diagnosed during pregnancy. Aetiology of type 1 diabetes due to β-cell destruction leading to absolute insulin deficiency, while type 2 diabetes ranging from predominantly insulin resistance with relative insulin deficiency to predominantly an insulin secretory defect with insulin resistance. Cause of other specific types of diabetes results from other causes for example genetic defects, diseases of the exocrine pancreas, drug or chemical-induced as shown in table 1.

The classification of diabetes depends on the circumstances present at the time of diagnosis. Many diabetic people cannot be clearly classified into a single class such as type 1 diabetes and type 2 diabetes. Clinical presentation and disease progression vary considerably in both types of diabetes.

Table 1 - Etiologic classification of diabetes mellitus (27)

I. Type 1 diabetes: β-cell destruction, usually leading to absolute insulin deficiency
- A. Immune mediated
- B. Idiopathic

II. Type 2 diabetes: may range from predominantly insulin resistance with relative insulin deficiency to a predominantly secretory defect with insulin resistance

III. Other specific types:

A. Genetic defects of β-cell function

1. Chromosome 12, HNF-1α (MODY3)
2. Chromosome 7, glucokinase (MODY2)
3. Chromosome 20, HNF-4α (MODY1)
4. Chromosome 13, insulin promoter factor-1 (IPF-1; MODY4)
5. Chromosome 17, HNF-1β (MODY5)
6. Chromosome 2, *NeuroD1* (MODY6)

Table 1 - Etiologic classification of diabetes mellitus (cont.)

III. Other specific types:

A. Genetic defects of β-cell function

7. Mitochondrial DNA
8. Others

B. Genetic defects in insulin action

1. Type A insulin resistance
2. Leprechaunism
3. Rabson-Mendenhall syndrome
4. Lipoatrophic diabetes
5. Others

C. Diseases of the exocrine pancreas

1. Pancreatitis
2. Trauma/pancreatectomy
3. Neoplasia
4. Cystic fibrosis
5. Hemochromatosis
6. Fibrocalculous pancreatopathy
7. Others

D. Endocrinopathies

1. Acromegaly
2. Cushing's syndrome
3. Glucagonoma
4. Pheochromocytoma
5. Hyperthyroidism
6. Somatostatinoma
7. Aldosteronoma
8. Others

Table 1 - Etiologic classification of diabetes mellitus (cont.)

III. Other specific types:

E. Drug- or chemical-induced

1. Vacor
2. Pentamidine
3. Nicotinic acid
4. Glucocorticoids
5. Thyroid hormone
6. Diazoxide
7. β-adrenergic agonists
8. Thiazides
9. Dilantin
10. α-Interferon
11. Others

F. Infections

1. Congenital rubella
2. Cytomegalovirus
3. Others

G. Uncommon forms of immune-mediated diabetes

1. “Stiff-man” syndrome
2. Anti–insulin receptor antibodies
3. Others

H. Other genetic syndromes sometimes associated with diabetes

1. Down’s syndrome
2. Klinefelter’s syndrome
3. Turner’s syndrome

Table 1 - Etiologic classification of diabetes mellitus (cont.)

III. Other specific types:

H. Other genetic syndromes sometimes associated with diabetes

4. Wolfram's syndrome
5. Friedreich's ataxia
6. Huntington's chorea
7. Laurence-Moon-Biedl syndrome
8. Myotonic dystrophy
9. Porphyria
10. Prader-Willi syndrome
11. Others

IV. Gestational diabetes mellitus (GDM)

Patients with any form of diabetes may require insulin treatment at some stage of their disease. Such use of insulin does not, of itself, classify the patient.

3.1.3 Criteria for Diagnosis of Diabetes Mellitus (26)

The diagnostic criteria for diabetes mellitus in general adults are shown in table 2. Three directions to diagnose diabetes are possible, and each must be confirmed on a subsequent day unless unequivocal symptoms of hyperglycemia are present. Although the FPG is less sensitive than the 75-g oral glucose tolerance test (OGTT) but preferred diagnostic test because of facilitation of procedure, acceptability to patients, and lower cost. The OGTT is useful for further evaluation of people with diabetes is still strongly suspected due to its more sensitive and modestly more specific than the FPG to diagnose diabetes.

Table 2 - Criteria for the diagnosis of Diabetes Mellitus (28)

1. HbA1c ≥ 6.5%. The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.*

OR

2. FPG ≥ 126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 hours.*****

OR

3. Two - hour plasma glucose ≥ 200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.*

OR

4. In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, random plasma glucose ≥ 200 mg/dl (11.1 mmol/l).

* In the absence of unequivocal hyperglycemia, criteria 1–3 should be confirmed by repeat testing.

3.1.4 Type 2 Diabetes

Type 2 diabetes (Non-Insulin-Dependent Diabetes Mellitus, NIDDM) is the most general form of diabetes that results from the cell cannot use insulin properly, while the pancrease has normally function to secreting the insulin hormone. This irregular condition referred to insulin resistance. The resistant of insulin action has affect to the deficient glucose metabolism that leading to hyperglycemia or the elevated glucose level remain in the blood vessel. The hyperglycemia condition manifests destructively to the vascular and important organ. Several year of diagnosis type 2 diabetes has develop gradually the diabetes complication for example macrovascular complication, microvascular complication and diabetic neuropathy that these complications are mainly cause morbidity and mortality in the patients with type 2 diabetes (29, 30).

In addition, type 2 diabetes is associated with elderly age, obesity, impaired glucose metabolism, a family history of diabetes or gestational diabetes, sedentary lifestyle, and race. The most of people with type 2 diabetes are overweight or obesity which contributes to the insulin resistant. Particularly the people with type 2 diabetes who accumulate the abdominal visceral obesity have related developing of diabetes, although they were not categorized to overweight or obesity (31).

3.1.5 Presence of complications in individuals with Type 2 diabetes (32-35)

Patients with a history of any disorder related to diabetes before the clinical diagnosis of type 2 diabetes are increased risk of developing type 2 diabetic complication after diagnosis. The risk of complications is significantly related to the duration of diabetes. The diabetic complications are the main cause leading to morbidity and mortality in the people with type 2 diabetes. These complications may already be present at diagnosis and coexisting hypertension or dyslipidemia may exacerbate their risk. The present of type 2 diabetic complications can be divided depend on symptoms into 2 groups that are the acute complications and the long-term complications.

A. Acute Complications

Acute complications of type 2 diabetes are the hyperosmolar hyperglycemic status which is a condition severe hyperglycemia. The hyperosmolar hyperglycemic status usually develops slowly within over several day or week in the absence of ketosis. It is a cause of neurological abnormalities such as abnormal refluxes, motor impairments, reduced verbal ability, and seizures. Opposite, some people with type 2 diabetes may have the symptoms include hunger, sweating, shakiness, heart palpitations, slurred speech, and confusion. These conditions are the symptoms of hypoglycemia or low blood glucose in people with type 2 diabetes. It is results from inappropriate management of diabetes such as excessive amounts of antidiabetic drugs, prolonged exercise, skipped or delayed meals, or drinking alcohol without food.

B. Long Term Complications

Chronic complications of type 2 diabetes are result from uncontrolled and untreated high blood glucose level or hyperglycemia. Prolonged exposure to high glucose concentrations destroys cell and tissue. The consequence of long term high blood glucose concentration leads to diabetes neuropathy, microvascular complications, and macrovascular complications. Diabetes neuropathy or nerve degeneration is damage of nerve that leading to symptoms of pain, numbness, and loss of sensation in the hands and feet. Microvascular complications are disorders that affect the arterioles and capillaries, including retinal damage and kidney disease. Macrovascular complications result from damage of the coronary arteries and arteries in the limb which leads to peripheral vascular disease and cardiovascular disease.

The major risk factors for long-term complications especially macrovascular disease including cardiovascular disease is explained as metabolic syndrome and insulin resistance. It is characterized by obesity, hypertension and dyslipidemia that all factors individually associated with increased risk for mortality from cardiovascular disease (36, 37).

- **Obesity**

Epidemical study of obesity and type 2 diabetes in Asia showed that the proportions of people with type 2 diabetes and obesity have increased throughout Asia including Thailand (38). Asian populations who have the high risk of type 2 diabetes and cardiovascular disease is significant at BMI > 23 kg/m^2 (39). Increasing of BMI extremely increases with the prevalence of hypertension, diabetes, dyslipidemia, and metabolic syndrome (40). The excess adipose tissue increases with BMI is affected to serum lipid and blood pressure that are related to the risk of comorbidity. Moreover the visceral abdominal obesity lead to insulin resistance and a metabolic abnormality that related to the development of type 2 diabetes and cardiovascular disease (41). The people with type 2 diabetes who loss the weight moderately (5% of body weight) are associated with reduced insulin resistance, decreased blood pressure, and improvement in glycemia and serum lipids (42, 43).

- **Dyslipidemia**

The characteristic features of diabetic dyslipidemia are high plasma triglyceride levels, low high-density lipoprotein (HDL) cholesterol levels and high levels of low-density lipoprotein (LDL) cholesterol (44). In the Framingham Heart Study (45) revealed that people with diabetes had an increased prevalence of hypertrigyceridemia and low HDL cholesterol levels, but total cholesterol and LDL cholesterol levels did not differ from people without diabetes. Moreover the UK Prospective Diabetes Study (UKPDS) (46) showed the plasma triglyceride levels of patients with T2DM were increased, whereas HDL cholesterol levels were reduced in patients with diabetes compared with the nondiabetic controls. For Thai diabetic people more than 80% of Thai adults type 2 diabetes, had dyslipidemia (47).

- **Hypertension**

In the majority of Thai adults with type 2 diabetes 78.4% have hypertension (48). These people are related to increase risk of nephropathy, retinopathy, and cardiovascular complications. Sowers J.R. and colleagues (49) showed that type 2 diabetic patients with hypertension are associated with increased salt sensitivity, volume expansion, loss of nocturnal dipping of blood pressure and pulse, proteinuria, orthostatic hypotension, and isolated systolic hypertension. The initial diagnosis is provided the intensive antihypertensive therapy, appropriate glycemic control and management of conventional cardiovascular risk factors which reduce these complications (50-52). Moreover the UKPDS revealed that the management of hypertension is cost-effective in patients with type 2 diabetes (53).

3.1.6 Treatment Strategy of Type 2 Diabetes

The important target of type 2 diabetes treatment is achieving and maintaining the glycemic level within the normal range or as close to normal as possible. Maintaining healthy blood lipid concentrations and blood pressure level can be prevented or slowed the risks of development of the chronic diabetes complications. ADA and the European Association for the Study of Diabetes recommended that intervention at the time of diagnosis with metformin in combination with lifestyle changes, including increased physical activity and dietary modifications is the management approach for hyperglycemia in individuals with type 2 diabetes (54, 55).

In addition, the Diabetes Prevention Program Research Group (56) studied the effect of the lifestyle intervention and the administration of metformin to prevent or delay the development of diabetes during a period of three years. The study showed that the incidence of diabetes was lower in the metformin and lifestyle intervention groups than in the placebo group throughout the follow-up period, with the incidence rates of 11.0, 7.8, and 4.8 cases per 100 person-years for placebo, metformin, and lifestyle intervention groups, respectively. Incidence of diabetes was 58% lower (95% CI: 48-66%) in the lifestyle intervention group, whereas 31% lower (95% CI; 17-43%) in the metformin group than in the placebo group. The lifestyle intervention was highly effective to prevent or delay the development of diabetes than metformin. The study from China (57), showed that diet, exercise, and diet-plus-exercise interventions were associated with 31%, 46%, and 42% reductions in risk of developing diabetes, respectively.

Nutrition intervention is essential involved in diabetes management to achieve target blood glucose goals and make lifestyle changes. Benefit of nutrition management is not only reducing HbA_{1c} in patients with diabetes but it is advantage to other aspects of metabolic status as well, including dyslipidemia and hypertension which are major risk factors for cardiovascular disease (58, 59).

3.1.7 Type 2 Diabetes and Nutrition Management (12, 60)

Carbohydrate - Consumption of carbohydrate is extremely influence the blood glucose level more than other component contained food. The clearance of glycemic response is depending on amount and type of carbohydrate. Simple carbohydrate including sugar is digested and absorbed immediately, whereas complex carbohydrate including whole grains and legumes can gradually raise the glycemic response after intake. The prior study showed the consumption of whole grain and high dietary fiber can increase ability of insulin sensitivity and reduce the development of diabetes complication (61, 62). ADA recommended 45-65% of total energy from carbohydrate provided to diabetes and 130 gram of carbohydrate a day is a minimum in people with diabetes.

Protein - The prior short-term studies showed that high protein diet is able to improve the blood glucose response (63) and increase insulin response without increasing plasma glucose concentrations after ingestion in people with diabetes (64, 65). The people with type 2 diabetes should have the protein intake about 15-20% of total energy.

Fat - The primary goal of dietary fat in people with diabetes is to restrict saturated fatty acids, trans fatty acids, and cholesterol intakes to reduce cardiovascular risk. A monounsaturated fats (MUFA) - rich diet can reduce postprandial small very low density lipoprotein (VLDL) and triglyceride greater than a saturated fats - rich diet in type 2 diabetic patients (66). Comparison of MUFA and polyunsaturated fats (PUFA) are revealed that the PUFA is associated with smaller LDL particle size which is cause of atherosclerosis in type 2 diabetes people significantly (67). According to ADA recommendation, individuals with diabetes should control the saturated fatty acids < 7% of total energy, cholesterol intake < 200 mg/day and minimize the intake of trans fatty acids.

Fiber - The soluble dietary fiber is useful to improve the postprandial glycemic response and insulin concentration resultant from slowing the digestion and absorption of diet, where as insoluble dietary fiber can improve insulin sensitivity contributing to decreased risk of diabetes complication (68, 69). People with T2DM should be encouraged to consume the dietary fiber 14 g/1,000 kcal.

Sodium - A high sodium intake elevated blood pressure which is important risk factor for cardiovascular and renal diseases, including stroke, coronary heart disease, heart failure, and kidney failure (70). The people with type 2 diabetes should reduce high sodium intake to prevent the complication of microvascular and macrovascular. The amount of sodium intake is recommended 2,400 - 3,000 mg/day for people with diabetes who have normal blood pressure, whereas people with diabetes who have mild to moderate hypertension and severe high blood pressure is recommended less than 2400 mg/day and 2000 mg/day, respectively.

Figure 1 summarizes ADA nutrition recommendation for people with diabetes

Carbohydrate: Total carbohydrate 45 – 65 % of total energy per day

- Sugar < 10% of total calories
- Fiber 14 g/1,000 kcal

Protein: Protein Approximately 15-20% of daily energy

Fat: Total fat 25- 35% of total energy per day

- Saturated fats < 7% of total calories
- Monounsaturated fats up to 20% of total calories
- Polyunsaturated fats up to 10% of total calories
- Dietary cholesterol < 200 mg/day

Sodium: Sodium < 2400 - 3000 mg/day for normal blood pressure

- Sodium < 2400 mg/day for mild to moderate high blood pressure
- Sodium < 2000 mg/day for severe high blood pressure or kidney problems (Nephropathy)

A complete refers to standards of medical care in diabetes 2006 and 2010; position statement by ADA.

Figure 1: **ADA nutrition recommendation for people with diabetes**

3.2 Assessment of Nutritional Status among Type 2 Diabetes

The nutritional status is the condition of a person's health influenced by the intake or the levels of nutrients in the body and the ability of utilization of nutrients to maintain normal metabolic integrity in the body. The nutritional status of individual can be determined by using interpretation of 4 informations from anthropometry, laboratory, dietary and clinical studies.

3.2.1 Anthropometric Assessment (74)

Anthropometric assessment is commonly used to indicate the nutritional status in the individual and population. The information of anthropometric measurement can be retrospect on the past long-term nutrition history and it is generated on the changes in the nutrition status at the present and trend to the future. Additionally the advantage of anthropometric assessment is simple, safe and noninvasive technique; it is applicably used with the large sample size. Anthropometric measurement is proceeded to assess the body size and the body composition that including the indices as below.

A. Body Size

Anthropometric measurement of body size (body weight and height) is widely used primarily to identify the nutritional status in the adults. The relation of body weight and height can be used to calculate BMI for classify overweight and obesity in adults. The calculation of BMI is taken from weight in the unit of kilogram divided by meter square of height. World Health Organization (WHO) recommends the classification of overweight and obesity in Asian adults as shown in table 3.

Kramer H. and colleagues (75) studied the trend of BMI and obesity among adults with and without Type 2 diabetes from the National Health and Examination Surveys completed during years 1976 - 2006. The result showed that the obesity prevalence is rising rapidly among adults with and without type 2 diabetes, as the mean of BMI increased from 29.2 kg/m^2 to 34.2 kg/m^2 and 25.2 kg/m^2 to 28.1 kg/m^2 among adults with and without type 2 diabetes, respectively. Total obesity increased by 58% of adults with type 2 diabetes and 136% of adults without type 2 diabetes, whereas class III obesity increased by 141% and 345% among adults with and without type 2 diabetes, respectively. In addition, the prevalence of obesity among diabetic

individuals has increased overtime which increased risk of mortality in these individuals. The study of Leibson C.L., *et al.* (76) showed that increasing obesity within the people with diabetes was at increased risk of mortality compared with the non-obese diabetic people.

Table 3 Classification of Body Mass Index in Asians adult age ≥ 20 years (77)

Classification	BMI (kg/m^2)
Underweight	< 18.5
Normal range	18.5 - 22.9
Overweight	≥ 23
Mild obesity (Pre-obese)	23 - 24.9
Moderate obesity (Obese class I)	25 - 29.9
Severe obesity (Obese class II)	≥ 30

Source: WHO Expert Consultation: Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies.

B. Body Composition

The body composition has 2 compartments including body fat and fat free mass. The assessment of changes in amount and proportion of body fat and fat free mass can be indicated the nutritional status. Indices of body composition are used to identify under or over nutrition in each individual. The study assessed the body composition from the information of waist circumference, skinfold thickness, mid upper arm circumference and mid upper arm muscle circumference.

- **Waist Circumference** - The value of waist circumference is related with abdominal obesity. The waist circumference is associated with cardiovascular disease and powerful prediction of glucose control in people with type 2 diabetes. The prospective cohort study (78) reported waist circumference is a strong predictor of glucose control among type 2 diabetes. Whereas the study of Tseng C.H. from Taiwan (79) showed that the waist circumference is the determinants of coronary artery disease in adults with type 2 diabetes. The standard for waist circumference of Asian adult was identified based on the cut-off values from WHO as shown in table 4.

Table 4 Normal rang of waist circumference for Asian adults (80)

Gender	Normal values (centimeter)
Male	≤ 90
Female	≤ 80

Source: World Health Organization: The Asia-Pacific perspective Redefining Obesity

● **Triceps Skinfold Thickness (TSF)** - The skinfold thickness measurement is commonly used to estimate the content of subcutaneous fat and total body fat. The triceps skinfold thickness can be indicate the calorie reserves stored in the form of fat and a change of body composition overtime. The skinfold thickness is presented as % standard TSF for classified the level of nutritional status. The standard TSF value for male is 12.5 mm and female 16.5 mm. The percentage of standard TSF is calculated as follows: % standard TSF = (measure TSF/ standard TSF) × 100. The classification of % standard TSF is shown in table 5.

Table 5 The criteria for % standard TSF value are classified by Jelliffe (82)

Percentage of standard TSF	Level of nutritional status
> 90% of standard	Normal nutritional status
80-90% of standard	Mild malnutrition
60-79% of standard	Moderate malnutrition
< 60% of standard	Severe malnutrition

● **Mid-Upper Arm Muscle Circumference (MAMC)** - The measurement of mid-upper arm circumference (MUAC) is used for calculated MAMC which is base on subcutaneous fat and muscle mass in the arms. It is useful to assess the size of body muscle mass which can be indicated the amount of protein reserve. The reduction of MAMC may be reflect to changes in the amount of subcutaneous fat and muscle mass which is benefit to diagnose the protein-energy malnutrition and the protein nutritional status.

The MUAMC is obtained from calculation of MUAC and triceps skinfold thickness (MAMC = MUAC - ($\pi \times$ TSF)). The assessment of nutritional status level is presented as % standard MAMC which calculated from the standard MAMC are 23.5 cm. in male and 23.2 cm. in female. The percentage of standard MAMC is calculated as follows: % standard MAMC = (calculated MAMC/ standard MAMC) $\times$ 100. The classification of % standard MAMC is shown in table 6.

Table 6 The criteria for % standard MAMC value are classified by Jelliffe (82)

Percentage of standard MAMC	Level of nutritional status
> 90% of standard	Normal nutritional status
80-90% of standard	Mild malnutrition
60-79% of standard	Moderate malnutrition
< 60% of standard	Severe malnutrition

● **Bioelectrical Impedance Analysis (BIA)** - The study estimated the body fat by using Karada Scan HBF-362 that refers to Bioelectrical Impedance method. The prior study (83) reported that the using BIA is a reliable technique for determination of body composition in type 2 diabetic people in clinical and investigative studies. The technique of BIA is based on the differences in electrical conductivity of fat free mass (muscle or blood vessels) and fat that have high electric conductivity and low electric conductivity, respectively. The principle of BIA is the electrical current of 50 kHz - 500 μA is sent through to the body for determine amount of body fat. The fat free mass has high water content lead to effortless electrical current, as for the body fat is low electric conductivity effect to difficult electrical current (74, 84). Karada Scan HBF-362 can analyze several data of body composition including body fat percentage and visceral fat level.

● **Body Fat Percentage -** The percentage of body fat is calculated as following formula that Body fat percentage (%) = {Body fat mass (kg) / Body weight (kg)} × 100. The study of Singh R.B., *et al.* from India (85) showed the high and moderate body fat percent was associated with the coronary-risk factors including diabetes mellitus. The classification of body fat percentage is given in table 7.

Table 7 Interpretation of percentage body fat results (84)

Gender	- (Low)	0 (Normal)	+ (High)	++ (Very High)
Female	5.0 – 19.9 %	20.0 – 29.9 %	30.0 – 34.9 %	35.0 – 50.0 %
Male	5.0 – 9.9 %	10.0 – 19.9 %	20.0 – 24.9 %	25.0 – 50.0 %

The values for obesity judgement proposed by Mr. Lohman (1986) and Mr. Nagamine (1972)

● **Visceral Fat Level -** Visceral fat or abdominal fat is the excess fat contained inside the peritoneal cavity. The visceral fat level of subjects is classified as shown in table 8. The high accumulation of visceral fat has affect to the glycemic control and occurring on the aortic stiffness among patient with type 2 diabetes.

Gastaldelli A. and colleagues studied the metabolic effects of visceral fat accumulation in type 2 diabetes, which found that the elevated of visceral fat has a significant negative impact on glycemic control through a decrease in peripheral insulin sensitivity and an enhancement of gluconeogenesis (86). Whereas the study of Anan F., *et al* from Japan determined the correlations of visceral fat accumulation and atherosclerosis in patients with type 2 diabetes, showed that the high abdominal visceral fat group was higher in FPG and index of atherosclerosis than the normal abdominal visceral fat group (87).

Table 8 Interpretation of visceral fat level results (84)

Visceral Fat Level	Classification
1 - 9	0 (Normal)
10 - 14	+ (High)
15 - 30	++ (Very High)

The data referenced by Omron Health care.

3.2.2 Blood Pressure

Blood pressure is the pressure exerted by circulating blood within arteries. The heart pumps blood into the arteries and through the circulatory system. The value of blood pressure is reported by 2 numbers including systolic pressure and diastolic pressure. Systolic blood pressure (SBP) is recorded after the heart contracts and it is maximum pressure, while diastolic blood pressure (DBP) is recorded before the heart contracts and it is minimum pressure (91). Elevated blood pressure is important risk factor for cardiovascular and renal disease (92). The classification of blood pressure for adults is shown in table 9. The target of blood pressure is less than 130/80 mmHg in people with diabetes.

A cross-sectional survey of Wong N. and colleagues from Australia (93) studied the proportion of diabetes and hypertension patients with optimal blood pressure control (<130/80 mmHg) and their awareness of the importance of BP control. The study showed 80% of the study subjects had both diabetes and hypertension, 28% and 48% of these study subjects realigned the importance of blood pressure control and blood glucose control for diabes management, respectively. However, less than one-third of subjects were achieved the blood pressure level recommended.

Table 9 Classification of blood pressure for adults (94)

Blood Pressure Classification	SBP (mmHg)	DBP (mmHg)
Normal range	< 120	and < 80
Prehypertension	120 - 139	or 80 - 89
Stage 1 - Hypertension	140 - 159	or 90 - 99
Stage 2 - Hypertension	> 160	or > 100

Source: The 7th Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, 2004.

3.2.3 Biochemical Markers

A. Fasting Plasma Glucose (FPG)

FPG is the most commonly method to indicate glucose or sugar level in blood sample taken after 8-10 hour overnight fast. Diabetic patients should control the fasting blood glucose level close to normal value as shown in table 10.

B. Glycolated Hemoglobin (HbA1c)

HbA1c level is assessing a long term glycemic control in people with diabetes. The glucose molecules react with hemoglobin and forming into glycated hemoglobin that effect to blood glucose concentrate. The phenomenon has been exposed during 120 days life cycle of the red blood cell. Uncontrolled diabetes have amount of glycated hemoglobins higher than individuals with diabetes who controlled blood glucose level. Therefore HbA1c level is proportional to average blood glucose concentration during the past 120 days or 2-3 months. The target of HbA1c level is shown in table 10.

Table 10 Summary of glycemic recommendations for adults with diabetes (27)

Variables	Normal range
Fasting Plasma Glucose (ml/dl)	70 - 130
Glycolated Hemoglobin (%)	< 7

Standard medical care in diabetes, American Diabetes Association 2010

C. Serum Lipid Profiles

The reduction of lipid profile to normal range is a goal on the treatment strategy of diabetes for reducing the risk of vascular disease. High level of triglyceride, total cholesterol, and LDL cholesterol are the main lipid markers for risk estimation of coronary heart disease. Whereas HDL cholesterol has advantage to transports excess cholesterol from blood vessel and the tissue of body returns to the liver processing. Carmena R. (88) reported that people with diabetes have a characteristic atherogenic dyslipidemia of decreased HDL cholesterol, elevated triglyceride, and increased small dense LDL. As well as the UKPDS (89) showed that

the reduction of HDL cholesterol and increased LDL cholesterol level leading to coronary heart disease in people with type 2 diabetes. Therefore type 2 diabetes should control serum lipid to the normal level as shown in table 11.

Table 11 Target of serum lipid profiles for adults (90)

Lipid profiles	Normal range
Triglyceride	< 150 mg/dl
Cholesterol	< 200 mg/dl
LDL cholesterol	< 100 mg/dl
HDL cholesterol	
- Male	≥ 40 mg/dl
- Female	≥ 50 mg/dl

Source: Standards of medical care in diabetes ADA, 2010

3.2.4 Evaluation of Dietary Consumption (74)

A. Twenty Four Hour Recall

Twenty four hour recall is estimated the usual intake of individual during the previous 24 hour. Gibson and Ferguson reveal 4 stages to achieve a valid measure of the usual intake in population.

Stage I : Interviewing the list of foods and beverage is consumed during the previous 24 hour.

Stage II : Detail of each foods and beverage such as cooking ingredients, method and brand name of products is interviewed from individuals.

Stage III : Estimating the amount of ingredients and food items consumed are obtained by using photograph, a measuring cups, spoons, food models or local household utensil (calibrated for used) as memory in assessing the portion size of food consumed in population.

Stage IV: Review to ensure that all food items including use of vitamin and mineral supplement has been record correctly.

Ma Y., *et al* (95) revealed the number of 24-hour diet recalls is required to estimate energy intake. The study showed energy intake is underreported on the first 24 hour dietary recall. Average energy intake from two diet recalls is better approximated true energy expenditure than did the first recall, whereas average three diet recalls further improved the estimation. Therefore three 24 hour dietary recalls are appropriate for estimating energy intake.

The study of Lee H., *et al* (96) from Korea studied the relation of nutritional intake and serum glucose and lipid by using 24 hour dietary recall in a face-to-face interview. The result showed that the dialy nutrition intake was 1664.1 kcal of energy intake, 64.5 g of protein, 30.3 g of fat, 280.7 g of carbohydrate, 511.5 mg of calcium, and 941.9 mg of phosphorus, whereas percentage of carbohydrate: protein: fat ratio was 75: 17: 8. The most Korean diabetic patient had inappropriate levels of total energy and insufficient calcium intake.

C. Food Frequency Questionnaire (FFQ)

The purpose of FFQ is assessing the frequency of food item or food groups are consumed during a specified time period which it provides descriptive qualitative information about usual food-consumption patterns. The FFQ comprises with a list of foods that focus on specific group of food in association with special events or season. The frequency of use response categories is set as daily, weekly, monthly, or yearly that depending on the objective of study.

Mutata G.H., *et al*. (97) studied the validation of FFQ as a predictor of metabolic status in people with type 2 diabetes. The study showed that FFQ data could identify poor metabolic control in among people with type 2 diabetes who had a dietary intake more than 1,000 kcal/day.

3.3 Doi Tung Development Project Area (98, 99)

Doi Tung developments project under the patronage of Somdej Phra Srinagarindra Boromarajajonani, Her Royal Highness the Princess Mother, mother of the reigning King Bhumibol Adulyadej. Doi Tung development project was established within the objectives of project are solute the social, economic and environmental problems through intensive reforestation of the surrounding forestlands. Furthermore the Doi Tung Development Project conceived works, established health and education systems which have aided to raise the standard of living of the indigenous ethnic minorities

3.3.1 Location/ Territory/ Administrative district

A. Location/ Territory

The Doi Tung development project of responsible area is situated in Toed Thai sub-district of the Mae Fah Luang district and some part of Mae Sai district of Chiang Rai, the northernmost province of Thailand. The Project extends over an area of 93,515 rai or about 150 square kilometers and territory bound land including:

North - the area is near Mai Sai district
South - the area is near Mae Chan district
East - the area is near Mae Chan district
West - the area is near Myanmar

Figure 3 shows the map of Doi Tung Development Project Area at Chiang- Rai province.

B. Administrative district

The Doi Tung Development Project area covers a total of 27 villages located in the Thoed Thai sub-district of the Mae Fah Luang district and some part of Mae Sai district of Chiang Rai province which reveal in table 12.

3.3.2 Geography

The area is covered by densely forested, mountainous terrain of hills and complicated mountainous regions. The region is dominated by the Nang Non mountain range with Doi Chang Mub and the tallest peak at 1,509 metres above sea level.

Figure 2: Map of Doi Tung Development Project Area, Chiang Rai province

Table 12 Name of village located in Doi Tung development project area, Mae Fah Luang district and Mae Sai district, Chiang Rai

Village No.	Name of Village	Thai Name
Mae Fah Luang district		
1	Huai Nam Khun	บ้านห้วยน้ำขุ่น
2	Huai Rai Sa Makkhi	บ้านห้วยไร่สามัคคี
3	Akha Phaka	บ้านอาข่าป่าคา
4	E-kaw Si Lang	บ้านอีก้อสี่หลัง
5	Kha Yeng Phatthana	บ้านขาแหย่งพัฒนา
6	Muhso Pa Kluai	บ้านมูเซอป่ากล้วย
7	Akha Pa Kluai	บ้านอาข่าป่ากล้วย
8	Muhso La Ba	บ้านมูเซอลาบา
9	Liseh	บ้านลิเช
10	Cha Lo	บ้านจะลอ
11	Sa Makkhi Kao	บ้านสามัคคีเก่า
12	Pa Sang Na Ngoen	บ้านป่าซางนาเงิน
13	Sa Makkhi Mai	บ้านสามัคคีใหม่
14	Suan Pha	บ้านสวนป่า
15	Pang Pra Ratchatan	บ้านปางพระราชทาน
16	Pa Yang Lahu	บ้านป่ายางลาหู่
17	Huai Nam Khun	บ้านห้วยน้ำขุ่น
18	Huai Nam Khun	บ้านห้วยน้ำขุ่น
19	Pa Sang Saen Sut Dan	บ้านป่าซางแสนสุดแดน
Mae Fah Luang district: Villages Satellite		
9	Pha Bue	บ้านผาบือ
11	Huai Pu Mai	บ้านห้วยปูใหม่
13	Mae Poen	บ้านแม่เปิน
16	Pa Yang Akha	บ้านป่ายางอาข่า
19	Pang Nun Phatthana	บ้านปางหนุนพัฒนา

Table 12 Name of village located in Doi Tung development project area, Mae Fah Luang district and Mae Sai district, Chiang Rai (cont.)

Village No.	Name of Village	Thai Name
Mae Sai district		
6	Pha Mi	บ้านผาหมี
10	Akha Pha Hi	บ้านอาข่าผาฮี้
11	Muhso Pha Hi	บ้านมูเซอผาฮี้

Source: Sub-district Administration Organization of Mae Fah Luang district, Chiang Rai

3.3.3 Population

The Doi Tung development project area has amounts of population 14,340 people that are various ethnic minority groups and hill-tribes. The area situated in the Thoed Thai sub-district of the Mae Fah Luang district representing a total population of 13,825 people or 3,307 families which contain 6,984 males and 6,841 females. The density of population is 127 people per square kilometers. A different ethics consist of Akha, Lahu, Haw, Tai Yai, Tai Lue, Lawa and the other ethnic minority who reside in the area (3, 4).

3.3.4 Weather Climate

There are 3 seasons including:

- **Summer season** starts in March to April, average temperature 27 degree Celsius with hot and humid.
- **Rainy season** starts in May to October, average temperature 22 degree Celsius with heavy rain and foggy.
- **Winter season** starts in November to February has average temperature 10 degree Celsius with cold to very cold.

CHAPTER IV
MATERIALS AND METHODS

The study is designed as a cross-sectional study to determine the nutritional status and the selected local foods of people with type 2 diabetes that have different ethnics among Doi Tung Development Project area, Chiang Rai province. The study was carried out between November 2008 to July 2009. The procedure of research was divided into two - phases as follows:

Phase 1: Development of the questionnaire

Phase 2: Determination of nutritional status among type 2 diabetes

Phase 3: Determination of local foods consumption and most frequently consumed local food items among type 2 diabetes

The study was approved by the ethics committee on Human Rights Related to Research Involving Human Volunteers, Mahidol University (appendix A). The study was also reviewed by Mae Chan Hospital, Mae Fah Luang public health, and Mae Sai public health.

4.1 Study Subjects

The subjects are people with type 2 diabetes in Doi Tung Development Project area. These subjects were recruited from 5 health stations including Huai Nam Khun, Sa Makkhi Mai, Pa Yang, Pha Mi, Pha Hi and 1 primary health care unit named Doi Tung Queen Sirikit Health Center. They were situated at two sub-districts (Mae Fah Luang and Pong Ngam) and 2 districts (Mae Fah Luang and Mae Sai district), Chiang Rai province as shown in figure 2. All subjects were invited to participate in the study.

4.1.2 Sample Size Calculation

The sample size was calculated to acquire enough samples to represent people with type 2 diabetes in Doi Tung Development Project area. In 2009, the report of primary health care units under Mae Fah Luang and Mae Sai public health showed that the Doi Tung Development Project area has 105 type 2 diabetes. The sample size was calculated based on total amount of people with type 2 diabetes with a 95% confident interval for the sample size calculation using the following Yamane formula.

The calculation of sample size from Yamane formula:

Yamane formula	n = The sample size
$n = N / (1+d^2N)$	N = Total amount of type 2 diabetes in Doi Tung area
$n = 105/ [1+((0.05)^2 \times 105)]$	d = 0.05 (The standard error)
$n = 83.2$	

Drop-out rate of 10% is expected: $(83 \times 110) / 100 = 91.3 \approx$ 92 subjects

Therefore the sample size was 92 subjects who represent people with type 2 diabetes in Doi Tung Development Project area.

4.1.3 Subject Selection

The population of Doi Tung area has 6 different ethnic background including Tai Yai, Tai Lue, Lawa, Haw, Akha, and Lahu. Each ethnic has different amount of people with type 2 diabetes. The proportionate allocation was used to calculate sample selection in each ethnic subject as shown in Table 13.

Table 13 Calculation of subject selection by using proportionate allocation

Ethnics	N	P = (N×1.0)/105	n = P × 92	Estimated value	Participants
Akha	31	0.30	27.60	28	30
Lahu	25	0.24	22.08	22	21
Haw	16	0.15	13.80	14	13
Tai Yai	16	0.15	13.80	14	14
Lawa	12	0.11	10.12	10	9
Tai Lue	5	0.05	4.60	4	5
Total	**105**	**1.00**	**92.00**	**92**	**92**

N = Total amount of type 2 diabetes in Doi Tung area, P = Proportion, n = Amount of sample in each ethnic group

Thus, ninety two people with type 2 diabetes including 21 Lahu, 30 Akha, 13 Haw, 14 Tai Yai, 9 Lawa, and 5 Tai Lue were enrolled in the study.

A full list of subjects was obtained from 5 health stations and 1 primary health care unit including Huai Nam Khun, Sa Makkhi Mai, Pa Yang, Pha Mi, Pha Hi, and Doi Tung Queen Sirikit health center, respectively. The staffs of each health stations and primary health care unit and the researcher obtained about history of medical treatment for diabetes in each subjects. To invite diabetes people to participate into the study, the list of subjects was given to the village health volunteers to inform each people with diabetes and also provided to the head of villages for announce to people with diabetes who reside in the villages.

4.1.4 Qualifications of Subjects

Inclusion Criteria:

- People with type 2 diabetes who resided within Doi Tung Development Project area
- Have six different ethnics including Tai Yai, Tai Lue, Lawa, Haw, Akha, and Lahu
- Age equal or less than 80 years old and receiving diabetes treatment at Huai Nam Khun health station, Sa Makkhi Mai health station, Pa Yang health station, Pha Mi health station, Pha Hi health station, and Doi Tung Queen Sirikit Health Center.
- Be able to communicate with an interpreter
- Can provide signature or thumb print for informed consent form of the study

Exclusion Criteria:

- Unable to communicate or provide information to the study
- Unwilling to participate the study

4.2 Training the Interpreters

Since the most subjects could not communicate in Thai language with the researcher, an interpreter in each ethnical language was needed to communicate between researcher and the study subjects. The researcher informed about the study details, the questionnaires for data collection, and the main point of interview to the interpreters. Trained interpreters must understand and be able to convey reliable information of the study to the subjects. The family members/close relatives/ caretakers of each subject can sometimes assist in providing subjects' information.

4.3 Procedures of Research

4.3.1 Development of the Questionnaires

The development of questionnaire was begun to review the literatures about nutritional status and dietary intake among people with type 2 diabetes. The data of local food items and other food groups included starches, vegetables, fruits, meats, animal products, milk, fat/oil, and seasoning were collected from the local markets and people who reside in Doi Tung Development Project area. In order to obtain the content validity of the questionnaire, a draft copy of questionnaire were provided to the expert committees of the research.

The content validations of the questionnaires are based on responses from three experts whose names are listed in appendix B. The questionnaires were modified according to the comments of three expert committees in the study. The questionnaires were then validated among 10-15 people in each ethnic background (Tai Yai, Tai Lue, Haw, Lawa, Lahu, and Akha) who resided in Doi Tung area. The final questionnaires were used to interview the study subjects. The flow chart of questionnaires development process is shown in figure 3.

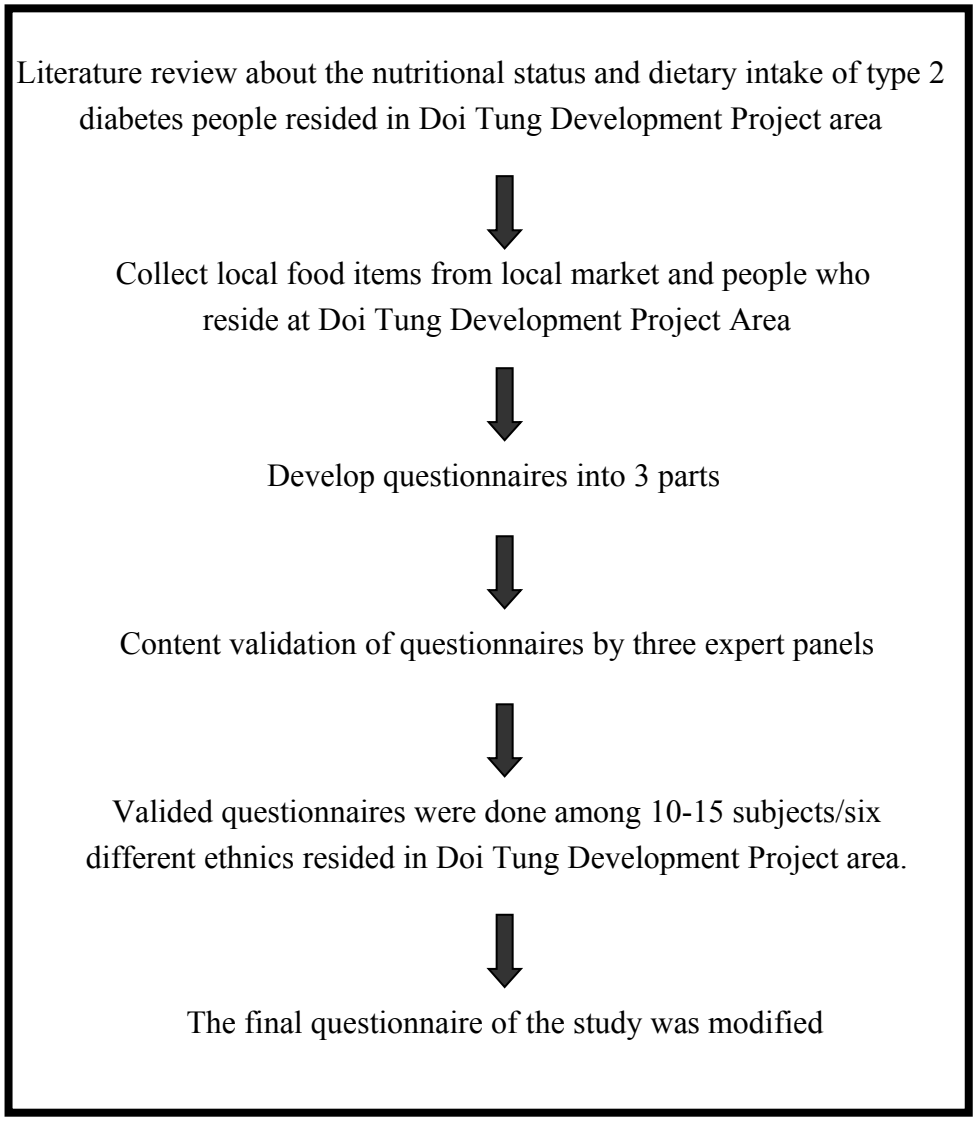

Figure 3: Flow chart of the procedure for questionnaire development

The final questionnaires in appendix D were used to collect the data from the study subjects. The questionnaire consisted of 3 parts as follows:

<u>Part I:</u> Demographics and dietary information

This part has 21 questions for obtaining the characteristic and demographic data (for example ethnics, education, occupation etc.), food availability, dietary consumption, and dietary behavior of the study subjects.

Part II: Health status related to diabetes

The second part consists of 12 questions about diabetes condition, diabetes treatment, diabetes complications, physical activity, and nutrition knowledge of subjects.

Part III: Food frequency questionnaire

A food frequency questionnaire was used to determine the most commonly food consumed by diabetic subjects. Food frequency questionnaire comprised more than 100 items of the local food items and other food groups (for example vegetable, fruits, meat, starch, etc.). A scale of the frequency was categorized to everyday (7 times/week), frequent (5-6 times/week), sometimes (1-4 times/week), seldom (<4 times/month), and never (not consume).

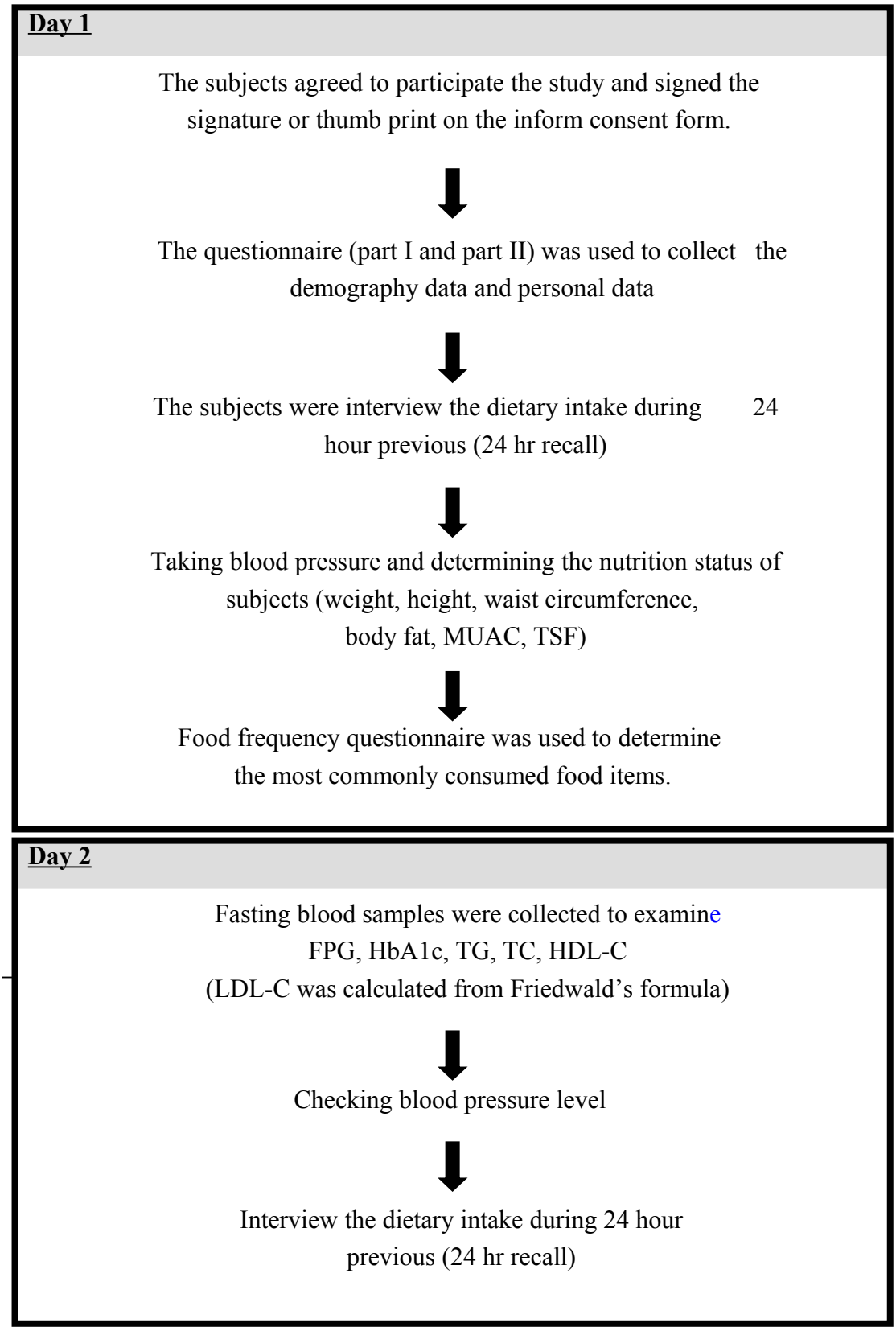

Figure 4: **Process of Evaluation the Subject's Nutritional Status**

4.3.2 Determination of Nutritional Status among Type 2 Diabetes

Ninety two subjects with type 2 diabetes aged 38-80 years old were recruited from 5 health stations and 1 primary health care unit in Doi Tung development project area as mentioned before. The details of the study were explained to each subject by trained interpreters in each ethnic. Informed consent was obtained by signature or thumb print from all the subjects when the subjects agreed to participate in the study. The subjects were interviewed for demographic information, personal history, socioeconomic status, medical history and physical activity by using the questionnaire. All interviews were conducted by researcher and trained interpreters assisted in translating the questions. Afterward the subjects were assessed their nutritional status as follows:

A. Anthropometric Measurement

- **Body Composition Monitor**

The Omron Karada Scan Body Composition Monitor with Scale, Model HBF 362 was used to measure weight, body fat and other body composition of subjects in the study. The measurement of body composition was taken according to instruction manual of the Omron HBF-362 (84). Subjects wore light clothing and stood on barefoot. Each heel of subjects is positioned on the main unit heel electrode and the arm extend straight 90° angle to the body. Subjects do not step on the display area of the main unit during measurement and may step off the unit after measurement complete.

- **Height**

The height was measured in centimeter to the nearest 0.5 cm. by using stadiometer instrument, developed by the Institute of Nutritional, Mahidol University. Standing height was measured in a relaxed position barefoot (without shoes) and stood straight with head in horizontal platform**.** The subjects should be standing on knees straight, back straight and feet together. Moreover the shoulder blades, buttocks and heels were touching measurement board and arm at sides.

- **Body Mass Index (BMI)**

BMI is defined as the weight in kilograms divided by the square of the height in metres (BMI = weight/height, expressed in kg/m^2). This study used the results from the calculation of Omron HBF-362 that following BMI definition to indicate ration between weight and height of a person. BMI value was interpreted with BMI cut-off level of the Asia-Pacific perspective, WHO as given in table 3.

- **Waist Circumference**

Waist circumference was measured in centimeter by using a tape measure at the nearest 0.1 cm. Subjects were measured 2 positions that are passing horizontally at the navel and taken midway between the inferior margin of the last rib and the crest of the ilium in a horizontal plane. Mean values of the results were used as final waist circumference. The criteria of waist circumference for Asian adults are shown in table 4.

- **Triceps Skinfold Thickness (TSF)**

Triceps skinfold was measured in millimeter on the left arm of the study subjects by using Holtain skinfold thickness calipers. The study subjects stand straight with shoulders relaxed and arms hanging freely at the sides. The principal of triceps skinfold measurement was taken over the triceps muscle at the marked mid point between the acromion and the olecranon process of the back of the left upper arm. Three repeat measurements were taken to the nearest 0.5 mm. Mean values of three results were used as final Triceps skinfold. The average TSF value was calculated as formula shown below and compare with the criteria in table 5. %standard TSF = (measure TSF/ standard TSF) $\times$ 100.

- **Mid-Upper-Arm Circumference (MUAC)**

Mid-upper-arm circumference was measured in centimeter on the left arm of study subjects by using a simple tape measure. The subjects stand straight and sideways to measure with the left arm hanging relaxed and remove or rolled up a sleeved garment. The study subjects were measured MUAC at the midpoint between the acromion process and the tip of olecranon. Measurements were recorded to the nearest 0.1 cm. The average MAMC value was calculated as formula shown below and compare with the criteria in table 6. MAMC = MUAC - ($\pi \times$ TSF).

B. Blood Pressure Measurement

Blood pressure was measured in millimeter of mercury (mmHg) by using the Terumo automatic digital sphygmomanometer after the subjects have been at rest for at least 5 minutes. Measurement of blood pressure was taken twice on the left arm and the average of the two measurements was used for analysis. The cutoff level for blood pressure was based on the Seventh Report of the Joint National Committee, as shown in table 9.

C. Biochemical Determination

Blood samples were collected in the morning after the subjects had fasted for 10-12 hours. The blood samples were stored in a cool box and directly transport to the Department of Medical Laboratory, Maechan Hospital for the analysis of glycolated hemoglobin (HbA_{1c}), total cholesterol (TC), triglycerides (TG), and HDL cholesterol (HDL-C). LDL cholesterol (LDL-C) was obtained from formula calculation.

- **Glycemic Control Parameters**

Fasting Plasma Glucose was measured by using One Touch Ultra 2 glucometer from LifeScan, Inc. The procedure of blood glucose test was taken according to the instruction of glucometer. HbA_{1c} was examined by Turbidimetric Inhibition Immunoassay (TINIA) method. The recommendation of glycemic control for diabetic adults is shown in table 10.

- **Serum Lipid Profiles**

Total cholesterol, triglyceride, and HDL cholesterol were analyzed by using enzymatic method, colorimetric method and homogeneous enzymatic colorimetric assay. LDL cholesterol was calculated by using Friedwald's formula (LDL-C = TC – HDL-C – TG/5), when the triglyceride levels were lower than 400 mg/dl. The criteria of lipid control for diabetic adults are shown in table 11.

D. Assessment of Dietary Intake

The dietary intake of each subject was assessed by using 24 hour dietary recall. The study subjects were recalled twice a week including weekday and weekend day. The average dietary intake was calculated. The food models, measuring cups and spoons were used to assist the accurate estimate of portion sizes consumed. The dietary data was recorded in a 24 hour dietary intake form and inputted to Inmucal - Nutrients program WD.2 versions for analyzing the nutrient intake of each person including carbohydrate, protein, fat, cholesterol, fiber, sugar and sodium. Average of daily dietary intake base on the recommendation of ADA as shown in figure 1.

The dietary intake was analyzed by mainly using Inmucal - Nutrients program WD.2 versions. If some food items was not assembled in the food composition database of Inmucal program**,** the researcher referred to the nutritional value of food item from the Nutritive Value of Thai Food, 2005 (100) and the Cholesterol and Fatty acid of Thai Food, 2002 (101) Department of Nutrition, Ministry of Public Health.

4.3.3 Determination of Local Foods Consumption and Most Frequently Consumed Local Food Items among Type 2 Diabetes

The subjects were asked about the frequency of food items they usually consumed for 2 months by using food frequency questionnaire. The photographs were used to assist the respondent visualize of local food items consumed. Food frequency data was calculated and presented in percentage.

The subjects of most commonly consumed food items were inquired from 3 housewives in each ethnic group. The recipes were analyzed for nutritional values by using the Inmucal - Nutrients program WD.2 versions. If some food item was not assembled in the food composition database of Inmucal program**,** the food sample was sent to analyze at the food laboratory, Institute of Nutritional Mahidol University. The flow chart of determination of the nutritional values in the most commonly consumed local food recipes was shown in figure 5.

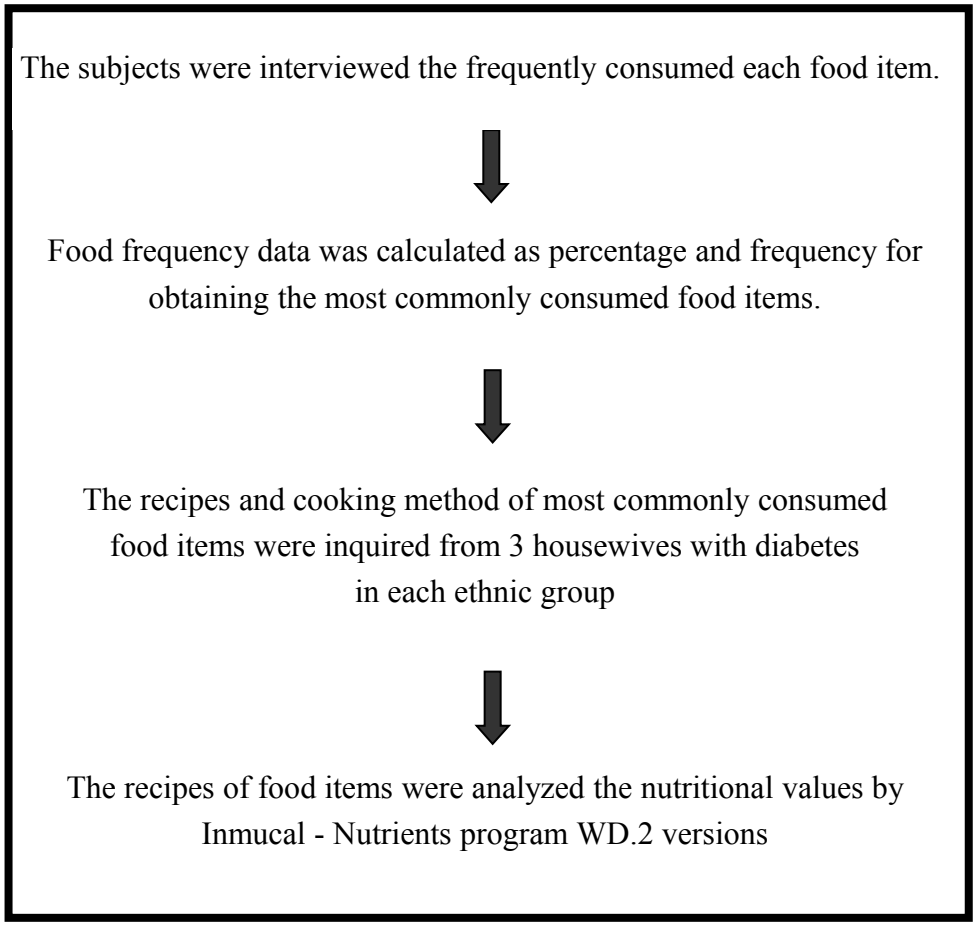

Figure 5: Flow chart of determination of the nutritional values in the most commonly consumed local food recipes

4.4 Statistic Analysis

The data were collected in a Microsoft Excel file 2003 before being analyzed the statistic by using the Statistical Package for Social Sciences (SPSS) version 13.0 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics such as frequency, percent, mean and standard deviation were used for analysis.

- Demographic data, baseline characteristics and health status of study subjects were reported as frequency, percent, mean and standard deviation separately for each ethnic group.
- Data of nutrition status in the subjects were expressed as frequency, percent, mean and standard deviation regarding to ethnics.
- Data of the most commonly consumed food items among study subjects were presented as frequency and percent.

CHAPTER V
RESULTS

This chapter showed the results of the cross-sectional study between November 2008 to July 2009 which is presented in 3 parts including general characteristics, the nutritional status, and the most commonly consumed food items of subjects with type 2 diabetes. The result of study was revealed from 92 study subjects in Doi Tung Development area. Whereas the determination of laboratory data was examined among 80 study subjects due to not agree for blood drawing.

Ninety-two subjects were enrolled in the study with a half of all subjects from Huai Nam Khun health station, while 26.1%, 8.7%, 5.4%, 4.3%, and 4.3% of subjects were from Doi Tung Queen Sirikit Health Center, Pa Yang health station, Sa Makkhi Mai health station, Pha Mi health station and Pha Hi health station, respectively. Table 14 shows the different ethnics of study subjects in each health station/primary health care unit. The study population had various ethnics background which comprised of 32.6% Akha, 22.8% Lahu, 15.2% Tai Yai, 14.1% Haw, 9.8% Lawa, and 5.4% Tai Lue.

Table 14 Subjects' Ethnics in each Health Station/ Primary Health Care Unit

Characteristics		Total N (%)	Male N (%)	Female N (%)
	Total	**92 (100.0)**	**17 (18.5)**	**75 (81.5)**
Ethnics	Tai Yai (ไทใหญ่)	14 (15.2)	2 (11.8)	11 (14.7)
	Tai Lue (ไทลื้อ)	5 (5.4)	1 (5.9)	5 (6.7)
	Lawa (ลัวะ)	9 (9.8)	2 (11.8)	7 (9.3)
	Haw (จีนฮ่อ)	13 (14.1)	2 (11.8)	11 (14.7)
	Lahu (ลาหู่)	21 (22.8)	5 (29.4)	16 (21.3)
	Akha (อาข่า)	30 (32.6)	5 (29.4)	25 (33.3)

Table 14 Subjects' Ethnics in each Health Station/ Primary Health Care Unit (cont.)

Characteristics	Total N (%)	Male N (%)	Female N (%)
Health Stations/Primary Health Care Unit (สถานีอนามัย/หน่วยบริการสุขภาพปฐมภูมิ)			
Total	**92 (100.0)**	**17 (18.5)**	**75 (81.5)**
• **Huai Nam Khun (สถานีอนามัยห้วยน้ำขุ่น)**	**47 (51.1)**	**8 (47.1)**	**39 (52.0)**
Tai Yai (ไทใหญ่)	14 (29.8)	2 (11.8)	11 (14.7)
Tai Lue (ไทลื้อ)	5 (10.6)	1 (5.9)	5 (6.7)
Lawa (ลัวะ)	9 (19.1)	2 (11.8)	7 (9.3)
Haw (จีนฮ่อ)	13 (27.7)	2 (11.8)	11 (14.7)
Lahu (ลาหู่)	3 (6.4)	1 (5.9)	2 (2.6)
Akha (อาข่า)	3 (6.4)	0	3 (4.0)
• **Doi Tung Queen Sirikit Health Center (สถานีอนามัยเฉลิมพระเกียรติฯ ดอยตุง)**	**24 (26.1)**	**7 (41.2)**	**17 (22.7)**
Lahu (ลาหู่)	14 (58.3)	3 (17.7)	11 (14.7)
Akha (อาข่า)	10 (41.7)	4 (23.5)	6 (8.0)
• **Sa Makkhi Mai (สถานีอนามัยสามัคคีใหม่)**	**5 (5.4)**	**0**	**5 (6.7)**
Lahu (ลาหู่)	1 (20.0)	0	1 (1.3)
Akha (อาข่า)	4 (80.0)	0	4 (5.4)
• **Pa Yang (สถานีอนามัยป่ายาง)**	**8 (8.7)**	**0**	**8 (10.7)**
Lahu (ลาหู่)	2 (25.0)	0	2 (2.7)
Akha (อาข่า)	6 (75.0)	0	6 (8.0)
• **Pha Mi (สถานีอนามัยผาหมี)**	**4 (4.3)**	**1 (5.9)**	**3 (4.0)**
Akha (อาข่า)	4 (100.0)	1 (5.9)	3 (4.0)
• **Pha Hi (สถานีอนามัยผาฮี้)**	**4 (4.3)**	**1 (5.9)**	**3 (4.0)**
Lahu (ลาหู่)	1 (25.0)	1 (5.9)	0
Akha (อาข่า)	3 (75.0)	0	3 (4.0)

5.1 General Characteristics of People with Type 2 Diabetes

The characteristics of 92 study population were presented in table 15 and table 16 presented general characteristics of subjects with different ethnic groups. Age of the subjects ranged from 38 to 80 years and the mean age was 59.4 years. Most study subjects (62.0%) aged between 45-64 years, whereas 31.5% aged ≥ 65 years. The mean age of subjects from Tai Lue was 71.2 years. Approximately eighty-two percent of the subjects were female. Seventy percent of the subjects were Buddhism and 31.5% were Christian, whereas 23.3% of subjects with Akha worship in spirit and ancestors. The majority of study subjects were married (70.7%) and living with their family (96.7%). Ninety-four percent of the subjects are uneducated. Fifty-four percent of subjects were unemployed 54.3% and 68.5 % of them had income between 2,000 - 6,000 baht/month.

Table 15 General characteristics of 92 people with type 2 diabetes in Doi Tung Development Project area, Mae Fah Luang, Chiang Rai

	Characteristics	Total (92) N (%)	Male (17) N (%)	Female (75) N (%)
	Total	**92 (100.0)**	**17 (18.5)**	**75 (81.5)**
Age (years)	20 - 44	6 (6.5)	0	6 (8.0)
	45 - 64	56 (60.9)	11 (64.7)	45 (60.0)
	≥ 65	30 (32.6)	6 (35.3)	24 (32.0)
	Mean ± SD	59.4 ± 9.8	61.8 ± 10.3	58.8 ± 9.7
Religion	Buddhism	56 (60.9)	9 (52.9)	47 (62.7)
	Christian	29 (31.5)	7 (41.2)	22 (29.3)
	Other	7 (7.6)	1 (5.9)	6 (8.0)
Marital status	Single	2 (2.2)	0	2 (2.7)
	Married	65 (70.7)	15 (88.2)	50 (66.7)
	Widowed	23 (25.0)	2 (11.8)	21 (28.0)
	Divorced	2 (2.2)	0	2 (2.7)
Living status	Living alone	3 (3.3)	0	3 (4.0)
	Living with family	89 (96.7)	17 (100.0)	72 (96.0)

Table 15 General characteristics of 92 people with type 2 diabetes in the Doi Tung Development Project area, Mae Fah Luang, Chiang Rai (cont.)

Characteristics		Total (92) N (%)	Male (17) N (%)	Female (75) N (%)
Education	None	87 (94.6)	14 (82.4)	73 (97.3)
	Elementary	4 (4.4)	3 (17.7)	1 (1.3)
	Bachelor degree	1 (1.1)	0	1 (1.3)
Occupation	None	50 (54.3)	7 (41.2)	43 (57.3)
	Agriculturer	29 (31.5)	8 (47.1)	21 (28.0)
	Merchandiser	4 (4.3)	0	4 (5.3)
	Laborer/Employee	8 (8.7)	2 (11.8)	6 (8.0)
	Government employee	1 (1.1)	0	1 (1.3)
Household income	< 2,000	12 (13.0)	1 (5.9)	11 (14.7)
(baht/month)	2,000 - 6,000	63 (68.5)	13 (76.5)	50 (66.7)
	6,001 - 10,000	8 (8.7)	1 (5.9)	7 (9.3)
	> 10,000	9 (9.8)	2 (11.8)	7 (9.3)

Table 16 General characteristics of 92 subjects with different ethnic groups in Doi Tung Development Project area

Variables		Number (%)					
		Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
Age, years (Mean ± SD)		62.0 ± 7.4	71.2 ± 11.3	59.9 ± 8.4	60.3 ± 6.2	57.8 ± 10.9	56.8 ± 10.1
Age, years	20 - 44	0	0	0	0	4 (19.0)	2 (6.7)
	45 - 64	8 (57.1)	1 (20.0)	4 (44.4)	9 (69.2)	13 (61.9)	21 (70.1)
	≥ 65	6 (42.9)	4 (80.0)	5 (55.6)	4 (30.8)	4 (19.0)	7 (23.3)
Sex	Male	3 (21.4)	0	2 (22.2)	5 (38.5)	5 (23.8)	5 (16.7)
	Female	11 (78.6)	5 (100.0)	7 (77.8)	8 (61.5)	16 (76.2)	25 (83.3)
Religion	Buddhism	14 (100.0)	5 (100.0)	9 (100.0)	13 (100)	6 (28.6)	9 (30.0)
	Christian	0	0	0	0	15 (71.4)	14 (46.7)
	Other	0	0	0	0	0	7 (23.3)
Marital status	Single	0	0	0	1 (7.7)	0	1 (3.3)
	Married	9 (64.3)	2 (40.0)	8 (88.9)	6 (46.2)	17 (81.0)	23 (76.7)
	Widowed	5 (35.7)	3 (60.0)	1 (11.1)	4 (30.8)	4 (19.0)	6 (20.0)
	Divorced	0	0	0	2 (15.4)	0	0
Living status	Living alone	0	1 (20.0)	0	0	0	2 (6.7)
	Living with family	14 (100.0)	3 (80.0)	9 (100.0)	14 (100.0)	21 (100.0)	27 (93.3)

Table 16 General characteristics of 92 subjects with different ethnic groups in Doi Tung Development Project area (cont')

Variables	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
Education						
None	13 (92.9)	5 (100.0)	8 (88.9)	13 (100.0)	19 (90.5)	29 (96.7)
Elementary	1 (7.1)	0	1 (11.1)	0	1 (4.8)	1 (3.3)
Bachelor degree	0	0	0	0	1 (4.8)	0
Occupation						
None	7 (50.0)	5 (100.0)	5 (55.6)	12 (92.3)	15 (71.4)	6 (20.0)
Agriculturer	3 (21.4)	0	3 (33.3)	1 (7.7)	3 (14.3)	19 (63.3)
Merchandiser	1 (7.1)	0	0	0	1 (4.8)	2 (6.7)
Laborer/Employee	3 (21.4)	0	1 (11.1)	0	1 (4.8)	3 (10.0)
Government employee	0	0	0	0	1 (4.8)	0
Household income (baht/month)						
< 2,000	0	2 (40.0)	3 (33.3)	1 (7.7)	1 (4.8)	5 (16.7)
2,000 - 6,000	13 (92.9)	2 (40.0)	5 (55.6)	10 (76.9)	16 (76.2)	17 (56.7)
6,001 - 10,000	1 (7.1)	1 (20.0)	0	1 (7.7)	3 (14.3)	2 (6.7)
> 10,000	0	0	1 (11.1)	1 (7.7)	1 (4.8)	6 (20.0)

Lifestyle characteristics of 92 study population are given in table 17. Lifestyle characteristics of 92 study population showed 9.8% of the study subjects were current smokers, meanwhile a regular alcohol drinking was observed in 8.7% of the study subjects. The majority of study population did not drink coffee (96.7%), fruit juice (84.8%) and carbonate beverage (87.0%), while 45.7% of all subjects drink tea regularly. All study subjects never add sugar in food before eating, while five percent of subjects are usually add fish sauce before meal. Eighty-eight percent of study subjects have never reduced weight as normal range. Fifty four percent of study subjects did not exercise, whereas 44.6% of study subjects exercised by walking as the mean frequency of exercise was 3.1 ± 2.6 days per week. The majority of study subjects (63.4%) who exercised spent time for exercise more than 5 days per week, and sixty six percent of subjects exercised 20-60 minutes per day. The mean duration of exercise was 23.9 ± 9.7 minutes per day.

Table 18 showed the lifestyle characteristic of 92 people with type 2 diabetes according to ethnics group. The study subjects with Tai Lue and Lawa were non smokers, while 7.1, 7.7, 9.5, 16.7 percent of study subjects with Tai Yai, Haw, Lahu, and Akha were current smokers, respectively. The study subjects with 14.2% Tai Yai, 20.0% Tai Lue, 22.2% Lawa, 7.7% Haw, and 6.7% Akha were drinking alcohol, respectively. The study subjects with Akha (63.3% of all Akha) drink tea more than other ethnic groups. Moreover, 7.1, 11.1, and 10.0 percent of study subjects with Tai Yai, Lawa, and Akha respectively, added fish sauce in food before eating.

This study found forty-four percent of study subjects had physical activity, including 11 Tai Yai, 1 Tai Lue, 8 Lawa, 12 Haw, 6 Lahu, and 3 Akha. Whereas most of study subjects with Tai Lue (80.0%), Lahu (70.0%), and Akha (90.0%) did not have physical activity or exercise. All study subjects with Akha who had physical activity spent 3-5 days/week for physical activity, whereas 72.7% Tai Yai, 100.0% Tai Lue, 66.7% Lahu and 66.7% Akha had physical activity more than 5 days/week. For duration of physical activity, most of study subjects with Tai Lue, Lawa, Lahu spent less than 20 minutes/day, while majority of study subjects with Tai Yai (63%) spent 20-60 minutes/day.

Table 17 Lifestyle characteristic of 92 people with type 2 diabetes

Characteristics		Total (92) N (%)	Male (17) N (%)	Female (75) N (%)
Current smoking	Smoke	9 (9.8)	3 (17.6)	6 (8.0)
	Not-smoke	83 (90.2)	14 (82.4)	69 (92.0)
Current alcohol - drinking	Drink	8 (8.7)	2 (11.8)	6 (8.0)
	Not-drink	84 (91.3)	15 (88.2)	69 (92.0)
Coffee	Drink	3 (3.3)	2 (11.8)	1 (1.3)
	Not-drink	89 (96.7)	15 (88.2)	74 (98.7)
Tea	Drink	42 (45.7)	9 (53.0)	33 (43.9)
	Not-drink	50 (54.3)	8 (47.1)	42 (56.0)
Carbonate drink	Drink	12 (13.1)	2 (11.8)	10 (13.3)
	Not-drink	80 (87.0)	15 (88.2)	65 (86.7)
Fruit juice	Drink	14 (15.2)	1 (5.9)	13 (17.3)
	Non-drink	78 (84.8)	16 (94.1)	62 (82.7)
Herb juice	Drink	29 (31.6)	5 (29.4)	24 (32.0)
	Not-drink	80 (87.0)	12 (70.6)	51 (68.0)
Adding sugar in - food before eating	Yes	0	0	0
	No	92 (100.0)	17 (100.0)	75 (100.0)
Adding fish sauce in- food before eating	Yes	5 (5.4)	1 (5.9)	4 (5.3)
	No	87 (94.6)	16 (94.1)	71 (94.7)
Reduce weight	Yes	11 (12.0)	0	11 (14.7)
	Never	81 (88.0)	17 (100.0)	64 (85.3)
Physical activity	Yes	41 (44.6)	8 (47.1)	33 (44.0)
	No	50 (54.3)	9 (52.9)	41 (54.7)

Table 17 Lifestyle characteristic of 92 people with type 2 diabetes (cont.)

Characteristics		Total (92) N (%)	Male (17) N (%)	Female (75) N (%)
Frequency of physical activity	< 3 days/week	2 (4.9)	0	2 (6.1)
	3-5 days/week	13 (31.7)	2 (25.0)	11 (33.3)
	> 5 days/week	26 (63.4)	6 (75.0)	20 (60.6)
	Mean ± SD	3.1 ± 2.6	3.3 ± 2.9	3.0 ± 2.5
Duration of physical activity	< 20 minutes/day	14 (34.1)	3 (37.5)	11 (33.3)
	20-60 minutes/day	26 (63.4)	5 (62.5)	22 (66.7)
	> 60 minutes/day	1 (2.4)	0	0
	Mean ± SD	23.9 ± 9.7	23.7 ± 8.8	23.9 ± 9.9

Table 18 Lifestyle characteristic of 92 people with type 2 diabetes, according to 6 ethnics

Variables		Number (%)					
		Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Current smoking							
	Smoke	1 (7.1)	0	0	1 (7.7)	2 (9.5)	5 (16.7)
	Not-smoke	13 (92.9)	5 (100.0)	9 (100.0)	12 (92.3)	19 (90.5)	25 (83.3)
Current alcohol drinking							
	Drink	2 (14.2)	1 (20.0)	2 (22.2)	1 (7.7)	0	2 (6.7)
	Not-drink	12 (85.7)	4 (80.0)	7 (77.8)	12 (92.3)	21 (100.0)	28 (93.3)
Coffee	Drink	0	0	0	1 (7.7)	1 (4.8)	1 (3.3)
	Not-drink	14 (100.0)	5 (100.0)	9 (100.0)	12 (92.3)	20 (95.2)	29 (96.7)
Tea	Drink	1 (7.1)	2 (40.0)	2 (22.2)	8 (61.6)	9 (42.9)	20 (63.3)
	Not-drink	13 (92.9)	3 (60.0)	7 (77.8)	5 (38.5)	12 (57.1)	10 (33.3)
Carbonate drink							
	Drink	0	0	0	1 (7.7)	7 (33.4)	4 (13.3)
	Not-drink	14 (100.0)	5 (100.0)	9 (100.0)	12 (92.3)	14 (66.7)	26 (86.7)
Fruit juice							
	Drink	3 (21.4)	0	1 (11.1)	2 (15.4)	2 (9.6)	6 (20.0)
	Not-drink	11 (78.6)	5 (100.0)	8 (88.9)	11 (84.6)	19 (90.5)	24 (80.0)

Table 18 Lifestyle characteristic of 92 people with type 2 diabetes, according to 6 ethnics (cont.)

Variables	Number (%)					
	Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Herb juice						
Drink	6 (42.8)	2 (40.0)	6 (66.7)	1 (7.7)	2 (9.5)	12 (40.0)
Not-drink	8 (57.1)	3 (60.0)	3 (33.3)	12 (92.3)	19 (90.5)	18 (60.0)
Adding sugar in food before eating						
Yes	0	0	0	0	0	0
No	14 (100)	5 (100.0)	9 (100.0)	13 (100.0)	21 (100.0)	30 (100.0)
Adding fish sauce in food before eating						
Yes	1 (7.1)	0	1 (11.1)	0	0	3 (10.0)
No	13 (92.9)	5 (100.0)	8 (88.9)	13 (100.0)	21 (100.0)	27 (90.0)
Reduce weight						
Yes	5 (35.7)	0	1 (11.1)	0	2 (9.5)	3 (10.0)
Never	9 (64.3)	5 (100.0)	8 (88.9)	13 (100.0)	19 (90.5)	27 (90.0)
Physical activity						
Yes	11 (78.6)	1 (20.0)	8 (88.9)	12 (92.3)	6 (30.0)	3 (10.0)
No	3 (21.4)	4 (80.0)	1 (11.1)	1 (7.7)	14 (70.0)	27 (90.0)

Table 18 Lifestyle characteristic of 92 people with type 2 diabetes, according to 6 ethnics (cont.)

Variables	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
Frequency of physical activity						
< 3 days/week	1 (9.1)	0	0	0	0	0
3-5 days/week	2 (18.2)	0	4 (50.0)	4 (33.3)	2 (33.3)	3 (100.0)
> 5 days/week	3 (72.7)	1 (100.0)	4 (50.0)	8 (66.7)	4 (66.7)	0
Duration of physical activity						
< 20 minutes/day	4 (36.4)	1 (100.0)	5 (62.5)	0	4 (66.7)	1 (33.3)
20-60 minutes/day	7 (63.6)	0	3 (37.5)	12 (100.0)	2 (33.3)	1 (33.3)
> 60 minutes/day	0	0	0	0	0	1 (33.3)

Disease status and treatment among 92 study subjects is presented in table 19. Data of disease status and treatment of 92 study subjects according to different ethnic groups are shown in table 20. The mean duration of diabetes was 4.9 ± 4.0 years. Family history of diabetes was 17.5% of the study subjects. Forty four percent of subjects had no complication, whereas 17.6%, 16.5%, 2.2%, and 2.2% of the subjects had dyslipidemia, hypertension, cardiovascular, and other disease, respectively. Ninety-seven percent of subjects were treated diabetes by taking hypoglycemic agent and diet control, meanwhile 12% of the subjects use the decoction for control their blood glucose. Ninety three percent of subjects had ever received the nutritional knowledge for glycemic control from a public health professional.

The majority of study subjects (55%) from Lawa had diabetes more than 5 years, whereas most subjects from Tai Yai, Tai Lue, Haw, Lahu and Akha had diabetes 1-5 years. The study subjects with 14.3% of Tai Yai, 11.1% of Lawa, 30.8% of Haw, 28.6% of Lahu, 10.0% of Akha had family history of diabetes, while study subjects with Tai Lue had no history of diabetes in their family.

Table 19 Disease status and treatment of 92 study subjects

Characteristics	Total (92) N (%)	Male (17) N (%)	Female (75) N (%)
Diabetes duration			
< 1 years	5 (5.5)	1 (5.9)	4 (5.4)
1 - 5 years	59 (64.8)	11 (64.7)	48 (64.9)
> 5 years	27 (29.7)	5 (29.4)	22 (29.7)
Mean ± SD	4.9 ± 4.0	5.3 ± 5.2	4.8 ± 3.7
Family history of diabetes			
Unknown	18 (19.6)	3 (17.6)	15 (20.0)
No	58 (63.0)	9 (52.9)	49 (65.3)
Yes	16 (17.5)	5 (29.4)	11 (14.7)

Table 19 Disease status and treatment of 92 study subjects (cont.)

Characteristics	Total (92) N (%)	Male (17) N (%)	Female (75) N (%)
Medical problem history			
Not-complication	40 (44.0)	9 (52.9)	31 (41.9)
Dyslipidemia	16 (17.6)	2 (11.8)	14 (18.9)
Hypertension	15 (16.5)	3 (17.6)	12 (16.2)
Cardiovascular	2 (2.2)	0	2 (2.7)
Dyslipidemia and Hypertension	10 (10.9)	1 (5.9)	9 (12.2)
Hypertension and Cardiovascular	2 (2.2)	0	2 (2.2)
Cardiovascular and Dyslipidemia	1 (1.1)	1 (5.9)	0
Dyslipidemia, Hypertension and-Cardiovascular	3 (3.3)	1 (5.9)	2 (2.7)
Other	2 (2.2)	0	2 (2.2)
Diabetes treatment			
Diet control	2 (2.2)	0	2 (2.6)
Drug use with diet control	90 (97.8)	17 (100.0)	73 (97.3)
Decoction and herb using			
Never using	76 (82.6)	15 (88.2)	61 (81.3)
Ex - using	5 (5.4)	1 (5.9)	4 (5.3)
Current - using	11 (12.0)	1 (5.9)	10 (13.3)
Receiving nutritional knowledge for glycemic control			
No	6 (6.5)	1 (5.9)	5 (6.7)
Yes	86 (93.5)	16 (94.1)	70 (93.3)

Table 20 Disease status and treatment of 92 study subjects, according to 6 ethnics

Variables	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
Diabetes duration, mean ± SD (years)	5.4 ± 2.6	4.4 ± 2.3	5.4 ± 2.7	5.8 ± 6.0	4.9 ± 3.1	4.1 ± 4.6
< 1 years	1 (7.1)	0	0	1 (7.7)	1 (4.8)	2 (6.7)
1 - 5 years	7 (50.0)	4 (80.0)	4 (44.4)	9 (69.2)	12 (57.1)	23 (76.7)
> 5 years	6 (42.9)	1 (20.0)	5 (55.6)	3 (23.1)	8 (38.1)	5 (16.7)
Family history of diabetes						
Unknown	1 (7.1)	1 (20.0)	1 (11.1)	1 (7.7)	4 (19.0)	10 (33.3)
No	11 (78.6)	4 (80.0)	7 (77.8)	8 (61.5)	11 (52.4)	17 (56.7)
Yes	2 (14.3)	0	1 (11.1)	4 (30.8)	6 (28.6)	3 (10.0)
Medical problem history						
Not-complication	7 (50.0)	3 (60.0)	4 (44.4)	4 (30.8)	7 (33.3)	16 (53.3)
Dyslipidemia	3 (21.4)	1 (20.0)	4 (44.4)	2 (15.4)	3 (14.3)	4 (13.3)
Hypertension	4 (28.6)	0	0	2 (15.4)	5 (23.8)	3 (10.0)
Cardiovascular	0	0	0	1 (7.7)	0	1 (3.3)
Dyslipidemia and Hypertension	0	1 (20.0)	1 (11.1)	0	4 (19.0)	4 (13.3)
Hypertension and Cardiovascular	0	0	0	1 (7.7)	1 (4.8)	0

Table 20 Disease status and treatment of 92 study subjects, according to 6 ethnics (cont.)

Variables	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
Medical problem history (cont.)						
Cardiovascular and Dyslipidemia	0	0	0	1 (7.7)	0	0
Dyslipidemia, Hypertension and-Cardiovascular	0	0	0	2 (15.4)	0	1 (3.4)
Others	0	0	0	0	1 (4.8)	1 (3.4)
Diabetes treatment						
Diet control	0	0	0	0	0	1 (3.3)
Drug use with diet control	14 (100.0)	5 (100.0)	9 (100.0)	13 (100.0)	21 (100.0)	29 (96.7)
Decoction and herb using						
Never using	12 (85.7)	5 (100.0)	7 (77.8)	12 (92.3)	18 (85.7)	22 (73.3)
Ex - using	1 (7.1)	0	0	0	2 (9.5)	2 (6.7)
Current - using	1 (7.1)	0	2 (22.2)	1 (7.7)	1 (4.8)	6 (20.0)
Receiving nutritional knowledge for glycemic control						
No	2 (14.3)	1 (20.0)	0	0	2 (9.5)	1 (3.3)
Yes	12 (85.7)	4 (80.0)	9 (100.0)	13 (100.0)	19 (90.5)	29 (96.7)

5.2 Nutritional Status of People with Type 2 Diabetes

5.2.1 **Anthropometry and Blood Pressure**

The nutritional status of 92 study subjects based on the anthropometric measurement, body composition, and blood pressure are reported in table 21. The majority of study population (85.0%) was classified as overweight and obesity. A total of 61 obese subjects (66.4%) included 51 women and 10 men had BMI ≥ 25 kg/ m^2. Whereas 17 study subjects (18.5%), 3 men and 14 women were classified as overweight. Ninety percent of subjects had the waist circumference higher than WHO criteria level for Asians. The percentage of male and female subjects who had the waist circumference higher than cutoff value was 58.8 and 97.3, respectively.

The mean of mid-arm circumference was 33.3 ± 14.4 cm and the mean of triceps skinfold thickness was 19.5 ± 14.4 mm. The bioelectric impedance method was used to analyze the percentage of body fat and visceral fat in 92 study subjects. The mean of body fat was 34.9 ± 6.1 % which a total of 84 subjects (91.4%) had a high percentage of body fat. A comparison of percentage of body fat according to gender was found that 88.3 % of male subjects (15 men) and 92.0% of female subjects (69 women) had a high percentage of body fat. Fifty-nine percent of study subjects had high visceral fat that included a total of 13 were 76.5 and 56.0, respectively.

Twenty-five percent and 46.7% of study subjects had systolic blood pressure level < 120 mmHg and diastolic blood pressure < 80 mmHg. The mean of blood pressure was 131.6 ± 19.8 mmHg in systolic blood pressure and 80.9 ± 11.8 mmHg in diastolic blood pressure. Approximately a half of male subjects and female subjects had poor control of both systolic blood pressure and diastolic blood pressure. A total of 10 male subjects (58.8% of men) and 37 female subjects (49.3% of women) had higher systolic blood pressure than normal level, whereas 10 male subjects (58.8% of men) and 39 female subjects (52.0% of women) had higher diastolic blood pressure than normal level.

Table 21 Anthropometric measurement, body composition, and blood pressure among 92 diabetic participants in Doi Tung Development Project area

Variables	Total (92) N (%)	Male (17) N (%)	Female (75) N (%)
BMI (kg/m^2):			
Underweight (< 18.5)	2 (2.2)	2 (11.8)	0 (0)
Normal weight (18.5 - 22.9)	12 (13.0)	2 (11.8)	10 (13.3)
Overweight (23.0 - 24.9)	17 (18.5)	3 (17.6)	14 (18.7)
Moderate obesity (25.0 - 29.9)	42 (45.7)	6 (35.3)	36 (48.0)
Severe obesity (≥ 30.0)	19 (20.7)	4 (23.5)	15 (20.0)
Mean ± SD	26.8 ± 4.0	25.9 ± 4.9	26.9 ± 3.8
Waist circumference [a] (cm):			
Normal value	9 (9.8)	7 (41.2)	2 (2.7)
Higher than cutoff value	83 (90.2)	10 (58.8)	73 (97.3)
Mean ± SD	-	92.4 ± 13.5	95.4 ± 8.6
Mid Arm Muscle Circumference [b] (cm):			
Lower than cutoff value	34 (37.0)	2 (11.8)	32 (42.7)
Higher than cutoff value	58 (63.0)	15 (88.2)	43 (57.3)
Mean ± SD	-	30.3 ± 17.7	26.5 ± 14.0
Triceps skinfold [b] (mm):			
Lower than cutoff value	24 (26.1)	6 (35.3)	18 (24.0)
Higher than cutoff value	68 (73.9)	11 (64.7)	57 (76.0)
Mean ± SD	-	14.1 ± 5.6	20.7 ± 6.7
Percentage of body fat [c] (%):			
Normal value	8 (8.7)	2 (11.8)	6 (8.0)
High body fat	19 (20.7)	2 (11.8)	17 (22.7)
Very high body fat	65 (70.7)	13 (76.5)	52 (69.3)
Mean ± SD	34.9 ± 6.1	27.1 ± 6.1	36.7 ± 4.5

Table 21 Anthropometric, body composition, and blood pressure data according to sex among 92 diabetic participants in Doi Tung Development Project area

Variables	Total (92) N (%)	Male (17) N (%)	Female (75) N (%)
Visceral fat level [d] :			
Normal value (< 9 level)	37 (40.2)	4 (23.5)	33 (44.0)
High visceral fat (10-14 level)	32 (34.8)	6 (35.3)	26 (34.7)
Very high visceral fat (15-30 level)	23 (25.0)	7 (41.2)	16 (21.3)
Mean ± SD	11.9 ± 5.3	13.5 ± 7.0	11.2 ± 4.7
Blood pressure [e] (mmHg):			
● **Systolic blood pressure (SBP)**			
Normal range (< 120)	23 (25.0)	6 (35.3)	17 (22.7)
Pre-hypertension (120-139)	43 (46.7)	4 (23.5)	39 (52.0)
Stage 1 - Hypertension (140-159)	19 (20.7)	5 (29.4)	14 (18.7)
Stage 2 - Hypertension (> 160)	7 (7.6)	2 (11.8)	5 (6.7)
Mean ± SD	131.6 ± 19.8	132.2 ± 21.3	131.4 ± 19.6
● **Diastolic blood pressure (DBP)**			
Normal range (< 80)	43 (46.7)	7 (41.2)	36 (48.0)
Pre-hypertension (80-89)	29 (31.5)	5 (29.4)	24 (32.0)
Stage 1 - Hypertension (90-99)	14 (15.2)	3 (17.6)	11 (14.7)
Stage 2 - Hypertension (> 100)	6 (6.5)	2 (11.8)	4 (5.3)
Mean ± SD	80.9 ± 11.8	83.4 ± 12.2	80.4 ± 11.8

[a] WHO criteria; waist circumference: male ≤ 90 cm, female ≤ 80 cm (80).

[b] The criteria for MAMC and TSF value are classified by Jelliffe (82); standard MAMC value for male is 23.5 cm and female 23.2 cm; standard TSF value for male is 12.5 mm and female 16.5 mm.

[c] Interpretation of percentage of body fat: normal range M 10.0-19.9, F 20.0-29.9; high body fat M 20.0-24.9, F 30.0-34.9; very high body fat M 25.0-50.0, F 35.0-50.0 (84).

[d] Instruction manual body composition monitor with scale: Model HBF-362 Karada Scanna. Japan: Kyoto (84).

[e] Blood pressure based on the 7th report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure (94).

Anthropometry and blood pressure in 92 study subjects according to 6 ethnic groups is shown in table 22. The percentage of overweight subjects with Tai Yai, Tai Lue, Lawa, Haw, Lahu and Akha were 14.3, 40.0, 22.2, 30.8, 9.5, and 16.7 percent respectively. Whereas 84.3% of Tai Yai, 80.0% of Tai Lue, 66.6% of Lawa, 53.9% of Haw, 66.7% of Lahu and 66.7% of Akha were obese. Ninety three percent of study subjects with Tai Yai, Tai Lue, Lawa, Haw, Lahu and Akha, respectively had the waist circumference higher than cutoff value was 92.9, 100.0, 88.9, 84.6, 95.2 and 86.7, respectively. A comparison of percentage of the body fat according to ethnic groups, it was found that 92.8% of Tai Yai, 100.0% of Tai Lue, 100.0% of Lawa, 92.3% of Haw, 90.6% of Lahu and 86.7% of Akha had the body fat higher than normal level, respectively, whereas the percentage of study subjects with Tai Yai, Tai Lue, Lawa, Haw, Lahu and Akha who had the visceral fat higher than normal range were 57.2, 80.0, 88.9, 69.3, 57.1, and 46.7 percent respectively.

Table 22 Anthropometric data and blood pressure of people with type 2 diabetes according to 6 ethnics

Variable	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
BMI (kg/m^2), Mean ± SD	26.9 ± 3.5	27.2 ± 3.8	28.5 ± 4.7	27.4 ± 4.7	26.8 ± 4.2	25.9 ± 3.6
Underweight (< 18.5)	1 (7.1)	0	0	0	0	1 (3.3)
Normal weight (18.5 - 22.9)	0	0	1 (11.1)	2 (15.4)	5 (23.8)	4 (13.3)
Overweight (23.0 - 24.9)	2 (14.3)	2 (40.0)	2 (22.2)	4 (30.8)	2 (9.5)	5 (16.7)
Moderate obesity (25.0 - 29.9)	9 (64.3)	2 (40.0)	3 (33.3)	3 (23.1)	8 (38.1)	17 (56.7)
Severe obesity (≥ 30.0)	2 (14.3)	1 (20.0)	3 (33.3)	4 (30.8)	6 (28.6)	3 (10.0)
Waist circumference (cm), Mean ± SD 95.6 ± 9.6		101.2 ± 6.5	96.9 ± 11.2	92.7 ± 8.6	96.9 ± 10.6	92.3 ± 9.0
Normal value	1 (7.1)	0	1 (11.1)	2 (15.4)	1 (4.8)	4 (13.3)
Higher than cutoff value	13 (92.9)	5 (100.0)	8 (88.9)	11 (84.6)	20 (95.2)	26 (86.7)
MAMC (% standard), Mean ± SD	162.6 ± 24.9	112.2 ± 17.4	122.5 ± 9.2	118.9 ± 13.1	130.2 ± 67.4	125.4 ± 50.7
Normal nutritional status	14 (100.0)	5 (100.0)	9 (100.0)	13 (100.0)	20 (95.2)	30 (100.0)
Mild malnutrition	0	0	0	0	0	0
Moderate malnutrition	0	0	0	0	1 (4.8)	0
Severe malnutrition	0	0	0	0	0	0

Table 22 Anthropometric data and blood pressure of people with type 2 diabetes according to 6 ethnics (cont.)

Variable	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
Triceps skinfold (% standard), Mean ± SD	120.5 ± 37.3	88.8 ± 42.5	129.7 ± 24.1	137.2 ± 47.3	130.7 ± 49.3	117.5 ± 36.5
Normal nutritional status	11 (78.6)	3 (60.0)	9 (100.0)	11 (84.6)	2 (9.5)	1 (3.3)
Mild malnutrition	2 (14.3)	0	0	0	0	2 (6.7)
Moderate malnutrition	0	0	0	1 (7.7)	0	1 (3.3)
Severe malnutrition	1 (7.1)	2 (40.0)	0	1 (7.7)	19 (90.5)	25 (83.3)
Percentage of body fat (%), Mean ± SD	35.1 ± 7.8	41.0 ± 4.9	36.5 ± 5.8	35.5 ± 7.4	35.1 ± 4.8	32.9 ± 5.3
Normal value	1 (7.1)	0	0	1 (7.7)	2 (9.5)	4 (13.3)
High body fat	1 (7.1)	1 (20.0)	0	3 (23.1)	3 (14.3)	11 (36.7)
Very high body fat	12 (85.7)	4 (80.0)	9 (100.0)	9 (69.2)	16 (76.2)	15 (50.0)
Visceral fat level, Mean ± SD	11.6 ± 4.3	12.6 ± 5.1	14.3 ± 6.3	12.3 ± 5.3	11.9 ± 6.4	10.0 ± 4.3
Normal value (< 9^{th} level)	6 (42.9)	1 (20.0)	1 (11.1)	4 (30.8)	9 (42.9)	16 (53.3)
High visceral fat	6 (42.9)	3 (60.0)	5 (55.6)	5 (38.5)	4 (19.0)	9 (30.0)
Very high visceral fat	2 (14.3)	1 (20.0)	3 (33.3)	4 (30.8)	8 (38.1)	5 (16.7)

Table 22 Anthropometric data and blood pressure of people with type 2 diabetes according to 6 ethnics (cont.)

Variable	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
Systolic blood pressure						
Mean ± SD (mmHg)	140.1 ± 22.2	149.4 ± 34.4	130.1 ± 12.6	143.8 ± 10.9	128.8 ± 19.2	121.7 ± 15.3
Normal range (< 120)	4 (28.6)	1 (20.0)	2 (22.2)	0	4 (19.0)	12 (40.0)
Pre-hypertension (120-139)	3 (21.4)	1 (20.0)	5 (55.6)	5 (38.5)	14 (66.7)	15 (50.0)
Stage 1 - Hypertension (140-159)	4 (28.6)	1 (20.0)	2 (22.2)	7 (53.8)	2 (9.5)	3 (10.0)
Stage 2 - Hypertension (> 160)	3 (21.4)	2 (40.0)	0	1 (7.7)	1 (4.8)	0
Diastolic blood pressure						
Mean ± SD (mmHg)	88.2 ± 11.3	81.0 ± 11.0	79.9 ± 9.8	88.1 ± 10.6	79.3 ± 12.0	75.9 ± 10.6
Normal range (< 80)	3 (21.4)	2 (40.0)	5 (55.6)	4 (30.8)	11 (52.4)	18 (60.0)
Pre-hypertension (80-89)	7 (50.0)	2 (40.0)	3 (33.3)	3 (23.1)	6 (28.6)	8 (26.7)
Stage 1 - Hypertension (90-99)	1 (7.1)	1 (20.0)	0	5 (38.5)	3 (14.3)	4 (13.3)
Stage 2 - Hypertension (> 100)	3 (21.4)	0	1 (11.1)	1 (7.7)	1 (4.8)	0

5.2.2 Biochemical Parameters

The results of biochemical parameters in the study subjects are reported in Table 23. According to the ADA guideline of metabolic control for people with diabetes, the mean of FPG level was 132.3 ± 37.3 mg/dl and 40.2% of subjects had FPG higher than normal range with 6 men and 31 women, whereas the mean of HbA_{1c} was 8.3 ± 1.8 % and 75.0% of subjects (12 men, 48 women) had HbA_{1c} higher than cutoff level. For lipid profiles, the mean of triglycerides, total cholesterol, LDL-C and HDL-C levels were 213.4 ± 177.4, 185.6 ± 44.9, 100.3 ± 34.5, 44.6 ± 12.0 mg/dl, respectively. Fifty six percent of the study subjects had high level of triglyceride, 31.3% had high total cholesterol, and 46.1% high LDL-C, whereas 66.3% of subjects had low HDL-C.

A comparison of triglyceride level according to gender, it was found that 52.9% of male subjects (9 men) and 56.3% of female subjects (39 women) had a high level of triglyceride. Thirty-one point three percent of study subjects had high cholesterol that included a total of 6 men and 19 women. A total of 8 male subjects (53.3% of men) and 27 female subjects (44.3% of women) had higher LDL cholesterol than normal level, whereas 7 male subjects (43.8% of men) and 47 female subjects (73.4% of women) had lower HDL cholesterol than criteria level.

The biochemical markers of 92 study subjects are reported according to ethnic groups are shown in table 24. It was shown that the percentage of study subjects with Tai Yai, Tai Lue, Lawa, Haw, Lahu and Akha who had FPG higher than normal value were 42.9, 40.0, 55.5, 53.8, 33.3 and 33.3, respectively. The study subjects who had HbA_{1c} higher than normal level were 75.0, 75.0, 71.4, 80.0, 77.8, and 72.4 percent of Tai Yai, Tai Lue, Lawa, Haw, Lahu and Akha, respectively. The percentage of study subjects with Tai Lue (75.0%) and Lahu (77.8%) who had high triglyceride level was higher than Tai Yai (41.7%), Lawa (57.1%), Haw (40.0%), and Akha (51.7%) ethnic group. The study subjects who had LDL cholesterol higher than normal level were 72.7% of Tai Yai, 50.0% of Tai Lue, 28.6% of Lawa, 66.7% of Haw, 29.4% of Lahu and 42.9% of Akha, whereas the percentage of study subjects with Tai Yai, Tai Lue, Lawa, Haw, Lahu and Akha who had HDL cholesterol lower than normal range were 50.0, 50.0, 57.1, 60.0, 83.3, and 72.4 percent, respectively.

Table 23 Biochemical parameters according to sex among 80 diabetic participants in Doi Tung Development Project area

Variables	Total (80) N (%)	Male (16) N (%)	Female (64) N (%)
FPG (mg/dl): N = 92 subjects			
Normal value (70 - 130)	55 (59.8)	11 (64.7)	44 (58.7)
Higher than cutoff value (> 130)	37 (40.2)	6 (35.3)	31 (41.3)
Mean ± SD	132.3 ± 37.3	135.4 ± 46.8	131.6 ± 35.2
Minimum value	83.0	86.0	83.0
Maximum value	298.0	255.0	298.0
HbA_{1c} (%)			
Normal value (< 7)	20 (25.0)	4 (25.0)	16 (25.0)
Higher than cutoff value (≥ 7)	60 (75.0)	12 (75.0)	48 (75.0)
Mean ± SD	8.3 ± 1.8	8.1 ± 1.9	8.3 ± 1.8
Minimum value	5.5	5.6	5.5
Maximum value	14.1	12.6	14.1
Triglyceride (mg/dl)			
Normal value (< 150)	35 (43.8)	7 (43.8)	28 (43.8)
Higher than cutoff value (≥ 150)	45 (56.3)	9 (52.9)	36 (56.3)
Mean ± SD	213.4 ± 177.4	203.1 ± 138.2	215.9 ± 186.7
Minimum value	62.0	62.0	65.0
Maximum value	1136.0	613.0	1136.0
Total cholesterol (mg/dl)			
Normal value (< 200)	55 (68.8)	10 (62.5)	45 (70.3)
Higher than cutoff value (≥ 200)	25 (31.3)	6 (37.5)	19 (29.7)
Mean ± SD	185.6 ± 44.9	185.8 ± 39.3	185.6 ± 46.5
Minimum value	109.0	109.0	122.0
Maximum value	377.0	270.0	377.0

Table 23 Biochemical parameters according to sex among 80 diabetic participants in Doi Tung Development Project area (cont.)

Variables	Total (80) N (%)	Male (16) N (%)	Female (64) N (%)
LDL - cholesterol (mg/dl)*			
Normal value (< 100)	41 (53.9)	7 (46.7)	34 (55.7)
Higher than cutoff value (≥ 100)	35 (46.1)	8 (53.3)	27 (44.3)
Mean ± SD	100.3 ± 34.5	98.3 ± 28.7	100.8 ± 36.0
Minimum value	50.0	55.0	50.0
Maximum value	265.0	147.0	265.0
HDL - cholesterol (mg/dl)			
Normal value (M ≥ 40, F ≥ 50)	27 (33.8)	9 (56.3)	17 (26.6)
Lower than cutoff value (M< 40, F< 50)	53 (66.3)	7 (43.8)	47 (73.4)
Mean ± SD	44.6 ± 12.0	46.2 ± 12.4	44.2 ± 12.0
Minimum value	18.0	29.0	18.0
Maximum value	87.0	77.0	87.0

* LDL cholesterol was calculated by using Friedwald's formula (LDL-C = TC – HDL-C – TG/5), when the triglyceride levels were lower than 400 mg/dl. Therefore subjects who had the triglyceride levels higher than 400 mg/dl, LDL cholesterol could not calculate by using Friedwald's formula.

Table 24 Biochemical parameters of 80 people with type 2 diabetes according to 6 ethnics

Variable	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
FPG, Mean ± SD (mg/dl)*	135.7 ± 38.5	132.8 ± 22.1	124.9 ± 17.1	144.5 ± 35.2	132.8 ± 43.2	127.3 ± 40.5
Normal value (70 - 130 mg/dl)	8 (57.1)	3 (60.0)	4 (44.4)	6 (46.2)	14 (66.7)	20 (66.7)
Higher than cutoff value	6 (42.9)	2 (40.0)	5 (55.5)	7 (53.8)	7 (33.3)	10 (33.3)
HbA_{1c}, Mean ± SD (%)	7.4 ± 0.8	8.6 ± 1.6	8.7 ± 2.9	8.8 ± 1.9	8.7 ± 2.2	8.0 ± 1.5
Normal value (< 7 %)	3 (25.0)	1 (25.0)	2 (28.6)	2 (20.0)	4 (22.2)	8 (27.6)
Higher than cutoff value	9 (75.0)	3 (75.0)	5 (71.4)	8 (80.0)	14 (77.8)	21 (72.4)
Triglyceride, Mean ± SD (mg/dl)	204.6 ± 154.9	189.7 ± 58.3	197.7 ± 79.3	210.9 ± 242.2	272.7 ± 168.8	188.0 ± 195.8
Normal value (< 150 mg/dl)	7 (58.3)	1 (25.0)	3 (42.9)	6 (60.0)	4 (22.2)	14 (48.3)
Higher than cutoff value	5 (41.7)	3 (75.0)	4 (57.1)	4 (40.0)	14 (77.8)	15 (51.7)
Cholesterol, Mean ± SD (mg/dl)	202.3 ± 39.3	228.5 ± 108.3	175.6 ± 22.7	199.0 ± 55.2	184.4 ± 40.9	171.3 ± 32.1
Normal value (< 200 mg/dl)	5 (41.7)	2 (50.0)	7 (100)	6 (60.0)	12 (66.7)	23 (79.3)
Higher than cutoff value	7 (58.3)	2 (50.0)	0	4 (40.0)	6 (33.3)	6 (20.7)

Table 24 Biochemical parameters of people with type 2 diabetes according to 6 ethnics (cont.)

Variables	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
LDL, Mean ± SD (mg/dl)**	109.73 ± 34.9	143.7 ± 87.9	91.7 ± 13.8	107.8 ± 30.1	91.9 ± 35.2	95.2 ± 23.1
Normal value (< 100 mg/dl)	3 (27.3)	2 (50.0)	5 (71.4)	3 (33.3)	12 (70.6)	16 (57.1)
Higher than cutoff value	8 (72.7)	2 (50.0)	2 (28.6)	6 (66.7)	5 (29.4)	12 (42.9)
HDL, Mean ± SD (mg/dl)	51.8 ± 13.0	46.8 ± 12.9	44.3 ± 5.7	48.7 ± 13.1	39.7 ± 9.1	42.9 ± 12.8
Higher than cutoff value	6 (50.0)	2 (50.0)	3 (42.9)	4 (40.0)	3 (16.7)	8 (27.6)
Lower than cutoff value	6 (50.0)	2 (50.0)	4 (57.1)	6 (60.0)	15 (83.3)	21 (72.4)

***** Fasting blood glucose was determined from 92 study subjects with type 2 diabetes.

****** LDL cholesterol was calculated by using Friedwald's formula (LDL-C = TC – HDL-C – TG/5), when the triglyceride levels were lower than 400 mg/dl. Therefore subjects who had the triglyceride levels higher than 400 mg/dl, LDL cholesterol could not calculate by using Friedwald's formula.

5.2.3 **Dietary Intake of Study Subjects**

The energy intake and dietary intake of 92 people with type 2 diabetes who reside at Doi Tung Development Project area is given in table 25 and table 26, respectively. The food intake was assessed from 2 day-24 hour recall during the study period. A mean caloric intake of the study subjects was 930.5 ± 414.3 kcal/day. The study subjects consumed the macronutrient profile with 66.2 ± 10.5% of energy from carbohydrate, 15.9 ± 3.7 % of energy from protein and 17.8 ± 13.4 % of energy from fat. Ninety percent of sugar and 95.7% of subjects consumed dietary cholesterol within the dietary recommendations. Whereas, ninety five percent of study subjects consumed low dietary fiber and 58.7% of subjects had a high sodium intake.

The results of dietary intake are reported by dividing study subjects into six groups according to ethnic groups as shown in table 27. The study subjects with Tai Yai (1124.2 ± 733.6 kcal) had the average of energy intake higher than other ethic groups, whereas study subjects with Haw (768.3 ± 246.5 kcal) had the average of energy intake less than other ethic groups. The percentage of study subjects who intake the carbohydrate higher than ADA in Tai Yai, Tai Lue, Lawa, Haw, Lahu and Akha was 57.1, 40.0, 55.6, 76.9, 60.0, and 57.1, respectively. The study subjects who had the protein intake higher than ADA were 7.1% of Tai Yai, 20.0% of Tai Lue, 33.3% of Lawa, 10.0% of Lahu, 23.8% of Akha and Haw had not. Some study subjects with Tai Yai, Tai Lue, Lawa, Haw, Lahu and Akha consumed high protein was 28.6, 20.0, 22.2, 69.2, 43.3, and 33.3 percent, respectively.

The percentage of study subjects who had fat intake higher than ADA was 20.0% of Tai Lue, 11.1% of Lawa, 7.7% of Haw, 10.0% of Lahu, 4.8% of Akha but study subjects with Haw did not consume high fat. The study subjects who had high cholesterol intake were 11.1% of Lawa, 7.7% of Haw, and 6.7% of Lahu, while Tai Yai, Tai Lue, and Akha had not cholesterol intake higher than ADA. All study subjects with Tai Lue, Lawa, and Haw consumed dietary fiber lower than ADA. Ninety three percent of study subjects with Tai Yai, 93.3% of Lahu, 4.8% of Akha consumed less dietary fiber. The percentage of study subjects who consumed high sodium in Tai Yai, Tai Lue, Lawa, Haw, Lahu and Akha was 64.3, 40.0, 55.6, 69.2, 63.3, and 47.6, respectively.

Table 25 Energy Intake of 92 Type 2 Diabetes

Sex	Age	N (%)	Energy* recommendation	Energy intake (kcal)	Lower than recommendation N (%)
Male	31-50	3 (17.6)	2100	894.0 ± 298.0	3 (100)
	51-71	12 (70.6)	2100	1016.3 ± 813.8	11 (91.7)
	> 71	2 (11.8)	1750	1144.3 ± 592.1	2 (100)
	Mean ± SD of Energy Intake 1009.8 ± 702.3 kcal				
Female	31-50	18 (24.0)	1750	924.0 ± 355.6	18 (100)
	51-71	47 (62.7)	1750	925.1 ± 334.8	47 (100)
	> 71	10 (13.3)	1550	833.8 ±156.2	10 (100)
	Mean ± SD of Energy Intake 912.7 ± 320.5 kcal				
Total	**Mean ± SD of Energy Intake 930.5 ± 414.3 kcal**				

* Thai DRI recommendation, 2003

Table 26 Daily dietary intakes of 92 subjects

Variables	Total (92) N (%)	Male (17) N (%)	Female (75) N (%)
Energy intake (kcal/day)			
Mean ± SD	930.5 ± 414.3	1009.8 ± 702.3	912.7 ± 320.5
Minimum value	370.2	600.6	370.2
Maximum value	3533.4	3533.3	1615.7
Carbohydrate distribution (% of kcal/day)			
Lower than cutoff value (< 45%)	2 (2.2)	0	2 (2.7)
Cutoff value (45-65%)	35 (38.0)	6 (35.3)	29 (38.7)
Higher than cutoff value (> 65%)	55 (59.8)	11 (64.7)	44 (58.7)
Mean ± SD	66.2 ± 10.5	67.3 ± 9.1	66.0 ± 10.8
Minimum value	39.4	49.0	39.4
Maximum value	90.3	87.6	90.3
Protein distribution (% of kcal/day)			
Lower than cutoff value (< 15%)	36 (39.1)	5 (29.4)	31 (41.3)
Cutoff value (15-20%)	43 (46.7)	10 (58.8)	33 (44.0)
Higher than cutoff value (> 20%)	13 (14.1)	2 (11.8)	11 (14.7)
Mean ± SD	15.9 ± 3.7	16.0 ± 3.2	15.9 ± 3.8
Minimum value	7.2	9.3	7.2
Maximum value	28.3	21.6	28.3
Fat distribution (% of kcal/day)			
Lower than cutoff value (< 25%)	74 (80.4)	15 (88.2)	59 (78.7)
Cutoff value (25-35%)	11 (12.0)	1 (5.9)	10 (13.3)
Higher than cutoff value (> 35%)	7 (7.6)	1 (5.9)	6 (8.0)
Mean ± SD	17.8 ± 13.4	16.7 ± 7.4	18.1 ± 8.5
Minimum value	2.5	3.1	2.5
Maximum value	40.9	33.0	40.9

Table 26 Daily dietary intakes of 92 subjects (cont.)

Variables	Total (92) N (%)	Male (17) N (%)	Female (75) N (%)
Cholesterol (mg/day)			
Cutoff value (< 200 mg/dl)	88 (95.7)	17 (100.0)	71 (94.7)
Higher than cutoff value	4 (4.3)	0	4 (5.3)
Mean	63.2 ± 56.8	56.7 ± 37.6	64.7 ± 60.4
Minimum value	0	68.1	0
Maximum value	269.5	483.4	269.5
Dietary fiber (g/day)			
Lower than cutoff value	88 (95.7)	1 (5.9)	72 (96.0)
Cutoff value (> 14g/1000 kcal)	4 (4.3)	16 (94.1)	3 (4.0)
Mean	6.1 ± 3.6	6.1 ± 3.3	6.2 ± 3.7
Minimum value	0.33	0.33	0.33
Maximum value	15.1	12.6	15.1
Sugar (g/day)			
Cutoff value (<10% kcal)	83 (90.2)	16 (94.1)	67 (89.3)
Higher than cutoff value	9 (9.8)	1 (5.9)	8 (10.7)
Mean	11.3 ± 10.9	11.1 ± 9.7	11.4 ± 11.3
Minimum value	0	0	0
Maximum value	44.2	37.9	44.2
Sodium (mg/day)			
Cutoff value (< 2400 mg/day)	38 (41.3)	7 (41.2)	31 (41.3)
Higher than cutoff value	54 (58.7)	10 (58.8)	44 (58.7)
Mean	3021.0 ± 1167.1	2993.9 ± 1184.7	3027.2 ± 1171.1
Minimum value	1379.6	1379.6	1548.6
Maximum value	6399.9	5847.7	6399.9

Table 27 Dietary intake of 92 subjects compared to dietary recommendations of ADA according to 6 ethnics

Variables	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
Energy intake, Mean ± SD (kcal)	1124.2 ± 733.6	877.9 ± 190.6	954.9 ± 309.1	768.3 ± 246.5	1008.1 ± 670.0	896.6 ± 309.7
Carbohydrate, Mean ± SD (% of kcal)	63.1 ± 7.4	62.2 ± 13.8	64.7 ± 13.5	69.2 ± 9.2	67.3 ± 11.9	65.9 ± 10.1
Lower than cutoff value (< 45%)	0	0	1 (11.1)	0	1 (3.3)	0
Normal range (45-65%)	6 (42.9)	3 (60.0)	3 (33.3)	3 (23.1)	11 (36.7)	9 (42.9)
Higher than cutoff value (> 65%)	8 (57.1)	2 (40.0)	5 (55.6)	10 (76.9)	18 (60.0)	12 (57.1)
Protein, Mean ± SD (% of kcal)	15.9 ± 2.9	17.4 ± 5.0	18.2 ± 4.9	13.8 ± 2.6	16.1 ± 4.0	15.9 ± 3.2
Lower than cutoff value (< 15%)	4 (28.6)	1 (20.0)	2 (22.2)	9 (69.2)	13 (43.3)	7 (33.3)
Normal range (15-20%)	9 (64.3)	3 (60.0)	4 (44.4)	4 (30.8)	14 (46.7)	9 (42.9)
Higher than cutoff value (> 20%)	1 (7.1)	1 (20.0)	3 (33.3)	0	3 (10.0)	5 (23.8)
Fat, Mean ± SD (% of kcal)	18.9 ± 5.4	20.4 ± 9.8	17.1 ± 10.7	17.1 ± 7.7	16.6 ± 9.2	18.2 ± 8.4
Lower than cutoff value (< 25%)	12 (85.7)	3 (60.0)	8 (88.9)	11 (84.6)	24 (80.0)	16 (76.2)
Normal range (25-35 %)	2 (14.3)	1 (20.0)	0	1 (7.7)	3 (10.0)	4 (19.0)
Higher than cutoff value (> 35%)	0	1 (20.0)	1 (11.1)	1 (7.7)	3 (10.0)	1 (4.8)

Table 27 Dietary intake of 92 subjects compared to dietary recommendations of ADA according to 6 ethnics (cont.)

Variable	Number (%)					
	Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
Cholesterol, Mean ± SD (mg/day)	69.4 ± 43.4	61.1 ± 37.1	63.5 ± 65.7	54.3 ± 75.1	54.5 ± 45.2	70.6 ± 63.1
Normal range (< 200)	14 (100.0)	5 (100.0)	8 (88.9)	12 (92.3)	28 (93.3)	21 (100)
Higher than cutoff value (≥ 200)	0	0	1 (11.1)	1 (7.7)	2 (6.7)	0
Dietary fiber, Mean ± SD (g/day)	5.8 ± 4.1	8.6 ± 4.8	7.1 ± 2.9	5.2 ± 2.4	6.0 ± 4.0	6.1 ± 3.8
Lower than cutoff value	13 (92.9)	5 (100.0)	9 (100.0)	13 (100.0)	28 (93.3)	1 (4.8)
Normal range (14 g/1000 kcal)	1 (7.1)	0	0	0	2 (6.7)	20 (95.2)
Sugar, Mean ± SD (g/day)	11.6 ± 13.4	14.4 ± 13.2	13.8 ± 13.4	10.2 ± 6.3	9.8 ± 11.4	11.5 ± 10.4
Normal range (< 10% of kcal)	12 (85.7)	4 (80.0)	8 (88.9)	13 (100.0)	27 (90.0)	19 (90.5)
Higher than cutoff value	2 (14.3)	1 (20.0)	1 (11.1)	0	3 (10.0)	2(9.5)
Sodium (mg/day)						
Mean ± SD	3135.7 ± 1178.5	2997.4 ± 1661.4	2742.2 ± 1022.0	3238.0 ± 1198.5	2932.8 ± 1294.1	3022.9 ± 1084.5
Normal range (< 2400)	5 (35.7)	3 (60.0)	4 (44.4)	4 (30.8)	11 (36.7)	11 (52.4)
Higher than cutoff value (≥ 2400)	9 (64.3)	2 (40.0)	5 (55.6)	9 (69.2)	19 (63.3)	10 (47.6)

5.3 Food Consumption and Most Frequently Consumed Food Items among People with Type 2 Diabetes in Doi Tung Development Project Area

5.3.1 Food Consumption of People with Type 2 Diabetes

Food behaviors in 92 people with type 2 diabetes at Doi Tung Development Project area is shown in table 28. In household of people with type 2 diabetes, the average of food expense is 86.9 ± 45.6 baht per day. The persons who usually buy foods for the household are their descendants (42.2%) and themselves (40.2 %). For the source of vegetables, they consumed 64.1% were bought from market and 29.4% grown by themselves. As well as the source of meats 79.3.1% were bought from market and 18.5% from moveable market with 1-4 times/week. Regular seasoning using is salt, monosodium glutamate and soybean sauce, particularly salt (95.7%) and monosodium glutamate (3.3%) are popular used in this study subjects. Moreover the results showed that 69.6 % of study subject use soybean oil for cooking. In addition, it was found that 78.3% of subjects usually cooked their meal by boiling method, 16.3% consumed chili-paste, and 4.3% cooked by stir-frying method.

This study showed that the study subjects with 60% Tai Lue, 42.6% Haw, 50.0% Akha bought food by them, whereas other ethnic groups bought food by their wife, husband or descendants. Most of study subjects bought vegetable from market, while 57.1% of Lahu subjects and 53.3% of Akha grew their own plant and vegetable for consumed in their household. All study subjects in each ethnic group bough vegetable and meat 1-4 times/week. Moreover the study subjects from Lahu and Akha bought meat and vegetables from moveable market. Six percent of Akha (2 subjects) hunt animal including fish and snail for cooking. Each ethnic group commonly cooked their food by boiling method. Food behaviors in people with type 2 diabetes at Doi Tung Development Project area, according to ethnic groups, is shown in table 29.

Table 28 Food behaviors of 92 people with type 2 diabetes in Doi Tung Development Project area, Mae Fah Luang, Chiang Rai

Characteristics		Number (N)	Percentage (%)
Food expense (baht/day); Mean ± SD		86.9 ± 45.6	
Food buyer	Subjects	37	40.2
	Wife/Husband	13	14.1
	Descendants	39	42.4
	Take turns in family	3	3.3
Frequency of foods purchasing:			
Vegetables	Never	3	3.3
	Everyday	31	33.7
	Frequently (5-6 times/week)	1	1.1
	Sometimes (1-4 times/week)	50	54.3
	Seldom (< 4 times/month)	7	7.6
Meats	Never	1	1.1
	Everyday	12	13.0
	Frequently (5-6 times/week)	5	5.4
	Sometimes (1-4 times/week)	71	77.2
	Seldom (< 4 times/month)	3	3.3
Seasoning	Frequently (5-6 times/week)	4	4.3
	Sometimes (1-4 times/week)	9	9.8
	Seldom (< 4 times/month)	79	85.9
Source of Vegetables	Grow	27	29.4
	Moveable Market	6	6.5
	Market	59	64.1
Source of Meats	Hunt	2	2.2
	Moveable Market	17	18.5
	Market	73	79.3

Table 28 Food behaviors of 92 people with type 2 diabetes in Doi Tung Development Project area, Mae Fah Luang, Chiang Rai (cont.)

	Characteristics	Number (N)	Percentage (%)
Source of Seasoning	Shop	30	32.6
	Moveable Market	17	18.5
	Market	45	48.9
Method of Cooking	Stir-fry (Pad)	4	4.3
	Chilli-paste (Namprik)	15	16.3
	Boiled and Curry	72	78.3
	Grilled	1	1.1

Table 29 Food behaviors of 92 people with type 2 diabetes in Doi Tung Development Project area, according to 6 ethnics

Food Items		Number (%)					
		Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha N=30)**
Food expense, mean ± SD (baht/day)		84.6 ± 39.5	105.0 ± 61.4	128.9 ± 33.7	80.1 ± 29.5	88.4 ± 46.8	73.2 ± 48.9
Food buyer	Subjects	5 (35.7)	3 (60.0)	3 (33.3)	6 (46.2)	5 (23.5)	15 (50.0)
	Wife/Husband	1 (7.1)	1 (20.0)	1 (11.1)	3 (23.1)	2 (9.5)	5 (16.7)
	Descendants	7 (50.0)	1 (20.0)	5 (55.6)	3 (23.1)	14 (66.7)	9 (30.0)
	Take turns in family	1 (7.1)	0	0	1 (7.7)	0	1 (3.3)
Frequency of foods purchasing:							
Vegetables	Never	0	0	0	0	1 (4.8)	2 (6.7)
	Everyday	9 (64.3)	2 (40.0)	6 (66.7)	5 (38.5)	5 (23.8)	4 (13.3)
	Frequently (5-6 times/week)	0	0	0	0	0	1 (3.3)
	Sometimes (1-4 times/week)	5 (35.7)	3 (60.0)	3 (33.3)	7 (53.8)	14 (66.7)	18 (60.0)
	Seldom (< 4 times/month)	0	0	0	1 (7.7)	1 (4.8)	5 (16.7)

Table 29 Food behaviors of 92 people with type 2 diabetes in Doi Tung Development Project area, according to 6 ethnics (cont.)

Food Items		Number (%)					
		Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Meats	Never	0	0	0	1 (7.7)	0	0
	Everyday	4 (28.6)	1 (20.0)	2 (22.2)	1 (7.7)	1 (4.8)	3 (10.0)
	Frequently (5-6 times/week)	1 (7.1)	0	0	0	2 (9.5)	2 (6.7)
	Sometimes (1-4 times/week)	9 (64.3)	4 (80.0)	7 (77.8)	10 (76.9)	18 (85.7)	23 (76.7)
	Seldom (< 4 times/month)	0	0	0	1 (7.7)	0	2 (6.7)
Seasoning	Frequently (5-6 times/week)	1 (7.1)	0	0	0	1 (4.8)	2 (6.7)
	Sometimes (1-4 times/week)	0	2 (40.0)	1 (11.1)	1 (7.7)	1 (4.8)	4 (13.3)
	Seldom (< 4 times/month)	13 (92.9)	3 (60.0)	8 (88.9)	12 (92.3)	19 (90.5)	24 (80.0)
Source of Vegetables							
	Grow	0	0	3 (33.3)	2 (15.4)	6 (57.1)	16 (53.3)
	Moveable Market	0	0	0	0	4 (19.0)	2 (6.7)
	Market	14 (100.0)	5 (100.0)	6 (66.7)	11 (84.6)	11 (52.4)	12 (40.0)

Table 29 Food behaviors of 92 people with type 2 diabetes in Doi Tung Development Project area, according to 6 ethnics (cont.)

Food Items		Number (%)					
		Tai Yai (N=14)	**Tai Lue (N=5)**	**Lawa (N=9)**	**Haw (N=13)**	**Lahu (N=21)**	**Akha (N=30)**
Source of Meats	Hunt	0	0	0	0	0	2 (6.7)
	Moveable Market	0	0	0	0	7 (33.3)	10 (33.3)
	Market	14 (100.0)	5 (100.0)	9 (100.0)	13 (100.0)	14 (66.7)	18 (60.0)
Source of Seasoning	Shop	8 (57.1)	1 (20.0)	4 (44.4)	7 (53.8)	5 (23.8)	4 (13.3)
	Moveable Market	0	0	2 (22.2)	2 (15.4)	3 (14.3)	10 (33.3)
	Market	6 (42.8)	4 (80.0)	3 (33.3)	4 (30.8)	13 (61.9)	16 (53.3)
Method of Cooking	Stir-fry (Pad)	1 (7.1)	0	0	2 (15.4)	0	1 (3.3)
	Chilli-paste (Namprik)	4 (28.6)	1 (20.0)	1 (11.1)	1 (7.7)	3 (14.3)	5 (16.7)
	Boiled and Curry	9 (64.3)	4 (80.0)	8 (88.9)	10 (76.9)	18 (85.7)	23 (76.7)
	Grilled	0	0	0	0	0	1 (3.3)

5.3.2 Most Food Items Consumed by People with Type 2 Diabetes

A. Most Frequently Consumed Food Groups

The most commonly consumed food groups among study subjects with type 2 diabetes at Doi Tung Development Project area is shown in table 30. For the starch group, the most popular food items consumed are rice (100.0% of subjects), pumpkin (75.0% of subjects) and waxy corn (70.6% of subjects). Regular vegetable items consumed were flower Chinese cabbage (95.6%), Chinese cabbage (93.5%), cucumber (91.3%), green yard long bean (82.6%), and white Chinese cabbage (81.5%). Orange, banana, and ripe papaya were the most commonly consumed fruits with 85.9%, 84.8%, and 68.5%, respectively.

The study subjects received protein source from pork meat, poultry meat and Nile tilapia fish (Pla-Nin), whereas eggs, deep fried pork skin (Kab-Moo) and steamed mackerel (Pla-Too-Kheng) were popular animal products consumed among this study subjects. Forty subjects usually drank soybean milk more often than other kind of milk. The consumption of crispy rice cracker (Khao-Tan), and glutinous rice cooked in bamboo (Khao-Lam) were consumed 22.6, and 18.3 in study subjects, respectively. Most of subjects used salt (91.8% of all), monosodium glutamate (73.9% of all), and soybean sauce (45.6% of all) as seasoning, whereas 91.4% of subjects used soybean oil for cooking regularly. Frequency of the most commonly consumed food groups among 92 people with type 2 diabetes in Doi Tung Development Project area is shown in table 31.

The most commonly consumed food groups among 92 study subjects, according to 6 ethnics is shown in table 32. For starch consumption, 78.6% of Tai Yai consumed sticky rice, 80.0% of Tai Lue consumed fermented rice noodle and 84.6% of Haw consumed mungbean noodle, whereas other ethic groups consumed these food items less than the above ethnic groups. Leave of garden pea, swamp cabbage, French bean, green yard long bean were consumed by 100.0% Lawa, 100.0% Tai Lue, 100.0% Haw, and 86.7% Akha, respectively. Ripe papaya, guava, and jujube were the most commonly consumed fruits of Lahu (76.2%), Haw (84.6%), and Lawa (77.7%).

Eighty percent of study subjects with Tai Lue popularly consumed snakehead fish more than other ethnic groups, whereas study subjects with 71.4% of Lahu and 63.3% of Akha consumed red snapper fish. Ninety-two percent and 53.8% of study subjects with Haw consumed tofu and lard greater than other ethnic groups. Khao-Tan was a commonly consumed dessert among all ethnic groups, especially study subjects with Tai Lue (60% of Tai Lue) consumed Khao-Tan more than other ethnic groups. The percentage of frequency of most commonly consumed food groups among study subjects with Tai Yai, Tai Lue, Lawa, Haw, Lahu, and Akha were shown in appendix D and the pictures of most commonly consumed food items among 92 people with type 2 diabetes in Doi Tung Development Project area were shown in appendix G.

The nutritive values of Chinese cabbage per 100 g edible portion was energy 21.6 kcal, carbohydrate 3.4 g, sugar 1.6 g, fat 0.2 g, protein 1.8 g and 1.9 g of fiber, whereas flower Chinese cabbage was energy 20.8 kcal, carbohydrate 1.8 g, fat 0.4 g, and protein 2.6 g. The most commonly consumed fruits of subjects were oranges and bananas which had the nutritive values of oranges per 100 g edible portion was energy 45.0 kcal, carbohydrate 9.9 g, sugar 8.3 g, fat 0.2 g, protein 1.0 g, and fiber 1.5 g whereas the nutritive values of bananas per 100 g edible portion was energy 122.0 kcal, carbohydrate 29.0 g, fat 0.2 g, protein 0.8 g, and 2.4 gram of fiber. For meat, the nutritive values of chicken per 100 g edible portion was energy 186.0 kcal, carbohydrate 1.4 g, fat 12.4 g, cholesterol 81.0 g, and protein 17.3 g, whereas the nutritive values of Nile tilapia (Pla-Nin) per 100 g edible portion was energy 87.0 kcal, fat 1.1 g, cholesterol 58.0 g, and protein 17.4 g. The subjects usually drink soybean milk which had composition of energy 87.0 kcal, carbohydrate 10.0 g, fat 3.5 g, cholesterol 4.0 g, protein 2.5 g, and 0.4 g of fiber per 100 g edible portion. The nutritive values of most commonly consumed food groups were shown in appendix E.

Table 30 Most commonly consumed food groups among 92 people with type 2 diabetes in Doi Tung Development Project area

Food Groups	List of Foods	Number	Percentage
Starches	Rice (ข้าว)	92	100.0
	Pumpkin (ฟักทอง)	69	75.0
	Waxy corn (ข้าวโพดสาลี)	65	70.6
	Mungbean noodle (วุ้นเส้น)	62	67.4
	Rice noodle fermented (ขนมจีน)	62	67.4
	Rice noodle, small size (เส้นก๋วยเตี๋ยวเส้นเล็ก)	56	60.9
	Rice noodle, big size (เส้นก๋วยเตี๋ยวเส้นใหญ่)	56	60.9
	Potato (มันฝรั่ง)	48	52.2
	Sweet potato (มันเทศ)	43	46.7
	Sticky rice (ข้าวเหนียว)	42	45.6
Vegetables	Flower Chinese cabbage (ผักกวางตุ้ง, ดอก)	88	95.6
	Chinese cabbage (ผักกวางตุ้ง)	86	93.5
	Cucumber (แตงกวา)	84	91.3
	Green yard long bean (ถั่วฝักยาว)	76	82.6
	Rak Shoo (รากซู)	76	82.6
	White Chinese cabbage (ผักกาดขาว)	75	81.5
	Garden pea (ถั่วลันเตา)	75	81.5
	French bean (ถั่วแขก)	73	79.3
	Swamp cabbage (ผักบุ้ง)	70	76.1
	Garden pea, leave (ถั่วลันเตา, ใบ)	70	76.1
Fruits	Orange (ส้ม)	79	85.9
	Banana (กล้วย)	78	84.8
	Ripe papaya (มะละกอสุก)	63	68.5
	Rambutants (เงาะ)	61	66.3
	Guava (ฝรั่ง)	60	65.2

Table 30 Most commonly consumed food groups among 92 people with type 2 diabetes in Doi Tung Development Project area (cont.)

Food Groups	List of Foods	Number	Percentage
Fruits	Unripe mango (มะม่วงดิบ)	58	63.0
	Apple (แอปเปิ้ล)	58	63.0
	Sweet tamarind (มะขามหวาน)	55	59.8
	Ripe mango (มะม่วงสุก)	54	58.7
	Jujube (พุทรา)	51	55.4
Meats	Pork meat (เนื้อหมู)	90	97.8
	Chicken meat (เนื้อไก่)	70	76.1
	Nile Tilapia fish (ปลานิล)	68	73.9
	Catfish (ปลาดุก)	37	40.2
	Beef (เนื้อวัว)	36	39.1
	Red snapper fish (ปลาทราย)	34	36.9
	Barb fish (ปลาขาว)	32	34.8
	Snakehead fish (ปลาช่อน)	32	34.8
	Common shrimp (กุ้งน้ำจืดเล็ก)	28	30.4
	Pond snail (หอยขม)	27	29.3
Animal products	Egg (ไข่ไก่)	85	92.4
	Deep fried pork skin (แคบหมู)	62	67.4
	Steamed short bodied mackerel (ปลาทูเข่ง)	62	67.4
	Tofu (เต้าหู้)	43	46.7
	Pork ball (ลูกชิ้นหมู)	46	50.0
	Deep fried buffalo skin (แคบปอง)	40	43.5
	Fermented pork sausage (แหนม/จิ้นส้ม)	34	36.9
	Pork sausage, northern style (ไส้อั่ว)	30	32.6
	Chicken feet (เล็บมือนาง)	28	30.5
	Salted mackerel (ปลาทูเค็ม)	26	28.2

Table 30 Most commonly consumed food groups among 92 people with type 2 diabetes in Doi Tung Development Project area (cont.)

Food Groups	List of Foods	Number	Percentage
Milk	Soybean milk (น้ำเต้าหู้)	40	43.4
	UHT-no sugar (นมยูเอชทีจืด)	25	27.2
	UHT-soybean milk (นมถั่วเหลืองยูเอชที)	28	30.4
	Yogurt, drinking (นมเปรี้ยว)	15	16.3
	Milk, powder (นมผงแอลลีน)	5	5.4
Desserts	Crispy rice cracker (ข้าวแต๋น)	21	22.6
	Glutinous rice cooked in bamboo (ข้าวหลาม)	17	18.3
	Glutinous rice steamed with bean and coconut (ข้าวต้มมัด)	14	15.1
	Fried banana (กล้วยทอด)	8	8.6
Fat and Oil	Soybean oil	84	91.4
	Peanut	65	70.6
	Black-sesame	29	31.5
	White-sesame	29	31.5
	Palm oil	22	23.9
	Lard oil	22	23.9
Seasoning	Salt	90	91.8
	Monosodium glutamate	68	73.9
	Soybean sauce	42	45.6
	Fish sauce	29	31.6
	Bouillon cube (Kanor)	23	25.0

Table 31 Frequence of the most commonly consumed food groups among 92 people with type 2 diabetes in Doi Tung Development Project area

List of Foods	Everyday 7 times/week (%)	Frequent 5-6 times/week (%)	Sometimes 1-4 times/week (%)	Seldom < 4 times/month (%)	Never - (%)
Starches					
Rice	97.8	0	1.1	1.1	0
Pumpkin	1.1	1.1	19.6	53.3	25.0
Waxy corn	2.2	1.1	18.5	48.9	29.3
Mungbean noodle	0	0	21.7	45.7	32.6
Rice noodle fermented	0	2.2	6.5	58.7	32.6
Rice noodle, small size	0	2.2	8.7	50.0	39.1
Rice noodle, big size	0	2.2	5.4	53.3	39.1
Potato	0	3.3	3.3	45.7	47.8
Sweet potato	2.2	1.1	5.4	38.0	53.3
Sticky rice	4.3	2.2	5.4	33.7	54.3
Vegetables					
Flower Chinese cabbage	4.3	48.9	32.6	9.8	4.3
Chinese cabbage	5.4	33.7	43.5	10.9	6.5
Cucumber	1.1	16.3	54.3	19.6	8.7
Green yard long bean	0	8.7	42.4	31.5	17.4
White Chinese cabbage	0	8.7	38.0	34.8	18.5
Garden pea	0	1.1	39.1	41.3	18.5
Snap bean	0	6.5	40.2	32.6	20.7
Swamp cabbage	1.0	3.1	33.7	33.7	22.4
Garden pea, leave	0	3.1	36.7	31.6	22.4
Cabbage	0	9.8	41.3	23.9	25.0

Table 31 Frequency of the most commonly consumed food groups among 92 people with type 2 diabetes in Doi Tung Development Project area (cont.)

List of Foods	Everyday 7 times/week (%)	Frequent 5-6 times/week (%)	Sometimes 1-4 times/week (%)	Seldom < 4 times/month (%)	Never - (%)
Fruits					
Orange	10.9	19.6	38.0	17.4	14.1
Banana	8.7	23.9	32.6	19.6	15.2
Ripe papaya	1.1	2.2	30.4	34.8	31.5
Rambutants	1.1	0	9.8	55.4	33.7
Guava	1.1	0	13.0	51.1	34.8
Unripe mango	0	2.2	21.7	39.1	37.0
Apple	0	3.3	9.8	50.0	37.0
Sweet tamarind	0	1.1	13.0	45.7	40.2
Ripe mango	0	2.2	17.4	39.1	41.3
Jujube	0	0	22.8	32.6	44.6
Meats					
Pork meat	66.3	10.9	17.4	3.3	2.2
Chicken	4.3	15.2	32.6	23.9	23.9
Nile Tilapia fish	2.2	4.3	31.5	35.9	26.1
Catfish	0	2.2	13.0	25.0	59.8
Beef	1.1	2.2	3.3	32.6	60.9
Red snapper fish	0	0	21.7	15.2	63.0
Barb fish	0	0	19.6	15.2	65.2
Snakehead fish	0	0	12.0	22.8	65.2
Common shrimp	0	0	1.1	29.3	69.6
Pond snail	0	0	1.1	28.3	70.7

Table 31 Frequency of the most commonly consumed food groups among 92 people with type 2 diabetes in Doi Tung Development Project area (cont.)

List of Foods	Everyday 7 times/week (%)	Frequent 5-6 times/week (%)	Sometimes 1-4 times/week (%)	Seldom < 4 times/month (%)	Never - (%)
Animal products					
Chicken eggs	1.1	9.8	55.4	26.1	7.6
Deep fried pork skin	0	5.4	23.9	38.0	32.6
Steamed short bodied mackerel	0	0	28.3	39.1	32.6
Tofu	0	2.2	21.7	22.8	53.3
Pork ball	0	1.1	14.1	34.8	50.0
Deep fried buffalo skin	0	1.1	9.8	32.6	56.5
Fermented pork sausage	0	0	4.3	32.6	63.0
Pork sausage, northern style	0	0	2.2	30.4	67.4
Chicken feet	0	0	2.2	28.3	69.6
Salted mackerel	0	0	6.5	21.7	71.7
Milk					
Soybean milk	2.2	6.5	13.0	21.7	56.5
UHT-no sugar	1.1	1.1	9.8	15.2	72.8
UHT-soybean milk	0	0	4.3	26.1	69.6
Yogurt, drinking	0	1.1	6.5	8.7	83.7
Milk, powder (Anlene)	4.3	0	1.1	0	94.6
Desserts					
Khao-Tan	0	0	4.3	18.3	77.4
Khao-Hlam	1.1	0	1.1	16.1	81.7
Khao-Tom-Mud	1.1	0	3.2	10.8	84.9
Fried banana	0	1.1	0	7.5	91.4

Table 31 Frequency of the most commonly consumed food groups among 92 people with type 2 diabetes in Doi Tung Development Project area (cont.)

List of Foods	Everyday 7 times/week (%)	Frequent 5-6 times/week (%)	Sometimes 1-4 times/week (%)	Seldom < 4 times/month (%)	Never - (%)
Fat and Oil					
Soybean oil	45.7	25.0	18.5	2.2	8.7
Peanut	0	1.1	14.1	55.4	29.3
Black-sesame	0	0	4.3	27.2	68.5
White-sesame	0	0	2.2	29.3	68.5
Palm oil	3.3	9.8	6.5	4.3	76.1
Lard oil	1.1	2.2	12.0	8.7	76.1
Seasoning					
Salt	97.8	0	0	0	2.2
Monosodium glutamate	64.1	7.6	1.1	1.1	26.1
Soybean sauce	10.9	21.7	7.6	5.4	54.3
Fish sauce	7.6	10.9	9.8	3.3	68.5
Bouillon cube (Kanor)	4.3	7.6	10.9	2.2	75.0

Table 32 The most commonly consumed food groups among 92 study subjects, according to 6 ethnics

Food Items	Number (%)					
	Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Starches						
Rice	14 (100.0)	5 (100.0)	9 (100.0)	13 (100.0)	21 (100.0)	30 (100.0)
Sticky rice	11 (78.6)	1 (20.0)	2 (22.2)	8 (61.5)	6 (28.6)	14 (46.6)
Mungbean noodle	10 (71.4)	3 (60.0)	7 (77.7)	11 (84.6)	13 (61.9)	19 (63.3)
Rice noodle fermented	10 (71.4)	4 (80.0)	6 (66.7)	11 (84.6)	11 (52.4)	20 (66.7)
Pumpkin	9 (64.3)	5 (100.0)	8 (88.8)	8 (61.5)	15 (71.4)	24 (80.0)
Sweet potato	8 (57.1)	1 (20.0)	7 (77.7)	9 (69.2)	9 (42.9)	11 (84.6)
Waxy corn	7 (50.0)	2 (40.0)	8 (88.8)	10 (76.9)	14 (66.7)	21 (70.0)
Rice noodle, small size	7 (50.0)	2 (40.0)	6 (66.7)	9 (69.2)	12 (57.1)	11 (84.6)
Rice noodle, big size	6 (42.9)	3 (60.0)	5 (44.4)	11 (84.6)	14 (66.7)	20 (66.7)
Potato	5 (35.7)	1 (20.0)	3 (33.3)	11 (84.6)	14 (66.7)	14 (46.6)
Vegetables						
Flower Chinese cabbage	13 (92.9)	5 (100.0)	8 (88.8)	13 (100.0)	20 (95.2)	30 (100.0)
Chinese cabbage	13 (92.9)	4 (80.0)	9 (100.0)	13 (100.0)	19 (90.5)	29 (96.7)
Garden pea, leave	12 (85.7)	4 (80.0)	9 (100.0)	11 (84.6)	16 (76.2)	18 (60.0)
Cucumber	11 (78.6)	5 (100.0)	7 (77.7)	13 (100.0)	20 (95.2)	28 (93.3)

Table 32 The most commonly consumed food groups among 92 study subjects, according to 6 ethnics (cont.)

Food Items	Number (%)					
	Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Garden pea	11 (78.6)	4 (80.0)	8 (88.8)	11 (84.6)	19 (90.5)	24 (80.0)
Green yard long bean	10 (71.4)	4 (80.0)	8 (88.8)	10 (76.9)	18 (85.7)	26 (86.7)
White Chinese cabbage	9 (85.7)	4 (80.0)	8 (88.8)	12 (92.3)	18 (85.7)	25 (83.3)
Cabbage	9 (85.7)	3 (60.0)	6 (66.7)	12 (92.3)	16 (76.2)	14 (46.6)
Swamp cabbage	8 (57.1)	5 (100.0)	7 (77.7)	11 (84.6)	15 (71.4)	24 (80.0)
French bean	6 (42.9)	4 (80.0)	7 (77.7)	13 (100.0)	19 (90.5)	24 (80.0)
Fruits						
Orange	12 (85.7)	4 (80.0)	8 (88.8)	13 (100.0)	16 (76.2)	26 (86.7)
Banana	12 (85.7)	4 (80.0)	9 (100.0)	10 (77.9)	16 (76.2)	26 (86.7)
Ripe papaya	7 (50.0)	3 (60.0)	6 (66.7)	9 (69.2)	16 (76.2)	22 (73.3)
Rambutants	8 (57.1)	4 (80.0)	7 (77.7)	6 (46.2)	15 (71.4)	21 (70.0)
Guava	5 (35.7)	2 (40.0)	6 (66.7)	11 (84.6)	17 (80.9)	19 (63.3)
Unripe mango	6 (42.9)	4 (80.0)	4 (44.4)	7 (53.8)	15 (71.4)	22 (73.3)
Apple	9 (64.2)	4 (80.0)	7 (77.7)	9 (69.2)	15 (71.4)	14 (46.6)
Sweet tamarind	7 (50.0)	3 (60.0)	4 (44.4)	8 (61.5)	14 (71.4)	20 (66.7)

Table 32 The most commonly consumed food groups among 92 study subjects, according to 6 ethnics (cont.)

Food Items	Number (%)					
	Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Ripe mango	8 (57.1)	4 (80.0)	5 (55.5)	6 (46.2)	14 (71.4)	18 (60.0)
Jujube	7 (50.0)	3 (60.0)	7 (77.7)	9 (69.2)	11 (52.4)	14 (46.6)
Meats						
Pork meat	10 (71.4)	5 (100.0)	9 (100.0)	12 (92.3)	20 (95.2)	30 (100.0)
Chicken	10 (71.4)	3 (60.0)	3 (33.3)	12 (92.3)	17 (81.0)	25 (83.3)
Nile Tilapia fish	12 (85.7)	4 (80.0)	6 (66.6)	12 (92.3)	12 (57.1)	22 (73.3)
Catfish	7 (50.0)	2 (40.0)	3 (33.3)	2 (15.4)	7 (33.3)	16 (53.3)
Beef	4 (28.6)	2 (40.0)	5 (55.5)	6 (46.2)	6 (28.5)	13 (43.3)
Red snapper fish	0	0	0	0	15 (71.4)	19 (63.3)
Barb fish	1 (7.1)	0	0	0	13 (61.9)	18 (60.0)
Snakehead fish	5 (35.7)	4 (80.0)	5 (55.5)	3 (23.1)	6 (28.5)	9 (30.0)
Common shrimp	2 (14.3)	1 (20.0)	3 (33.3)	1 (7.7)	9 (42.9)	12 (40.0)
Pond snail	7 (50.0)	1 (20.0)	1 (11.1)	4 (30.8)	5 (23.8)	9 (30.0)

Table 32 The most commonly consumed food groups among 92 study subjects, according to 6 ethnics (cont.)

Food Items	Number (%)					
	Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Animal products						
Chicken eggs	13 (92.9)	5 (100.0)	8 (88.9)	12 (92.3)	21 (100.0)	26 (86.7)
Deep fried pork skin	10 (71.4)	4 (80.0)	7 (77.8)	3 (23.1)	11 (52.4)	27 (90.0)
Steamed short bodied mackerel	7 (50.0)	2 (40.0)	6 (66.3)	11 (84.6)	13 (61.9)	23 (76.7)
Tofu	7 (50.0)	4 (80.0)	6 (66.3)	12 (92.3)	8 (38.1)	6 (20.0)
Pork ball	9 (64.2)	4 (80.0)	6 (66.3)	3 (23.1)	9 (42.8)	15 (50.0)
Deep fried buffalo skin	9 (64.2)	3 (60.0)	7 (77.8)	1 (7.7)	3 (14.3)	17 (56.7)
Fermented pork sausage	7 (50.0)	3 (60.0)	3 (33.3)	5 (38.5)	5 (23.8)	11 (36.6)
Pork sausage, northern style	6 (42.8)	2 (40.0)	4 (44.4)	3 (23.1)	5 (23.8)	10 (33.3)
Chicken feet	6 (42.8)	4 (80.0)	1 (11.1)	4 (30.8)	2 (9.5)	11 (36.6)
Salted mackerel	1 (7.1)	1 (20.0)	4 (44.4)	1 (7.7)	4 (19.1)	15 (50.0)
Milk						
Soybean milk	5 (35.7)	5 (100.0)	4 (44.4)	10 (76.9)	9 (42.8)	7 (23.3)
UHT-no sugar	6 (42.8)	2 (40.0)	4 (44.4)	7 (53.8)	2 (9.5)	3 (10.0)
UHT-soybean milk	6 (42.8)	2 (40.0)	4 (44.4)	4 (30.8)	6 (28.6)	6 (20.0)

Table 32 The most commonly consumed food groups among 92 study subjects, according to 6 ethnics (cont.)

Food Items	Number (%)					
	Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Yogurt, drinking	3 (21.4)	0	2 (22.2)	4 (30.8)	3 (14.3)	3 (10.0)
Milk, powder (Anlene)	0	3 (60.0)	0	2 (15.4)	0	0
Desserts						
Khao-Tan	1 (14.3)	3 (60.0)	2 (22.2)	5 (38.5)	5 (23.8)	8 (26.7)
Khao-Hlam	5 (35.7)	2 (40.0)	0	1 (7.7)	3 (14.3)	5 (16.6)
Khao-Tom-Mud	4 (28.6)	2 (40.0)	0	0	3 (14.3)	4 (13.3)
Fried banana	0	0	0	0	3 (14.3)	4 (13.3)
Fat and Oil						
Soybean oil	13 (92.8)	5 (100.0)	9 (100.0)	13 (100.0)	18 (85.7)	26 (86.7)
Peanut	10 (71.4)	5 (100.0)	8 (88.9)	6 (46.2)	14 (66.7)	22 (73.3)
Black-sesame	4 (28.6)	1 (20.0)	4 (44.4)	5 (38.5)	3 (14.3)	12 (40.0)
White-sesame	1 (14.3)	0	2 (22.2)	6 (46.2)	7 (33.3)	13 (43.3)
Palm oil	1 (14.3)	1 (20.0)	0	1 (7.7)	5 (23.8)	14 (46.7)
Lard oil	1 (14.3)	2 (40.0)	2 (22.2)	7 (53.8)	4 (19.0)	6 (20.0)

Table 32 The most commonly consumed food groups among 92 study subjects, according to 6 ethnics (cont.)

Food Items	Number (%)					
	Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Seasoning						
Salt	14 (100.0)	5 (100.0)	9 (100.0)	13 (100.0)	19 (90.5)	30 (100.0
Monosodium glutamate	14 (100.0)	5 (100.0)	4 (44.4)	12 (92.3)	12 (57.1)	21 (70.0)
Soybean sauce	6 (42.8)	2 (40.0)	5 (55.6)	11 (84.6)	7 (33.3)	11 (36.7)
Fish sauce	5 (35.7)	1 (20.0)	7 (77.8)	2 (15.4)	6 (28.6)	8 (26.7)
Bouillon cube (Kanor)	8 (57.1)	2 (40.0)	3 (33.3)	5 (38.5)	2 (9.6)	3 (10.0)

B. Most Frequently Consumed Local Food Items

The most frequently consumed of local food items among 92 people with type 2 diabetes in the Doi Tung Development Project area is shown in table 33. The study subjects usually consumed boiled foods, chili paste, sauté and fried foods. The most commonly consumed local food of 92 study subjects were Chinese cabbage curry (76.1%), flower Chinese cabbage curry (68.2%), tomato chili paste (87.1%), fried seasoning pork (52.7%), and Khao Ram-Fhuen (62.4%). The percentage of frequency of the most commonly consumed local food menu among 92 people with type 2 diabetes in Doi Tung Development Project area is shown in table 34.

For most commonly consume soup and curry according to ethnic group, it was found that 80.0% of Tai Lue (4 subjects), 85.7% of Lahu (18 subjects), and 83.3% of Akha (25 subjects) consumed flower Chinese cabbage curry, whereas 80.0% of Tai Lue (4 subjects), 88.8% of Lawa (8 subjects), 100.0% of Haw and 83.3% of Akha (25 subjects) consumed Chinese cabbage curry. For consumption of chili paste, tomato chili paste was preferably consumed by 78.6% of Tai Yai, 76.9% of Haw, 90.5% of Lahu and 96.7% of Akha, whereas 80.0% of Tai Lue consumed green chilli Dip, Northern style. Sixty-six percent of study subjects with Lawa frequently consumed tomato chilli paste, dried fermented soybean chilli paste (Nam prik tooa-nao), green chilli dip, northern style (Nam prik noom). All ethnic groups frequently consumed fried seasoning pork (Moo-tod) and fried seasoning Nile tilapia (Pla-nin tod), whereas saute common cabbage and pork, saute flower Chinese cabbage and pork were consumed by 34.5% of Akha and 80.0% of Tai Lue.

Moreover present study showed that subjects with all ethnic groups frequently consumed pork salad (Laab moo) by 50.0% of Tai Yai (7 subjects) , 40% of Tai Lue (2 subjects), 66.6% of Lawa (6 subjects) , 46.2% of Haw (6 subjects) , 28.6% of Lahu (6 subjects) , 73.3% of Akha (22 subjects). The most frequently consumed of food items among 92 study subjects, according to 6 ethnics is shown in table 35. The frequency of the most commonly consumed local food among study subjects with Tai Yai, Tai Lue, Lawa, Haw, Lahu, and Akha are shown in appendix D. The pictures of the most frequently consumed of food groups among 92 study subjects are presented in appendix G.

Table 33 Most frequently consumed of local food items among 92 people with type 2 diabetes in Doi Tung Development Project area

Food Groups	List of Foods	Number	Percentage
Curry and soup	Chinese cabbage curry (แกงผักกวางตุ้ง)	70	76.1
	Flower Chinese cabbage curry (แกงผักกวางตุ้งดอก)	62	68.2
	Mungbean noodle soup (แกงจืดวุ้นเส้น)	57	61.3
	Flower Chinese cabbage curry with pork bone (จอผักกาด)	32	35.2
	White Chinese cabbage curry (แกงผักกาดขาว)	22	24.7
	Sesbania curry (แกงแค)	21	22.6
	Potato curry (แกงมันฝรั่ง)	21	22.6
	Young leaves pumpkin curry (แกงยอดฟักทอง)	20	21.5
	Nile tilapia soup (แกงส้มปลานิล)	17	18.3
Chilly paste	Tomato chilli paste (น้ำพริกมะเขือเทศ)	81	87.1
	Dried fermented soybean chilli paste (น้ำพริกถั่วเน่า)	50	53.8
	Green chilli Dip, Northern style (น้ำพริกหนุ่ม)	48	51.6
	Ground pork with tomatoes and chilli paste, Northern style (น้ำพริกอ่อง)	23	25.3
	Peanut chilli paste (น้ำพริกถั่วลิสง)	22	23.7
	Dried chilli paste (น้ำพริกแห้ง)	20	21.5
	Olive chilli paste (น้ำพริกมะกอก)	14	15.4
Stir-fried and	Fried seasoning pork (หมูทอด)	49	52.7
Fried	Fried seasoning Nile tilapia (ปลานิลทอด)	33	38.8
	Saute common cabbage and pork- (ผัดกะหล่ำปลีใส่หมู)	24	26.1
	Saute Flower Chinese cabbage and pork (ผัดผักกวางตุ้งดอกใส่หมู)	24	25.8
	Saute Chinese kale and pork- (ผัดผักคะน้าใส่หมู)	19	20.4

Table 33 Most frequently consumed of local food items among 92 people with type 2 diabetes in Doi Tung Development Project area (cont.)

Food Groups	List of Foods	Number	Percentage
Stir-fried and Fried	Saute Chinese cabbage and pork (ผัดผักกวางตุ้งใส่หมู)	16	17.2
	Saute green yard long bean and pork- (ผัดถั่วฝักยาวใส่หมู)	16	17.2
	Saute swamp cabbage and pork- (ผัดผักบุ้งใส่หมู)	15	16.3
Other foods items	Khao Ram-Fhuen (ข้าวแรมฟืน)	58	62.4
	Num-Ngyo (น้ำเงี้ยว)	58	62.4
	Pork salad (ลาบหมู)	50	53.8
	Abb (แอ๊บหมู)	33	35.5
	Sour mungbean noodle salad (ยำวุ้นเส้น)	33	35.5
	Long egg plant pounded salad (ตำมะเขือยาว)	24	25.8
	Flower Chinese cabbage salad (ยำผักกวางตุ้งดอก)	21	22.6

Table 34 The percentage of frequency of the most commonly consumed local food items among 92 people with type 2 diabetes in Doi Tung Development Project area

List of Foods	Everyday 7 times/week (%)	Frequent 5-6 times/week (%)	Sometimes 1-4 times/week (%)	Seldom < 4 times/month (%)	Never - (%)
Curry and soup					
Chinese cabbage curry	7.6	50.0	17.4	1.1	23.9
Flower Chinese cabbage curry	7.7	41.8	17.6	1.1	31.9
Mungbean noodle soup	1.1	5.4	30.1	23.7	39.8
Flower Chinese cabbage curry-with pork bone (Jor puk kad)	1.1	5.5	16.5	12.1	64.8
White Chinese cabbage curry	0	7.9	9.0	6.7	76.4
Sesbania curry (Kang kae)	1.1	0	8.7	13.0	77.2
Potato curry	0	1.1	5.4	15.1	78.5
Young leaves pumpkin curry	0	3.2	9.7	2.2	84.9
Nile tilapia soup (Tum pla-nin)	0	0	3.2	14.0	82.8
Chilly paste					
Tomato chilli paste	3.2	21.5	47.3	14.0	14.0
Dried fermented soybean chilli-paste (Nam prik tooa-nao)	0	1.1	32.3	19.4	47.3
Green chilli Dip, Northern style-(Nam prik noom)	1.1	11.8	25.8	11.8	49.5
Ground pork with tomatoes-and chilli paste, Northern style (Nam prik ong)	0	1.1	5.5	17.6	75.8
Peanut chilli paste-(Namprik tooa-lisong)	0	0	5.4	17.2	77.4
Dried chilli paste-(Namprik hang)	0	7.5	11.8	1.1	79.6
Olive chilli paste (Namprik ma-koak)	0	0	9.9	4.4	85.7

Table 34 The percentage of frequency of the most commonly consumed local food items among 92 people with type 2 diabetes in Doi Tung Development Project area (cont.)

List of Foods	Everyday 7 times/week (%)	Frequent 5-6 times/week (%)	Sometimes 1-4 times/week (%)	Seldom < 4 times/month (%)	Never - (%)
Stir-fried and Fried					
Fried seasoning pork (Moo-tod)	0	5.4	26.9	19.4	48.4
Fried seasoning Nile tilapia (Pla-nin tod)	0	0	18.8	18.8	62.4
Saute common cabbage and pork (Pad ka lhum)	0	5.4	12.0	7.6	75.0
Saute Flower Chinese cabbage- and pork	0	7.5	15.1	2.2	75.3
Saute Chinese kale and pork (Pad puk ka na)	0	3.2	11.8	4.3	80.7
Saute Chinese cabbage and pork	1.1	6.5	7.5	1.1	83.9
Saute green yard long bean and- pork (Pad tua fuk yaw)	0	1.1	9.7	5.4	83.9
Saute swamp cabbage and pork- (Pad puk-bung)	0	3.3	7.6	4.3	84.8
Other foods items					
Khao Ram-Fhuen	0	1.1	9.7	50.5	38.7
Num-Ngyo	0	1.1	6.5	53.8	38.7
Pork salad (Laab moo)	0	0	9.7	43.0	47.3
Abb	0	3.2	12.9	18.3	85.6
Sour mungbean noodle salad	0	0	6.5	28.0	65.6
Long egg plant pounded salad	0	0	11.8	12.9	74.2
Flower Chinese cabbage salad	0	7.5	11.8	2.2	78.5

Table 35 Most frequently consumed of food items among 92 study subjects, according to 6 ethnics

Food Items	Number (%)					
	Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Curry and soup						
Mungbean noodle soup	10 (71.4)	3 (60.0)	7 (77.8)	9 (69.2)	11 (52.4)	16 (53.3)
Flower Chinese cabbage curry-with pork bone (Jor puk kad)	8 (57.1)	3 (60.0)	3 (33.3)	1 (7.7)	0	12 (37.9)
Flower Chinese cabbage curry	7 (53.9)	4 (80.0)	6 (66.6)	2 (15.4)	18 (85.7)	25 (83.3)
Sesbania curry (Kang kae)	7 (53.9)	1 (20.0)	7 (77.8)	0	1 (4.8)	4 (13.4)
Chinese cabbage curry	5 (35.7)	4 (80.0)	8 (88.8)	13 (100.0)	15 (71.4)	25 (83.3)
Young leaves pumpkin curry	3 (21.4)	0	0	0	9 (42.9)	9 (30.0)
White Chinese cabbage curry	1 (7.1)	0	0	2 (15.4)	11 (55.0)	7 (25.9)
Nile tilapia soup (Tum pla-nin)	1 (7.1)	1 (20.0)	0	0	1 (4.8)	13 (43.3)
Potato curry	0	0	0	1 (7.7)	10 (47.6)	9 (30.0)
Chilly paste						
Tomato chilli paste	11 (78.6)	3 (60.0)	6 (66.6)	10 (76.9)	19 (90.5)	29 (96.7)
Dried fermented soybean chilli paste (Nam prik tooa-nao)	10 (71.4)	3 (60.0)	6 (66.6)	3 (23.1)	8 (38.0)	19 (63.3)

Table 35 Most frequently consumed of food items among 92 study subjects, according to 6 ethnics (cont.)

Food Items	Number (%)					
	Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Chilly paste						
Green chilli Dip, Northern style-(Nam prik noom)	9 (64.3)	3 (60.0)	6 (66.6)	7 (53.8)	8 (30.1)	19 (63.3)
Ground pork with tomatoes and-chilli paste, Northern style	6 (42.9)	4 (80.0)	5 (62.5)	1 (7.7)	1 (5.0)	5 (16.7)
Peanut chilli paste-(Namprik tooa-lisong)	5 (35.7)	3 (60.0)	5 (62.5)	2 (15.4)	2 (9.5)	4 (13.3)
Dried chilli paste (Namprik hang)	1 (7.1)	2 (40.0)	0	0	9 (42.9)	8 (26.7)
Olive chilli paste (Namprik ma-koak)	8 (57.1)	3 (60.0)	1 (14.3)	0	1 (4.8)	0
Stir-fried and Fried						
Fried seasoning pork (Moo-tod)	6 (42.9)	1 (20.0)	7 (77.8)	9 (69.2)	12 (57.1)	13 (43.3)
Fried seasoning Nile tilapia (Pla-nin tod)	6 (42.9)	1 (20.0)	5 (55.6)	9 (81.8)	4 (23.8)	7 (26.9)
Saute common cabbage and pork	1 (7.1)	1 (20.0)	1 (11.1)	4 (30.8)	6 (28.6)	10 (34.5)
Saute Flower Chinese cabbage-and pork	4 (28.6)	4 (80.0)	3 (33.3)	7 (53.8)	1 (4.8)	4 (13.4)

Table 35 Most frequently consumed of food items among 92 study subjects, according to 6 ethnics (cont.)

Food Items	Number (%)					
	Tai Yai (N=14)	Tai Lue (N=5)	Lawa (N=9)	Haw (N=13)	Lahu (N=21)	Akha (N=30)
Stir-fried and Fried						
Saute Chinese kale and pork	2 (14.2)	1 (20.0)	3 (33.3)	6 (46.2)	2 (9.6)	4 (13.3)
Saute Chinese cabbage and pork	0	1 (20.0)	3 (33.3)	0	2 (9.6)	9 (30.0)
Saute green yard long bean and-pork (Pad tua fuk yaw)	0	1 (20.0)	0	1 (7.7)	6 (28.6)	7 (23.3)
Saute swamp cabbage and pork	0	1 (20.0)	3 (33.3)	1 (7.7)	5 (23.8)	4 (13.3)
Other foods items						
Khao Ram-Fhuen	9 (64.3)	4 (80.0)	7 (77.8)	8 (61.5)	14 (66.7)	13 (43.4)
Num-Ngyo	8 (57.1)	4 (80.0)	7 (77.8)	6 (46.2)	13 (61.9)	19 (63.3)
Pork salad (Laab moo)	7 (50.0)	2 (40.0)	6 (66.6)	6 (46.2)	6 (28.6)	22 (73.3)
Abb	0	1 (20.0)	5 (55.6)	0	9 (42.9)	17 (56.7)
Sour mungbean noodle salad	0	0	5 (55.6)	5 (38.5)	7 (33.3)	15 (50.0)
Long egg plant pounded salad	0	1 (20.0)	0	0	10 (47.6)	12 (40.0)
Flower Chinese cabbage salad	0	1 (20.0)	0	0	9 (42.9)	10 (33.3)

5.3.3 Nutritive Value of the Most Commonly Consumed Food Items

The comparison of the nutritive value of the most commonly consumed 10 local food items per serving are shown in table 36. The nutritive value of the most commonly consumed 10 local food items were presented according to percentage of consumption among people with type 2 diabetes. The most commonly consumed 10 local food items included chili paste 3 items (tomato chili paste, Namprik Tooa-Nao, Namprik Noom), curry 3 items (Chinese cabbage curry, flower Chinese cabbage curry (Jor puk kad), mungbean noodle soup), fried 1 items (Moo-Tod) and other food 3 items (Khao Ram-Fhuen, Num-Ngyo, Laab Moo). The total energy of each local food items was between 11.2-470.3 kcal per serving which Namprik Noom had lowest energy per serving and Num-Ngyo had highest energy. The energy of tomato chili paste, Namprik Tooa-Nao, and Namprik Noom were 46.3 kcal, 25.8 kcal, and 11.2 kcal per serving, respectively. The carbohydrate of local food items was between 0.7 - 54.7 g per serving which Moo Tod had lowest carbohydrate per serving and Num-Ngyo had highest amount of carbohydrate. The dietary protein per serving of local food items was between 0.1 - 19.7 g per serving which Namprik Noom had low protein (0.1 g/serving), whereas Moo-Tod was high protein 19.7 g/serving. The amount of fat in most commonly consumed 10 local food items was between 0.5 - 130.1 g per serving which Namprik Noom had dietary fat 0.5 g/serving, whereas Num-Ngyo had fat 130.1 g/serving.

The dietary cholesterol of local food items was between 0-140.2 mg/serving which Khao Ram-Fhuen, tomato chili paste, Namprik Tooa-Nao, and Namprik Noom had no cholesterol, whereas mungbean noodle soup had highest cholesterol (140.2 mg/serving). The amount of sugar in most commonly consumed 10 local food items was between 0.1-8.9 g per serving which Jor puk kad, Laab-Moo, and Namprik Tooa-Nao had sugar only 0.1 g/serving, whereas Khao Ram-Fhuen had sugar 8.9 g/serving. The dietary fiber per serving of local food items was between 0.2-2.8 g per serving which Jor puk kad, Num-Ngyo, Laab-Moo, and Moo-Tod had low dietary fiber (0.2 g/serving), whereas Khao Ram-Fhuen was high dietary fiber 2.8 g/serving. For sodium, the amount of sodium in l0 local food items were between 286.2 - 4409.0 mg of sodium/serving which Tomato chili paste had the lowest sodium content, whereas Num-Ngyo had the highest sodium content.

Table 36 Nutritive value of the most commonly consumed 10 local food items per serving among type 2 diabetes

Local food items	Energy (kcal)	Carbohydrate (g)	Protein (g)	Fat (g)	Cholesterol (mg)	Sugar (g)	Fiber (g)	Sodium (mg)
Chili pastes								
Tomato chili paste	16.3	3.0	0.2	0.7	0	1.6	0.6	286.2
Namprik Tooa-Nao	25.8	2.3	0.9	2.3	0	0.1	0.4	539.2
Namprik Noom	11.2	2.2	0.1	0.5	0	0.8	0.9	414.1
Curries								
Chinese cabbage curry	148.2	2.9	9.3	13.2	29.4	1.3	1.6	670.7
Jor puk kad	172.9	2.4	10.7	16.7	35.8	0.1	0.2	743.1
Mungbean noodle soup	305.2	8.1	18.9	25.6	140.2	0.6	1.6	989.7
Fried								
Moo-Tod	247.7	0.7	19.7	16.9	37.4	0.2	0.2	476.6
Other foods								
Laab-Moo	227.4	1.8	17.7	15.2	33.5	0.1	0.2	919.1
Khao Ram-Fhuen	328.4	59.9	9.1	6.1	0	8.9	2.8	2080.5
Num-Ngyo	470.3	54.7	19.1	130.1	14.0	4.2	0.2	4409.0
Mean ± SD	181.9 ± 144.2	17.6 ± 10.7	10.2 ± 8.2	38.5 ± 22.9	42. 3 ± 29.0	2.8 ± 1.8	0.8 ± 0.7	1245.8 ± 1146.9
Range	11.2 - 470.3	0.7 - 54.7	0.1 - 19.7	0.5 - 130.1	0 - 140.2	0.1 - 8.9	0.2 - 2.3	286.2 - 4409.0

Nutritive Value and Ingredients of the Most Commonly Consumed 10 Food Items

1) Tomato chili paste

The nutritive values of tomato chilli paste per person was 16.3 kcal of energy, 0 mg of cholesterol, 1.6 g of sugar, 0.6 g of fiber, 286.2 mg of sodium, and percentage ratio of carbohydrate: protein: fat was 74: 18: 8.

Ingredients:	Tomato	100	g
(4 people)	Coriander	12	g
	Spring onion	10	g
	Chilli pepper	14	g
	Garlic	13	g
	Salt	½	teaspoon
	Monosodium glutamate	0.2	teaspoon

Nutritive value per person:

Energy (kcal)	CHO (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	VitA (RE)	$VitB_1$ (mg)	$VitB_2$ (mg)	VitC (mg)	NiA (mg)
16.3	3	0.2	0.7	8.1	16.1	0.3	113.8	17.9	0.03	0.03	15.3	0.4

2) Chinese cabbage curry

The nutritive values of Chinese cabbage curry with pork bone per person was 148.2 kcal of energy, 29.4 mg of cholesterol, 1.3 g of sugar, 1.6 g of fiber, 670.7 mg of sodium, and percentage ratio of carbohydrate: protein: fat was 8: 36: 56.

Ingredients:	Chinese cabbage	265	g
(4 people)	Pork bone	250	g
	Water	800	g
	Chilli pepper	7	g
	Coriander	10	g
	Salt	1	teaspoon
	Monosodium glutamate	0.25	teaspoon

Nutritive value per person:

Energy (kcal)	CHO (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	VitA (RE)	$VitB_1$ (mg)	$VitB_2$ (mg)	VitC (mg)	NiA (mg)
148.2	2.9	9.3	13.2	79.3	102.5	1.5	318.0	127.4	0.6	0.2	35.9	3.0

3) **Flower Chinese cabbage (Jor puk kad)**

The nutritive values of flower Chinese cabbage curry with pork bone (Jor puk kad) per person was 172.9 kcal of energy, 35.8 mg of cholesterol, 0.1 g of sugar, 0.2 g of fiber, 743.1 mg of sodium, and percentage ratio of carbohydrate: protein: fat was 5: 39: 56.

Ingredients:	Chinese cabbage flower	245	g
(4 people)	Water	760	g
	Tomato	56	g
	Shallot	14	g
	Pork bone	175	g
	Garlic	7	g
	Dried soybean fermented	7	g
	Salt	1	tea spoon
	Monosodium glutamate	0.25	tea spoon

Nutritive value per person:

Energy (kcal)	CHO (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	VitA (RE)	$VitB_1$ (mg)	$VitB_2$ (mg)	VitC (mg)	NiA (mg)
172.9	2.4	10.7	16.7	30.3	106.7	1.1	87.6	77.9	0.3	0.4	21.0	0.6

4) **Khao Ram-Fhuen**

The nutritive values of Khao Ram-Fhuen per person was 328.4 kcal of energy, 0 mg of cholesterol, 8.9 g of sugar, 2.8 g of fiber, 2080.5 mg of sodium, and percentage ratio of carbohydrate: protein: fat was 58: 16: 26.

Ingredients:	Khao Ram-Fhuen	-	
(per persons)	Roasted without shell peanut	1	table spoon
	Deep fried garlic	1	table spoon
	Thick soybean sauce-black	1.5	table spoon
	Tomato juice	6	table spoons
	Mungbean sprout	1	cup
	Coriander	1	table spoon
	White sugar	1	tea spoon
	Monosodium glutamate	0.5	tea spoon
	Salt	1/3	tea spoon

Nutritive value per person:

Energy (kcal)	CHO (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	VitA (RE)	$VitB_1$ (mg)	$VitB_2$ (mg)	VitC (mg)	NiA (mg)
328.4	59.9	6.1	9.1	58.2	108.8	1.7	718.7	4.7	0.1	0.1	11.0	2.3

5) Num-Ngyo

The nutritive values of Num-Ngyo per person was 470.3 kcal of energy, 14.0 mg of cholesterol, 4.2 g of sugar, 0.2 g of fiber, 4409.0 mg of sodium, and percentage ratio of carbohydrate: protein: fat was 47: 17: 36.

Ingredients:	Big size rice noodles	1 cup
(per people)	Pork, minced, boiled (Fat 14.8%)	2 table spoons
	Soup, Num-Ngyo (soup only)	2 cups
	Tomato	1 table spoons
	Mungbean sprout	2.5 table spoons
	Coriander	0.5 table spoon

Nutritive value per person:

Energy (kcal)	CHO (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	VitA (RE)	$VitB_1$ (mg)	$VitB_2$ (mg)	VitC (mg)	NiA (mg)
470.3	54.7	19.1	19.7	130.1	143.4	8.5	307.0	28.5	0.3	0.4	19.0	2.6

6) Mungbean noodle soup

The nutritive values of mungbean noodle soup per person was 305.2 kcal of energy, 140.2 mg of cholesterol, 0.6 g of sugar, 1.6 g of fiber, 989.7 mg of sodium, and percentage ratio of carbohydrate: protein: fat was 11: 34:56.

Ingredients:	Water	835 g
(4 people)	White Chinese cabbage	230 g
	Pork bone	235 g
	Mungbean noodle	37 g
	Soybean curd with egg	2 pouch
	Pork minced	110 g
	Spring onion	14 g
	Onion	76 g
	Coriander	7 g

6) Mungbean noodle soup (cont,)

Ingredients:	Soup instant (Kanor)	0.5	cubic
(4 people)	Salt	6	g
	Monosodium glutamate	0.25	tea spoon

Nutritive value per person:

Energy (kcal)	CHO (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	VitA (RE)	$VitB_1$ (mg)	$VitB_2$ (mg)	VitC (mg)	NiA (mg)
305.2	8.1	18.9	25.6	97.3	212.7	2.3	477.0	5.2	0.6	0.4	22.5	3.3

7) Dried fermented soybean chilli paste (Namprik Tooa-Nao)

The nutritive values of dried fermented soybean chilli paste (Namprik tooa-nao) per person was 25.8 kcal of energy, 0 mg of cholesterol, 0.1 g of sugar, 0.4 g of fiber, 539.2 mg of sodium, and percentage ratio of carbohydrate: protein: fat was 35: 36: 29.

Ingredients:	Dried soybean fermented	18.8	g
(4 people)	Chilli pepper	27.2	g
	Garlic	9.4	g
	Shallot	24.0	g
	Coriander	9.3	g
	Salt	1	tea spoon
	Monosodium glutamate	0.25	tea spoon

Nutritive value per person:

Energy (kcal)	CHO (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	VitA (RE)	$VitB_1$ (mg)	$VitB_2$ (mg)	VitC (mg)	NiA (mg)
25.8	2.3	0.9	2.3	18.3	5.5	1.1	33.8	4.3	0.03	0.1	4.6	0.2

8) Pork salad (Laab-Moo)

The nutritive values of Pork salad (Laab moo) per person was 227.4 kcal of energy, 33.5 mg of cholesterol, 0.1 g of sugar, 0.2 g of fiber, 919.1 mg of sodium, and percentage ratio of carbohydrate: protein: fat was 3: 27: 70.

Ingredients:	Pork minced	272.5	g
(4 people)	Dried chilli	4.3	g
	Oil	16	g
	Garlic	5	g
	Spring onion	10.5	g
	Coriander	7.5	g
	Salt	1.5	tea spoon
	Monosodium glutamate	0.25	tea spoon

Nutritive value per person:

Energy (kcal)	CHO (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	VitA (RE)	$VitB_1$ (mg)	$VitB_2$ (mg)	VitC (mg)	NiA (mg)
227.4	1.8	17.7	15.2	8.7	148.3	0.9	268.9	13.5	0.8	0.1	2.2	3.8

9) Fried seasoning pork (Moo-Tod)

The nutritive values of fried seasoning pork (Moo-tod) per person was 247.7 kcal of energy, 37.4 mg of cholesterol, 0.2 g of sugar, 0.2 g of fiber, 476.6 mg of sodium, and percentage ratio of carbohydrate: protein: fat was 1: 27: 72.

Ingredients:	Pork bone	180	g
(4 persons)	Coriander	5.5	g
	Spring onion	9	g
	Garlic	7.5	g
	Oil	66	g
	Salt	0.75	tea spoon
	Monosodium glutamate	0.25	tea spoon

Nutritive value per person:

Energy (kcal)	CHO (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	VitA (RE)	$VitB_1$ (mg)	$VitB_2$ (mg)	VitC (mg)	NiA (mg)
247.7	0.7	19.7	16.9	4.8	161.7	1.2	301.3	3.4	0.9	0.2	1.7	2.5

10) Green chilli Dip, Northern style (Namprik Noom)

The nutritive values of green chilli dip, northern style (Namprik Noom) per person was 11.2 kcal of energy, 0.8 g of sugar, 0.9 g of fiber, 414.1 mg of sodium, and percentage ratio of carbohydrate: protein: fat was 77: 18: 5.

Ingredients:	Green chilli pepper	56.5	g
(4 persons)	Garlic	8	g
	Spring onion	12	g
	Coriander	7	g
	Shallot	18	g
	Salt	0.75	tea spoon
	Monosodium glutamate	0.25	tea spoon

Nutritive value per person:

Energy (kcal)	CHO (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	VitA (RE)	$VitB_1$ (mg)	$VitB_2$ (mg)	VitC (mg)	NiA (mg)
11.2	2.2	0.1	0.5	5.1	7.5	0.2	36.9	4.3	0.02	0.01	5.3	0.07

CHAPTER VI
DISCUSSION

The study was revealed the nutritive value of local food preferences and the nutritional status in people with type 2 diabetes from Doi Tung Development Project area, Chiang Rai province. This chapter was performed to discuss the results from previous chapter. The results from the previous chapter have been discussed based on the relevant researches. The discussion of result is shown in a sequent that similar to result chapter as follows.

6.1 General Characteristics of Subjects

The socio-demographic characteristics were included with age, gender, ethnics, religion, marital status, education, living status, education, occupation, and family income. Wild S. and colleagues (102) studied the global prevalence of diabetes, the study showed that the majority of people with diabetes in developing countries were in 45-64 years age range. They considered sex-specific estimates of diabetes prevalence by age which found that the prevalence of diabetes was slightly higher in men than women with age < 60 years, whereas the prevalence of diabetes was higher number in elderly women than men at age ≥ 65 years. This study was revealed that majority of subjects (62.0%) aged 45-64 years that similar to the finding reported previously, meanwhile the subjects were 75 women (81.5%) and only 17 subjects (18.5%) were men which this finding was difference from the previous study. Consideration of sex-specific estimates of diabetes prevalence by age in this study, it was found that 29 diabetes subjects aged ≥ 65 years with 22 women (75.9%) and 7 men (24.1%).

The study subjects had various ethnic minority groups and hill-tribes including Akha, Lahu, Haw, Tai Yai, Tai Lue, and Lawa. Approximately 32.6% and 22.8% of the study subjects were Akha and Lahu who were the majority of population resided at Doi Tung Development Project area, respectively. More than a half of subjects communicated by their ethnic language and almost 95 percent were illiterate. Food and Agriculture Organization corporate document repository (103) revealed the education opportunities for hill tribes in northern of Thailand, it was found that the older generations lack access to basic social services including education and health care which result from geographical isolation, land settlement and communication barriers. It effected to lack opportunities for skill development, income and employment. Most hill-tribe people work in agriculture as their main economic activity. As well as 31.5% of study subjects were agriculture and half of study subjects were unemployed. Their family income was 2,000 - 6,000 baht/month. Moreover the study of Schillinger D., *et al.* showed literacy mediated the relationship between education and glycemic control among a low-income population with diabetes. It was important to implications both education and health policy (104).

Almost the study subjects did not drink either coffee, fruit juice or carbonate beverage, whereas forty five percent of study subjects always drank tea resultant from tea is economic crop which is available in the area. This study found a half of subjects did not have physical activity, whereas forty-four percent of study subjects had physical activity, by walking. The average frequency of physical activity was 3.1 ± 2.6 days per week and the average duration of physical activity was 23.9 ± 9.7 minutes per time. Several studies revealed that continuation of exercise can improve metabolic control including reductions in fasting blood glucose, HbA1C, total cholesterol, LDL-cholesterol, triglyceride, and an elevation in HDL-cholesterol concentrations in patients with type 2 diabetes which beneficial with reduced atherogenic lipid profile and prevent the development of cardiovascular diseases (105, 106). The subjects were adhering on a regimen of diet and exercise, whereas the study of Wallberg-Henriksson H., *et al.* (107) showed the effect on insulin sensitivity of aerobic exercise depending on the duration and intensity of the activity. Therefore ADA Position Statement on physical activity and exercise (108) recommended that individuals with type 2 diabetes should exercise or have physical activity at least 3

days/week or at least 150 minute/week or 20-60 minute/day of moderate-intensity aerobic physical activity including walk fast and aerobic dance.

The duration of diabetes among the study subjects were 4.9 ± 4.0 years, whereas the duration of diabetes of more than 5 years was risk factor associated with diabetic retinopathy and other diabetes complications. The study of Mayurasakorn K., *et al.* (109) from Thailand showed that type 2 diabetes patients who had the duration of diabetes > 4 years had high rate of microvascular complications, including nephropathy and retinopathy. Many studies reported the duration of diabetes has been the strongest independent risk factor for development and progression of diabetes retinopathy, cardiovascular disease (110, 111). The major risk factors of cardiovascular disease were hypertension, dyslipidemia and diabetes mellitus which this study found that 17.6% and 48.9% of subjects with type 2 diabetes had dyslipidemia and hypertension.

The majority of subjects (97%) controlled their blood glucose taking by drugs and diet control as a treatment, whereas 12% of study subjects have been used the decoction and herb for control their blood glucose due to their believe that it assist the metabolic control in people with diabetes. Anderson E. F. (112) studied medicinal plants and traditional medicine in Akha ethnic, the result showed that they used first in medicines derived from plants and animals for cure the illness or injury and these tribal medicines have long been used to treat a wide variety of illnesses and injuries in Akha generation (113). However, the study subjects received the nutritional knowledge from health care professional to improve metabolic control.

6.2 Nutritional Status of Study Subjects

6.2.1 Anthropometry and Blood Pressure

Eighty five of the study subjects were obese with 76.4% of men and 86.7% of women, whereas 17.6% of men and 18.7% women were overweight. The study of Eeg-Olofsson K. and colleagues (114) revealed that patients with type 2 diabetes who had overweight and obesity increased the risk of cardiovascular disease compared with normal weight. Moreover the risk of coronary heart disease was high with increasing BMI in patients with type 2 diabetes. Ninety two percent of female subjects in this study and 88.3% male subject had percentage of body fat higher than normal level. The study of Boonyavarakul A., et al. (115) found the percentage of body fat and BMI was significant association between men and women in rural Thai population. High BMI, female gender, and older age were associated with increased the prevalent of metabolic syndrome which was an important problem leading to coronary heart disease in rural Thai population.

The measurement of BMI and waist circumference in combination or waist circumference alone was recommended to assess the overweight and obesity in adults (116, 117). High waist circumference indicated elevate the abdominal fat mass in individuals, however the abdominal obesity had harmful influence on the metabolic status of type 2 diabetic subjects. Sumner A. E., *et al* (118) showed that elevate abdominal visceral fat had affected to insulin resistance and increased atherosclerosis that leading to coronary heart disease among patients with type 2 diabetes. There was 90.2% of this study subjects (83 subjects) had a high waist circumference with 10 men (58.8% of male subjects) and 73 women (97.3% of female subjects), whereas 50.8% of study subjects had high visceral fat with 13 men (76.5% of male subjects) and 42 women (56.0% of female subjects). This study showed that the percentage of male subjects who had high waist circumference was lower than female subjects, whereas the percentage of male subjects who had high visceral fat was higher than female subjects. Therefore the moderate weight loss is useful to decreased insulin resistance, improved the glycemia and lipidemia, and reduced blood pressure in people with type 2 diabetes.

The study of Sato S. and Demura S. (119) clarified the sex-specific, age-specific, and obesity level-specific regional subcutaneous fat characteristics and the relationships with total and visceral fat in Japanese adults. The study found the relationships between subcutaneous fat, total fat, and visceral fat differed with sex and obesity level. Subcutaneous fat accumulation progressed the central body with increased age and obesity which the subcutaneous fat accumulation capacity had a close relationship with visceral fat accumulation. Whereas the study of Sumner A. E., *et al.* (116) investigated the difference of sex in visceral adipose tissue volume among African Americans by using a single computed tomography slice. They found men had a volume of visceral adipose tissue higher than women after adjustment for percentage of body fat or fat mass. Male type 2 diabetes with high visceral obesity, regardless of a normal waist circumference, had higher risk of carotid atherosclerosis than male type 2 diabetes with high waist circumference, but without visceral obesity (120).

Twenty-eight percent and 21.7% of study subjects had ≥ 140 mmHg of systolic blood pressure and ≥ 90 mmHg of diastolic blood pressure. The UK prospective (121) diabetes study reported the risk of diabetic complications was strongly associated with raised blood pressure. Asia Pacific Cohort Studies Collaboration showed systolic blood pressure is an important factor to indicate the risk of macrovascular or microvascular complications in people with type 2 diabetes (122). Whereas 25% and 46.7% of this study subjects were classified as having normal SBP (< 120 mmHg) and pre-hypertension of SBP (120-139 mmHg), respectively. Approximately 46.7% and 31.5% of study subjects were classified as having normal DBP (< 80 mmHg) and pre-hypertension of DBP (80-89 mmHg), respectively. Most of study subjects had SBP ≤ 140 mmHg (71.7% of all subjects) and DBP ≤ 90 mmHg (78.2% of all subjects) that may effect from their subsequent treatment. This study found that more than a half of study subjects received antihypertensive drugs and medication from public health professional.

6.2.2 Biochemical Parameters

FPG and HbA_{1c} were used to indicate the glycemic control in study subjects. FPG is routine used as an indicator of glycemic control in the study subjects at Doi Tung Development project area, while HbA_{1c} was an indicator for long-term glycemic control (123). Forty percent of study subjects had high FPG with 6 men (35.3% of male subjects) and 31 women (41.3% of female subjects) were obese, whereas 75% of all study subjects (12 men and 48 women) had HbA_{1c} higher than the criteria of ADA. A cross-sectional study of diabetic patients from primary care units in urban areas of Thailand, also found that 58.7% of the diabetic patients had HbA_{1c} higher than 7% and they have significantly higher rates of microvascular complications (124).

Gikas A. and colleagues from Greece (125) studied the seasonal variations in fasting glucose and HbA_{1c} levels in patients with type 2 diabetes, they found that the value of fasting blood glucose and HbA1c were significantly higher at colder (a mean minimum temperature 5-10 Celsius) than in warmer months (the mean maximum temperature lies between 29-35 Celsius). Thus the season may effect blood glucose level in people with diabetes. As well as, this cross sectional study collected the data between November 2008 - July 2009 which covered winter, summer, and rainy season which may influenced on the outcome of fasting blood glucose and HbA_{1c} in the study subjects.

The study subjects with type 2 diabetes at Doi Tung Development projects area had mean serum lipids of cholesterol, LDL cholesterol, HDL cholesterol and triglycerides of 185.6 ± 44.9, 100.3 ± 34.5, 44.6 ± 12.0 and 213.2 ± 177.4 mg/dl, respectively. Pratipanawatr T., *et al.* (47) studied dyslipidemia in Thai diabetic patients, it was found that 36.5%, 65.8%, and 31.6%, of subjects without cardiovascular disease had triglyceride ≥ 150 mg/dl; LDL cholesterol ≥ 100 mg/dl; HDL cholesterol ≤ 40 mg/dl in male and 50 mg/dl in female, respectively. This study according to ADA recommendation for diabetes, the result showed that 31.3%, 56.3%, 46.1%, and 66.3% of the study subjects had high cholesterol, high triglyceride, high LDL cholesterol, and low HDL cholesterol, respectively. Compared of the study of Pratipanawatr T., *et al*, it was found that subjects in this study had higher prevalence of hypertriglyceridemia and low HDL.

This study subjects had poor control of blood glucose, high triglyceride and low HDL cholesterol which are risk factors for cardiovascular disease in people with diabetes (126). Poor glycemic control occur to be risk factor for low HDL cholesterol in people with diabetes, according to the study of Gatti A., *et al.* (127) which showed 1% increase of HbA_{1c} significantly raised the risk for low HDL cholesterol (odd ratio 1.17 [95% CI 1.1-1.2], P = 0.00072) and the association remained strong after adjustments for obesity and hypertriglyceridemia in multivariate analysis (1.12 [1.05-1.18], P = 0.00017). Lower HDL cholesterol is an important risk factor for ischemic heart disease and cardiovascular disease, especially in diabetic elderly individuals (128).

6.2.3 Dietary intake

The mean energy intake of the study subjects were 930.5 ± 414.3 kcal/day with 1009.8 ± 702.3 kcal in male subjects and 912.7 ± 320.5 kcal in female subjects. Comparison of energy intake and Thai DRI recommendation, it was found that both male and female in all age range had lower energy intake than energy recommendation. The result of FFQ showed that most of the study subjects commonly consumed chili paste with available vegetables and they preferred to eat rice with soup. The mean percentage of carbohydrate, protein, fat ratio were 66.2 ± 10.5, 15.9 ± 3.7, 17.8 ± 13.4 of total energy, respectively. A Cross-sectional study had been conducted among 109 patients with type 2 diabetes in Khon Kaen hospital, Thailand during May to June 2005 (20). The nutrient analysis of subjects'dietary intake showed that type 2 diabetes people basically consumed energy about 1075.9 kilocalories (59.7 of RDA) from dietary intake. The energy distribution of protein, carbohydrate, and fat in these people is 18.6%, 64.7%, and 16.7%, respectively. The study of Bothwell E. K. G., *et al* (129) showed the overweight, obese, and older persons were underreporting in 24 hour dietary recall. Fifty one percent of this study subjects were elderly and 85.0% of subjects were overweight and obese. This study might be underreported for energy intake.

In addition, the study of Ma Y., *et al* (95) reported that 3 days - dietary 24 hour recall is improved the dietary estimation, whereas average energy intake from two diet recalls is better approximated true energy expenditure than did the first recall. This study collected the daily dietary intake in the study subjects from 2 days - 24 hour recall because of big number of subjects and most subjects no education background.

The study subjects had high carbohydrate intake and low fat intake, whereas consumption of protein intake was within normal recommendation. High carbohydrate intake of the study subjects may result from starch, whereas the 24 hour dietary recall showed that only 9.8% of all subjects consumed high sugar. Eighty percent of study subjects consumed fat intake lower than the cutoff value. Barnard N. D. and colleagues (130) showed that the low fat diet and a diet based on ADA guidelines can improve the glycemic control and lipid profiles in individuals with type 2 diabetes. A high intake of dietary fiber is beneficial to enhance insulin sensitivity, improve glycemic control, decrease hyperinsulinemia, and lowers plasma lipid concentrations in people with type 2 diabetes (68, 131), whereas the majority of the study subjects (95.7%) were consumed dietary intake lower than ADA guidelines. Fifty-eight of the study subjects consumed sodium intake higher than ADA recommendation. High sodium intake may be a factor to the development of vascular disease in people with type 2 diabetes.

The local research study in elderly with diabetes at Mae Rai sub-district and municipality of Chan Chawa sub-district, Mae Chan district, Chiang Rai province (21) reported that people with diabetes restricted sweet, salty and fatty foods, used monosodium glutamate for cooking and consumed ready to eat foods bought from the markets which contain high monosodium glutamate.

6.3 Most Frequently Consumed Local Food Items of Subjects

Rice is the main staple food which is a source of carbohydrate. The study subjects in Doi Tung Development projects area frequently consume upland rice with local foods every day. The nutritive values of upland rice differ from the nutritive value of general rice as shown in table 36. The comparison of the nutritive value of general rice and upland rice, it was found that upland rice had energy and gram of carbohydrate higher than general rice. Although glutinous rice does not constitute the main staple food but they were used for dessert including crispy rice cracker (Khao-Tan), glutinous rice cooked in bamboo (Khao-Lam), and glutinous rice steamed with bean and coconut (Khao-Tom-Mud).

Table 37 The comparison of nutritive value of general rice and upland rice per 100 g

Nutritive value	General rice [1]	Upland rice [2] (ข้าวไร่)
Energy (kcal)	133.0	148.3
Fat (g)	0.3	0.1
Carbohydrate (g)	30.3	34.8
Protein (g)	2.3	1.6
Dietary fiber (g)	0.2	0.5
Phosphorus (mg)	19.0	36.8
Sodium (mg)	34.0	14.5
Potassium (mg)	88.0	18.4
Moisture (g)	66.8	63.0
Ash (g)	0.3	0.03

[1] The nutritive values was analyzed by INMUCAL - Nutrients program WD.2 versions

[2] The nutritive values was analyzed by the food laboratory, Institute of Nutritional, Mahidol University

Most commonly consumed vegetables of the study subjects are flower Chinese cabbage, Chinese cabbage, and white Chinese cabbage. These vegetables are grown and available in the area. For protein sources, pork meat, eggs, and fish shared a higher proportion, while deep fried pork skin (Kab-moo) and steamed of the mackerel (Pla-too-kheng) were the other most popular protein sources study subjects in Doi Tung Development Project area. Most of study subjects consumed soybean milk because it has more nutritive values and are easy for self prepare. For the study subjects who resided highness land including Lahu and Akha, they bought vegetables and meats from moveable market. They grew a vegetable garden in the backyard and got fish from the river that may be due to the geographic constraint. In addition, 23.9% of the study subjects preferred using lard for cooking that high in saturated fatty acid, this may lead to increase risk of cardiovascular disease.

The study subjects frequently consumed curry and chili paste. Seventy eight percent of subjects did their cooking by boiling and 16.3% of subjects cook with chilli paste regularly. Although the local recipes of the study subjects seem to contain a lot of vegetables but the result of 24 hour dietary recall showed that the study subjects consumed low fiber intake as recommendation for type 2 diabetes. The study subjects preferred to consume rice with soup more than vegetables and meats in their meal. Moreover sixty-two percent of study subjects preferred eating Khao Ram-Fhuen and Num-Ngyo that were popular carbohydrate source of the study subjects in this community.

Furthermore this study showed that a most commonly consumed food items were similar in each ethnic group, this may explain by less food availability to choose compared to people in low land. The study of hill tribe research center, Chiang Mai (132) showed that Lahu usually consumed rice and only one side dish consumed were curry or chilli paste. Lahu commonly consumed Chinese cabbage, pumpkin leave, cucumber, pork, chicken, banana, and mango. However a local food research of ethic group and hill tribe is needed to confirm the outcome of the study.

CHAPTER VII
CONCLUSION

The objective of the present study was to determine the nutritional status and the nutritive values of local foods commonly consumed among people with type 2 diabetes in the Doi Tung Development Project area, Chiang Rai province. The majority of study subjects had overnutrition problem with 18.5% of overweight and 66.4% of obese. They had abdominal obesity (90.2%) and excessive total body fat (91.4%). Meanwhile, the subjects had inappropriate blood glucose control, high HbA_{1c}, high triglyceride and low HDL cholesterol which are risk factors for cardiovascular disease in people with diabetes. The subjects with type 2 diabetes had inappropriate eating habit. The dietary intake was revealed that they consumed high carbohydrate intake and low dietary fiber that may lead to inappropriate blood glucose control.

Most commonly consumed 10 local food items of the study subjects were tomato chilli paste, Chinese cabbage curry, flower Chinese cabbage curry (Jor puk kad), Khao Ram-Fhuen, Num-Ngyo, mungbean noodle soup, Namprik Tooa-Nao, Laab-Moo, Moo-Tod, fried seasoning pork, and Namprik Noom, The mean of nutritive values per serving of the most commonly consumed local food items among type 2 diabetes were energy 181.9 ± 144.2 kcal, carbohydrate 17.6 ± 10.7 g, protein 10.2 ± 8.2 g, fat 38.5 ± 22.9 g, cholesterol 42.3 ± 29.0 mg, sugar 2.8 ± 1.8 g, fiber 0.8 ± 0.7 g, and sodium 1245.8 ± 1146.9 mg. Nutrition education should be conducted to healthy and dietary advice is also necessary which should be provided to people with diabetes at Doi Tung Development Projects area to make their own better food choices which could lead to more appropriate eating habit for blood glucose control of type 2 diabetes in the long term and prevent diabetes complications.

This finding is beneficial to manage an appropriate treatment of diabetes and fulfill the objective of the Doi Tung Development project in order to develop the health promotion campaigns to improve the quality of life of people.

Recommendation for Further Study

1. A further study should be focused on dietary habit of each specific ethnic group because tradition and culture of each ethnic group may effect their lifestyle and health care.
2. Appropriate nutrition education and intervention including knowledge of healthy eating and diabetes health care should be provided to people with diabetes in Doi Tung Development Project area to fit their tradition, culture and lifestyle.

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APPENDICES

APPENDIX A

COA. No. MU-IRB 2008/127.1410

Documentary Proof of Mahidol University Institutional Review Board

Title of Project. Nutritive Values of Local Foods and Nutritional Status in People with Diabetes at Doi Tung Development Project Area (Thesis for Master Degree)

Principle Investigator. Miss Chomnad Singhan

Name of Institution. Institute of Nutrition

Approval includes. 1) MU-IRB Submission form version received date 10 October 2008
2) Participant Information sheet version date 14 October 2008
3) Informed consent form version date 14 October 2008
4) Questionnaire version received date 10 October 2008

Mahidol University Institutional Review Board is in full compliance with International Guidelines for Human Research Protection such as Declaration of Helsinki, The Belmont Report, CIOMSGuidelines and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP)

Date of Approval. 14 October 2008

Date of Expiration. 13 October 2009

Signature of Chairman. .....
(Professor Shusee Visalyaputra)

Signature of Head of the Institute. .....
(Associate Professor Sansanee Chaiyaroj)
Vice President for Research and Academic Affairs

Office of the President, Mahidol University, 999 Phuttamonthon 4 Rd., Salaya, Phuttamonthon District, Nakhon Pathom 73170. Tel. (662) 8496223-5 Fax. (662) 8496223

APPENDIX B

The list of expert committee members who evaluated and commented the interviewing questionnaire for data collection among people with diabetes in Doi Tung Development project area.

1. Associate Professor Prapaisri Sirichakwal, Ph.D.
   Ph.D. (Nutritional Biochemistry and Metabolism)
   Human Nutrition Division
   Institute of Nutrition, Mahidol University
2. Asst. Prof. Wantanee Kriengsinyos, Ph.D.,RD
   Ph.D. (Nutritional Sciences)
   Human Nutrition Division
   Institute of Nutrition, Mahidol University
3. Orapin Banjong, M.C.N.
   M.C.N. (Community Nutrition)
   Community Nutrition Division
   Institute of Nutrition, Mahidol University

APPENDIX C

<u>แบบสัมภาษณ์</u>

สภาวะสุขภาพและอาหารพื้นบ้านที่ผู้เป็นโรคเบาหวานนิยมรับประทาน

แบบสัมภาษณ์นี้เพื่อประโยชน์ในงานวิจัยเกี่ยวกับ “คุณค่าทางโภชนาการของอาหารพื้นบ้านและสภาวะโภชนาการของผู้ที่เป็นโรคเบาหวานบนพื้นที่โครงการพัฒนาดอยตุง จังหวัดเชียงราย” ของนักศึกษาปริญญาโท สถาบันวิจัยโภชนาการ มหาวิทยาลัยมหิดล โดยมีวัตถุประสงค์เพื่อศึกษาสภาวะสุขภาพและอาหารพื้นบ้านที่ผู้เป็นโรคเบาหวานนิยมรับประทาน

<u>แบบสัมภาษณ์ประกอบด้วย 3 ส่วน</u> ดังนี้

ส่วนที่ 1 ข้อมูลทั่วไปและข้อมูลที่เกี่ยวกับอาหาร จำนวน 21 ข้อ
ส่วนที่ 2 ข้อมูลเกี่ยวกับสภาวะสุขภาพที่เกี่ยวข้องกับโรคเบาหวาน จำนวน 12 ข้อ
ส่วนที่ 3 ข้อมูลเกี่ยวกับอาหารที่บริโภค (แบบสัมภาษณ์ความถี่ในการบริโภคอาหารของผู้ที่เป็นโรคเบาหวาน)

ข้อมูลที่ได้จากการเก็บรวบรวมในครั้งนี้จะนำไปประเมินสภาวะสุขภาพและวิเคราะห์คุณค่าทางโภชนาการในอาหารที่ผู้เป็นโรคเบาหวานนิยมรับประทาน ข้อมูลทั้งหมดจะถือเป็นความลับ โดยข้อมูลที่ได้จากการประเมินและวิเคราะห์จะเป็นแนวทางในการแนะนำการบริโภคอาหารที่เหมาะสมแก่ผู้ที่เป็นโรคเบาหวานต่อไป

โปรดตอบคำถามให้ตรงกับความเป็นจริงมากที่สุด

ขอขอบคุณที่ให้ความร่วมมือ มา ณ โอกาสนี้

นางสาวชมนาด สิงห์หันต์
นักศึกษาปริญญาโท
หลักสูตรอาหารและโภชนาการเพื่อการพัฒนา
สาขาอาหารเพื่อการป้องกันและบำบัด
สถาบันโภชนาการ มหาวิทยาลัยมหิดล

ส่วนที่ 1: ข้อมูลทั่วไป

ชื่อ - สกุล..... **เพศ** (.....) **ชาย,** (.....) **หญิง**

อายุ..... **ปี** **วันเดือนปีที่สัมภาษณ์** ...../...../.……

กรุณาทำเครื่องหมาย ✓ ลงใน (.....) ที่ตรงกับข้อมูลของตัวท่าน

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1. เชื้อชาติ/เผ่าพันธุ์

(.....) ไทใหญ่ (.....) อาข่า/อีก้อ

(.....) ลาหู่/มูเซอ (.....) จีนฮ่อ

(.....) ไทลื้อ (.....) ลัวะ

(.....) อื่นๆ ระบุ.....

2. ศาสนา

(.....) พุทธ (.....) คริสต์

(.....) อิสลาม (.....) อื่นๆ ระบุ.....

3. สถานภาพสมรส

(.....) โสด (.....) อยู่ด้วยกัน

(.....) หม้าย (.....) หย่า/แยกกันอยู่

4. พื้นฐานการศึกษา

(.....) ไม่ได้รับการศึกษา

(.....) ต่ำกว่าประถมศึกษาปีที่ 4

(.....) จบชั้นประถมศึกษาปีที่ 4 (ป.4)

(.....) จบชั้นประถมศึกษาตอนปลาย (ป.7 หรือ ป.6)

(.....) จบชั้นมัธยมศึกษาตอนต้น (มศ. 3 หรือ ม.3)

(.....) จบชั้นมัธยมศึกษาตอนปลาย (มศ. 5 หรือ ม.5 หรือ ปวช.)

(.....) จบอนุปริญญา (ปวส.)

(.....) อื่นๆ ระบุ.....

5. อาชีพหลัก

(.....) เกษตรกรรม ระบุ.....

(.....) ค้าขาย (.....) รับจ้างทั่วไป

(.....) ข้าราชการ (.....) ลูกจ้าง

(.....) อื่นๆ ระบุ.....

6. สถานภาพของท่านในครอบครัว

(.....) หัวหน้าครอบครัว

(.....) สมาชิกในครอบครัว

7. สมาชิกครอบครัวที่อาศัยอยู่ในบ้านท่าน

(.....) พ่อ-แม่ (.....) ปู่ย่า-ตายาย

(.....) ลูก-หลาน (.....) เหลน

8. รายได้ของครอบครัว

(.....) น้อยกว่า 2000 บาท/เดือน (.....) 2000 - 6000 บาท/เดือน

(.....) 6001 - 10000 บาท/เดือน (.....) มากกว่า 10000 บาท/เดือน

(.....) อื่นๆ ระบุ.....

9. รายจ่ายค่าอาหารของครอบครัวต่อวัน.....บาท

10. บุคคล<u>หลัก</u>ที่จัดซื้อหรือหาอาหารมาประกอบในครัวเรือน

(.....) ตัวท่านเอง (.....) คู่สมรส

(.....) ลูกหลาน (.....) ลูกจ้าง

(.....) อื่นๆ ระบุ.....

11. ความบ่อยในการเลือกซื้ออาหารสดและอาหารแห้งในแต่ละฤดูกาลแตกต่างกันหรือไม่ อย่างไร

(.....) ไม่ต่างกัน

(.....) ต่างกัน เนื่องจาก…….

12. ที่บ้านของท่านจัดซื้อหา<u>ผัก</u> เช่น ผักกวางตุ้ง ผักบุ้ง ผักกาดขาว ฯลฯ บ่อยครั้งเพียงใด

(.....) ทุกวัน (.....) บ่อยครั้ง (5-6 ครั้ง/สัปดาห์)

(.....) บางครั้ง (1-4 ครั้ง/ สัปดาห์) (.....) นานๆ ครั้ง (≤ 4 ครั้ง/เดือน)

(…...) ไม่เคย (.....) อื่นๆ ระบุ.....

13. ที่บ้านของท่านจัดซื้อ<u>เนื้อสัตว์</u> เช่น เนื้อหมู ปลา เนื้อไก่ ฯลฯ บ่อยครั้งเพียงใด

(.....) ทุกวัน (.....) บ่อยครั้ง (5-6 ครั้ง/สัปดาห์)

(.....) บางครั้ง (1-4 ครั้ง/ สัปดาห์) (.....) นานๆ ครั้ง (≤ 4 ครั้ง/เดือน)

(…...) ไม่เคย (.....) อื่นๆ ระบุ.....

14. ที่บ้านของท่านจัดซื้อ<u>อาหารแห้งและเครื่องปรุงรสต่างๆ</u> บ่อยครั้งเพียงใด

(.....) ทุกวัน (.....) บ่อยครั้ง (5-6 ครั้ง/สัปดาห์)

(.....) บางครั้ง (1-4 ครั้ง/ สัปดาห์) (.....) นานๆ ครั้ง (≤ 4 ครั้ง/เดือน)

(…...) ไม่เคย (.....) อื่นๆ ระบุ.....

15. ครัวเรือนได้จัดซื้อหรือจัดหา<u>ผัก</u> เช่น ผักกวางตุ้ง ผักบุ้ง ผักกาดขาว ฯลฯ จากแหล่งใดมากที่สุด

(…...) ปลูกหรือหามาเอง (.....) ร้านขายของชำในหมู่บ้าน

(.....) รถที่เข้ามาขายของ (.....) ตลาดประจำหมู่บ้าน

(.....) อื่นๆ ระบุ.....

16. ครัวเรือนได้จัดซื้อหรือจัดหา<u>เนื้อสัตว์</u> เช่น เนื้อหมู ปลา เนื้อไก่ ฯลฯ จากแหล่งใดมากที่สุด

(…...) ปลูกหรือหามาเอง (.....) ร้านขายของชำในหมู่บ้าน

(.....) รถที่เข้ามาขายของ (.....) ตลาดประจำหมู่บ้าน

(.....) อื่นๆ ระบุ.....

17. ครัวเรือนได้จัดซื้อหรือจัดหา<u>อาหารแห้งและเครื่องปรุงรสต่างๆ</u> จากแหล่งใดมากที่สุด

(…...) ปลูกหรือหามาเอง (.....) ร้านขายของชำในหมู่บ้าน

(.....) รถที่เข้ามาขายของ (.....) ตลาดประจำหมู่บ้าน

(.....) อื่นๆ ระบุ.....

18. ครัวเรือนประกอบอาหารโดยวิธีการใดมากที่สุด

(.....) ผัด/ทอด (.....) น้ำพริก

(.....) นึ่ง/ตุ๋น (.....) ต้ม/แกง

(.....) ปิ้ง/ย่าง (.....) อื่นๆ ระบุ.....

19. ท่านเติมน้ำปลา หรือซอสปรุงรสเพิ่มในอาหาร ก่อนรับประทานหรือไม่

(.....) ไม่เติม (.....) เติม ..... ช้อนชา/มื้อ

20. ท่านเติมน้ำตาลเพิ่มในอาหาร ก่อนรับประทานหรือไม่

(.....) ไม่เติม (.....) เติม ..... ช้อนชา/มื้อ

21. เครื่องดื่มชนิดใดที่ท่านดื่มเป็นประจำ

(.....) น้ำเปล่า (.....) น้ำผลไม้

(.....) น้ำอัดลม (.....) น้ำสมุนไพร

(.....) อื่นๆ ระบุ.....

ส่วนที่ 2: ข้อมูลเกี่ยวกับสภาวะสุขภาพ

22. ท่านสูบบุหรี่/ยาเส้น/ยาสูบหรือไม่ (……) สูบบุหรี่/ยาเส้น/ยาสูบ..... มวน/วัน
(.....) ไม่สูบบุหรี่

23. ท่านดื่มเหล้า/สุราหรือไม่ (.....) ไม่ดื่ม
(……) ดื่ม (……) เหล้าขาว.....แก้ว/ขวดต่อวัน
(……) เหล้าโรง.....แก้ว/ขวดต่อวัน
(.....) เหล้าแดง.....แก้ว/ขวดต่อวัน
(……) เบียร์.....แก้ว/ขวด/กระป๋องต่อวัน
(.....) อื่นๆ ระบุ.....

24. ท่านเคยลดน้ำหนักตัวหรือไม่ (……) เคย (.....) ไม่เคย

25. ระยะเวลาที่ได้รับการวินิจฉัยว่าเป็นโรคเบาหวาน.....ปี……..เดือน

26. มีบุคคลในครอบครัวท่านเป็นโรคเบาหวานหรือไม่

(.....) ไม่มี
(.....) มี (ตอบได้มากกว่า 1 ข้อ)
(.....) พ่อ / แม่ (.....) สามี / ภรรยา
(.....) บุตร (.....) พี่ / น้อง
(.....) อื่น ระบุ.....

27. ท่านมีโรคดังต่อไปนี้ร่วมด้วยหรือไม่ (ตอบได้มากกว่า 1 ข้อ)

(.....) ไขมันในเลือดสูง (.....) โรคหัวใจ
(.....) โรคไต (.....) โรคความดันโลหิตสูง
(.....) อื่นๆ ระบุ.....

28. สถานที่ที่ท่านไปรับการรักษาโรคเบาหวาน

28.1) สถานีอนามัย พื้นที่โครงการพัฒนาดอยตุง อำเภอแม่ฟ้าหลวง จังหวัดเชียงราย

(……) สถานีอนามัยดอยตุง (.....) สถานีอนามัยห้วยน้ำขุ่น
(.....) สถานีอนามัยป่ายาง (.....) สถานีอนามัยสามัคคีใหม่

28.2) สถานีอนามัย พื้นที่โครงการพัฒนาดอยตุง อำเภอแม่สาย จังหวัดเชียงราย

(…...) สถานีอนามัยผาหมี (.....) สถานีอนามัยผาฮี้

28.3) โรงพยาบาลรัฐบาล จังหวัดเชียงราย

(…...) โรงพยาบาลอำเภอแม่จัน

(.....) โรงพยาบาลอำเภอแม่ฟ้าหลวง

(.....) โรงพยาบาลอำเภอแม่สาย

(.....) โรงพยาบาลเชียงรายประชานุเคราะห์

(.....) อื่นๆ ระบุ.....

28.4) โรงพยาบาล/คลินิกเอกชน ระบุ.....

29. ท่านทราบค่าระดับน้ำตาลครั้งล่าสุดหรือไม่

(.....) ไม่ทราบ

(.....) ทราบ ระดับน้ำตาลในเลือดขณะอดอาหาร_____mg/dl (วันที่.....)

ระดับน้ำตาลในเลือดของท่านเมื่อเทียบกับค่าปกติท่านคิดว่าจัดอยู่ในเกณฑ์:

(.....) สูง (…..) ปกติ

(.....) ต่ำ (.....) ไม่ทราบ

30. วิธีการรักษาโรคเบาหวานที่ได้รับในปัจจุบัน

(.....) ควบคุมอาหารอย่างเดียว

(.....) ฉีดอินซูลิน ระบุ.....

(.....) รับประทานยา ระบุ.....

(.....) อื่นๆ ระบุ.....

31. ท่านออกกำลังกายบ้างหรือไม่

(…..) ไม่ออกกำลังกาย

(…..) ออกกำลังกาย

ชนิดของการออกกำลังกาย ……

เวลาที่ใช้ออกกำลังกายในแต่ละครั้ง……....นาที

ความถี่ในการออกกำลังกาย .....ครั้ง/สัปดาห์

32. ท่านเคยได้รับความรู้ด้านการปรุงประกอบอาหารและรับประทานอาหาร เพื่อควบคุมระดับน้ำตาลในเลือดหรือไม่

(.....) ไม่เคย

(.....) เคย (.....) แพทย์/พยาบาล

(.....) เจ้าหน้าที่สถานีอนามัย/เจ้าหน้าที่สาธารณสุขประจำ - ท้องถิ่น

(.....) นักโภชนากร/นักกำหนดอาหารประจำโรงพยาบาล

(.....) เรียนรู้ด้วยตนเอง

(…...) โปสเตอร์ (.....) โทรทัศน์

(.....) แผ่นพับ (.....) หนังสือคู่มือ

(.....) คำบอกเล่า จากแหล่ง.....

(.....) อื่นๆ ระบุ.....

33. ท่านเคยรับประทานสมุนไพรเพื่อลดระดับน้ำตาลในเลือดหรือไม่

(…..) ไม่เคย

(…..) เคย (.....) ปัจจุบันหยุด/เลิกรับประทาน

ชนิดสมุนไพร.....

.....

(.....) ปัจจุบันยังคงรับประทาน

ชนิดสมุนไพร .....

.....

ตอนที่ 3: <u>แบบสัมภาษณ์ความถี่ในการบริโภคอาหารของผู้ที่เป็นโรคเบาหวาน</u>

ชื่อ - สกุล..... **เพศ** (.....) ชาย, (.....) หญิง

อายุ..... **ปี** **วัน/เดือน/ปี ที่สัมภาษณ์** ...../...../...…….....

<u>คำอธิบาย:</u> สัมภาษณ์ข้อมูลการรับประทานอาหารของผู้ที่เป็นโรคเบาหวาน โดยใช้แบบสัมภาษณ์ ความถี่ในการบริโภคอาหารของผู้ที่เป็นโรคเบาหวาน ซึ่งแบ่งออกเป็น 2 ตอน ดังนี้

ตอนที่ 3.1 ข้อมูลชนิดและความถี่การบริโภคหมวดอาหาร 5 หมู่

ตอนที่ 3.2 ข้อมูลรายการอาหารและความถี่ในการบริโภคอาหารของชาวไทใหญ่, ไทลื้อ, ลัวะ, จีนฮ่อ, ลาหู่, และอาข่า

<u>แนวคำถาม:</u>

1. สอบถามชนิดของอาหารในแต่ละหมวดที่ไม่รับประทาน
2. อาหารประเภทอื่นของแต่ละหมวดรับประทานบ่อยแค่ไหน เช่น ในหมวดผัก ท่านรับประทานผักกาดขาวบ่อยแค่ไหน?
3. สอบถามอาหารประเภทอื่นของแต่ละหมวดที่รับประทาน ที่นอกเหนือจากรายการสัมภาษณ์ รวมทั้งความถี่ในการรับประทานอาหารชนิดนั้นๆ
4. สอบถามรายการอาหารของแต่ละชนเผ่าที่รับประทานบ่อยที่สุด และสอบถามความถี่ของการรับประทานรายการอาหารนั้นๆ
5. สอบถามรายการอาหารอื่นที่แต่ละชนเผ่ารับประทาน ที่นอกเหนือจากรายการสัมภาษณ์ รวมทั้งความถี่ในการรับประทานอาหารชนิดนั้นๆ

ขอขอบคุณที่ให้ความร่วมมือ มา ณ โอกาสนี้

นางสาวชมนาด สิงห์หันต์
นักศึกษาปริญญาโท
สาขาอาหารเพื่อการป้องกันและบำบัด
สถาบันวิจัยโภชนาการ มหาวิทยาลัยมหิดล

ตอนที่ 3.1 ข้อมูลชนิดและความถี่การบริโภคหมวดอาหาร 5 หมู่

วัตถุประสงค์: ศึกษารายการอาหารในหมวดอาหาร ที่ผู้เป็นโรคเบาหวานนิยมบริโภคบ่อยที่สุด

หมวดอาหาร	รายการ	ประจำทุกวัน	บ่อยครั้ง 5-6 ครั้ง/สัปดาห์	บางครั้ง 1-4 ครั้ง/สัปดาห์	นานๆ ครั้ง ≤ 4 ครั้ง/เดือน	ไม่รับประทาน
ข้าว/แป้ง	ข้าวเจ้า					
	ข้าวเหนียว					
	ข้าวเหนียวดำ (ข้าวกั่ม)					
	เส้นก๋วยเตี๋ยวเล็ก/ใหญ่					
	ขนมจีน (ขนมเส้น)					
	เส้นหมี่เหลืองพม่า					
	ข้าวเม่า					
	วุ้นเส้น					
	เผือก					
	มันเทศ					
	ข้าวโพด					
	ข้าวโพดสาลี					
	ฟักทอง (ฟักแก้ว)					
	มันฝรั่ง (มันอลู)					
ผัก	ดอกกะหล่ำ					
	กะหล่ำปลี					
	หน่อกะหล่ำปลี					
	ข้าวโพดอ่อน					
	คะน้า					

ประเภทอาหาร	รายการ	ประจำทุกวัน	บ่อยครั้ง 5-6 ครั้ง/สัปดาห์	บางครั้ง 1-4 ครั้ง/สัปดาห์	นานๆ ครั้ง ≤ 4 ครั้ง/เดือน	ไม่รับประทาน
ผัก	แครอท					
	ชะอม (ผักหละ)					
	ดอกงิ้ว					
	ถั่วฝักยาว					
	ถั่วลันเตา (ถั่วน้อย)					
	แตงกวา (บะแตง)					
	บวบ (บะนอย)					
	รากบัว					
	ปะเดือด					
	ผักกวางตุ้ง (ผักกาดต้น)					
	ผักกวางตุ้งดอก (ผักกาด					
	ผักกาดขาว					
	ผักบุ้ง					
	ผักหวาน					
	ผักฮี้					
	พริกหวาน					
	ฟักเขียว					
	มะเขือเครือ					
	มะเขือพวง					
	มะเขือยาว					
	มะระ					
	ยอดมะระหวาน					
	ยอดขี้เหล็ก					
	ยอดลันเตา					
	กระชาย (หัวละแอน)					

ประเภทอาหาร	รายการ	ประจำทุกวัน	บ่อยครั้ง 5-6 ครั้ง/สัปดาห์	บางครั้ง 1-4 ครั้ง/สัปดาห์	นานๆ ครั้ง ≤ 4 ครั้ง/เดือน	ไม่รับประทาน
ผัก	หน่อขม					
	หน่อไม้จีน					
	หน่อหวาน					
	หน่อไผ่ตง					
	หน่อขม					
	หัวไชเท้า					
	เห็ดตะมอด					
	เห็ดแต๊บ					
	เห็ดนางฟ้า					
	เห็ดหอม					
	กระเจี๊ยบ					
	ลิ้นไม้					
	น้ำเต้า (บะน้ำ)					
ผลไม้	กระท้อน (บะตื๋น)					
	กล้วย					
	แก้วมังกร					
	แคนตาลูป					
	เงาะ					
	แตงไทย (แตงลาย)					
	แตงโม (บะเต้า)					
	ทุเรียน					
	พุทรา (บะตัน)					
	น้อยหน่า					

ประเภทอาหาร	รายการ	ประจำทุกวัน	บ่อยครั้ง 5-6 ครั้ง/สัปดาห์	บางครั้ง 1-4 ครั้ง/สัปดาห์	นานๆ ครั้ง ≤4 ครั้ง/เดือน	ไม่รับประทาน
ผลไม้	มะพร้าว					
	มะม่วง (ดิบ/สุก)					
	มะละกอ (บะกล้วยเตด)					
	มังคุด					
	มันแกว					
	ระกำ					
	ลองกอง					
	ส้มเขียวหวาน					
	ส้มเช้ง					
	ส้มโอ					
	สับปะรด (บะขนัด)					
	สาลี่					
	องุ่น (เขียว/ม่วง)					
	แอปเปิ้ล (แดง/เขียว)					
	ลิ้นจี่					
	มะไฟ					
เนื้อสัตว์	เนื้อหมู					
	เนื้อไก่					
	เนื้อวัว					
	เนื้อควาย					
	ปลาช่อน					
	ปลาดุก					

ประเภทอาหาร	รายการ	ประจำทุกวัน	บ่อยครั้ง 5-6 ครั้ง/สัปดาห์	บางครั้ง 1-4 ครั้ง/สัปดาห์	นานๆ ครั้ง ≤ 4 ครั้ง/เดือน	ไม่รับประทาน
เนื้อสัตว์	ปลาทราย					
	ปลาขาว					
	ปลาทับทิม					
	ปลานิล					
	ปลาไหล					
	หอยขม					
	หอยนางรม					
	หอยแครง					
	หอยแมลงภู่					
	หมึกหลอด					
	กบ					
	กุ้ง……					
	ปู……					
ผลิตภัณฑ์	ไข่ (ไก่/เป็ด)					
เนื้อสัตว์	ไข่เค็ม					
	ไข่เยี่ยวม้า					
	ปลาทูเข่ง					
	ปลาทู (เค็ม / มัน)					
	ไส้กรอก					
	ไส้กรอก (ไส้อั่ว)					
	หมูยอ					
	หมูหยอง					

ประเภทอาหาร	รายการ	ประจำทุกวัน	บ่อยครั้ง 5-6 ครั้ง/สัปดาห์	บางครั้ง 1-4 ครั้ง/สัปดาห์	นานๆ ครั้ง ≤ 4 ครั้ง/เดือน	ไม่รับประทาน
ผลิตภัณฑ์	ปลาทู (มัน/เค็ม)					
เนื้อสัตว์	ปลาหมึกแห้ง					
	กุ้งแห้ง					
	กุนเชียง					
	น้ำหนัง					
	แคบหมู					
	หนังปอง					
	จิ้นส้ม (แหนม)					
	ลูกชิ้น (ไก่/หมู/					
	ลูกชิ้นปลาทอด					
	เล็บมือนาง					
	ปูอัด					
	เต้าหู้ปลา					
นมและ	น้ำเต้าหู้					
ผลิตภัณฑ์	นมเปรี้ยว					
	นมผง					
	นมยูเอชทีรส					
	นมพาสเจอไรด์รส					

ประเภทอาหาร	รายการ	ประจำทุกวัน	บ่อยครั้ง 5-6 ครั้ง/สัปดาห์	บางครั้ง 1-4 ครั้ง/สัปดาห์	นานๆ ครั้ง ≤ 4 ครั้ง/เดือน	ไม่รับประทาน
ไขมัน	น้ำมันถั่วเหลือง					
	น้ำมันปาล์ม					
	น้ำมันหมู					
	งาขาว					
	งาดำ					
	ถั่วดิน (ถั่วลิสง)					
	มะม่วงหิมพานต์					
	ถั่วเหลือง					
เครื่องปรุง	เกลือ					
	ผงชูรส					
	น้ำปลา					
อื่นๆ	บะหมี่กึ่งสำเร็จรูป					
	ปลากระป๋อง					
	เต้าหู้ยี้					
	ผักกวางตุ้งดอง					

ตอนที่ 3.2 ข้อมูลรายการอาหารและความถี่ในการบริโภคอาหารของ ชาวไทใหญ่, ไทลื้อ, ลัวะ, จีนฮ่อ, ลาหู่, และอาข่า

วัตถุประสงค์: ศึกษาอาหารพื้นบ้านที่ผู้เป็นโรคเบาหวานนิยมบริโภคในชีวิตประจำวัน

ประเภทอาหาร	รายการ	ประจำทุกวัน	บ่อยครั้ง 5-6 ครั้ง/สัปดาห์	บางครั้ง 1-4 ครั้ง/สัปดาห์	นานๆ ครั้ง ≤ 4 ครั้ง/เดือน	ไม่รับประทาน
แกง	จอผักกาด (ปลา/.....)					
	แกงแค (ไก่/หมู/.....)					
	แกงอ่อม (ไก่/หมู/.....)					
	แกงขนุน (หมู/....)					
	แกงผักฮี้ (ไก่/หมู/.....)					
	แกงผักกว้างตุ้งดอก(หมู/.)					
	แกงผักกวางตุ้ง (หมู/..)					
	แกงยอดฟักทอง(ปลา/..)					
	แกงผักเลื้อน					
	แกงหน่อไม้					
	แกงมันฝรั่ง					
	แกงผักกาดขาว					
ต้ม	ต้มปลานิล					
	ต้มขาหมู					
	ต้มยำ.....					
	ต้มจืด……...					

ประเภทอาหาร	รายการ	ประจำทุกวัน	บ่อยครั้ง 5-6 ครั้ง/สัปดาห์	บางครั้ง 1-4 ครั้ง/สัปดาห์	นานๆ ครั้ง ≤ 4 ครั้ง/เดือน	ไม่รับประทาน
ผัด/ทอด	เนื้อทอด(หมู/ไก่/					
	ผัดกะหล่ำ (หมู/					
	ผัดถั่วฝักยาว (หมู/					
	ผัดคะน้า (หมู/					
	ผัดแตงกวา (หมู/					
	ผัดกะเพราใส่ปลาไหล					
น้ำพริก	น้ำพริกถั่วเน่า					
	น้ำพริกอ่อง					
	น้ำพริกมะเขือเทศ					
	น้ำพริกเห็ดหูหนู					
	น้ำพริกหนุ่ม					
	น้ำพริกน้ำปู					
	น้ำพริกปู					
	น้ำพริกดักแด้					
	น้ำพริกตาแดง					
	น้ำพริกมะกอก					
	น้ำพริกถั่วลิสง					
	น้ำพริกแห้ง					
	น้ำพริกปลา.....					

ประเภทอาหาร	รายการ	ประจำทุกวัน	บ่อยครั้ง 5-6 ครั้ง/สัปดาห์	บางครั้ง 1-4 ครั้ง/สัปดาห์	นานๆ ครั้ง ≤ 4 ครั้ง/เดือน	ไม่รับประทาน
ยำ	ยำวุ้นเส้น					
	ยำหน่อไม้					
	ยำหมูยอ					
	ยำไก่บ้าน					
	ยำผักกวางตุ้ง					
อาหาร	แอ๊บ (หมู/ปลา					
	คั่วแฮ้มหมา					
	ลาบแพะ					
	ลาบ(ปลา/ไก่/หมู/วัว/					
	หลู่ (หมู/วัว/					
	ส่า (หมู/วัว/					
	ข้าวซอยน้ำเงี้ยว					
	ข้าวซอยไก่					
	ข้าวแรมฟืน					
ขนมหวาน	ข้าวแอ๊บ					
	ข้าวแต๋น					
	ข้าวควบ					

APPENDIX D

Table A-1 Frequency of most commonly consumed food groups among 14 subjects with Tai Yai

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Starches	Rice	14 (100.0)	92.9	0	0	7.1	0
	cky rice	11 (78.6)	14.3	0	21.4	42.9	21.4
	Mungbean noodle	10 (71.4)	0	0	35.7	35.7	28.6
	Rice noodle fermented	10 (71.4)	0	0	7.1	64.3	28.6
	Pumpkin	9 (64.3)	0	0	14.3	50.0	35.7
Vegetables	Chinese cabbage	13 (92.9)	0	21.4	42.9	28.6	7.1
	Flower Chinese cabbage	13 (92.9)	0	14.3	50.0	28.6	7.1
	White Chinese cabbage	12 (85.6)	0	7.1	21.4	57.1	14.3
	Garden pea, leave	12 (85.6)	0	7.1	14.3	64.3	14.3
	Egg plant pounded	12 (85.6)	0	0	14.3	71.4	14.3

Table A-1 Frequency of most commonly consumed food groups among 14 subjects with Tai Yai (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Fruits	Banana	12 (85.7)	14.3	0	35.7	35.7	14.3
	Orange	12 (85.7)	0	0	71.4	14.3	14.3
	Apple	9 (64.2)	0	7.1	0	57.1	35.7
	Rambutants	8 (57.1)	0	0	7.1	50.0	42.9
	Watermelon	8 (57.1)	0	0	7.1	50.0	42.9
Meats	Nile Tilapia fish	12 (85.7)	0	0	35.7	50.0	14.3
	Pork meat	10 (71.4)	64.3	7.1	28.6	0	0
	Chicken meat	10 (71.4)	0	35.7	21.4	14.3	28.6
	Catfish	7 (50.0)	0	7.1	14.3	28.6	50.0
	Pond snail	7 (50.0)	0	0	7.1	42.9	50.0
Animal products	Chicken eggs	13 (92.9)	7.1	0	57.1	28.6	7.1
	Deep fried pork skin	10 (71.4)	0	7.1	0	64.3	28.6
	Pork ball	9 (64.2)	0	7.1	7.1	50.0	35.7
	Deep fried buffalo skin	9 (64.2)	0	0	7.1	57.1	35.7

Table A-1 Frequency of most commonly consumed food groups among 14 subjects with Tai Yai (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Animal products	Steamed short bodied mackerel	7 (50.0)	0	0	14.3	35.7	50.0
	Fermented pork sausage	7 (50.0)	0	0	7.1	42.9	50.0
	Tofu	7 (50.0)	0	0	14.3	35.7	50.0
Fat and oil	Soybean oil	13 (92.8)	50.0	35.7	7.1	0	7.1
	Peanut	10 (71.4)	0	0	7.1	64.3	28.6
	Black-sesame	4 (28.6)	0	0	14.3	14.3	71.4
	Cashew nut	3 (21.4)	0	0	0	21.4	78.6

Table A-2 Frequency of most commonly consumed food groups among 5 subjects with Tai Lue

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Starches	Rice	5 (100.0)	100.0	0	0	0	0
	Pumpkin	5 (100.0)	0	0	0	100.0	0
	Rice noodle fermented	4 (80.0)	0	0	0	80.0	20.0
	Mungbean noodle	3 (60.0)	0	0	20.0	40.0	40.0
	Rice noodle, big size	3 (60.0)	0	0	0	60.0	40.0
Vegetables	Flower Chinese cabbage	5 (100.0)	0	20.0	80.0	0	0
	Swamp cabbage	5 (100.0)	0	0	60.0	40.0	0
	Cucumber	5 (100.0)	0	0	40.0	60.0	0
	Angled sponge gourd (Boub)	5 (100.0)	0	0	20.0	80.0	0
	Long green egg plant	5 (100.0)	0	0	40.0	60.0	0
Fruits	Banana	4 (80.0)	20.0	40.0	20.0	0	20.0
	Orange	4 (80.0)	20.0	0	40.0	20.0	20.0
	Apple	4 (80.0)	0	20.0	0	60.0	20.0
	Unripe mango	4 (80.0)	0	0	20.0	60.0	20.0

Table A-2 Frequency of most commonly consumed food groups among 5 subjects with Tai Lue (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Fruits	Ripe mango	4 (80.0)	0	0	40.0	40.0	20.0
	Rambutants	4 (80.0)	0	0	0	80.0	20.0
	Chinese pear	4 (80.0)	0	0	0	80.0	20.0
Meats	Pork meat	5 (100.0)	60.0	20.0	20.0	0	0
	Nile Tilapia fish	4 (80.0)	0	0	80.0	0	20.0
	Snakehead fish (Pla-Mhor)	4 (80.0)	0	0	40.0	40.0	20.0
	Chicken meat	3 (60.0)	0	20.0	20.0	20.0	40.0
Animal products	Chicken eggs	5 (100.0)	0	20.0	40.0	40.0	0
	Deep fried pork skin	4 (80.0)	0	20.0	20.0	40.0	20.0
	Tofu	4 (80.0)	0	0	40.0	40.0	20.0
	Pork ball	4 (80.0)	0	0	20.0	60.0	20.0
	Chicken feet	4 (80.0)	0	0	0	80.0	20.0
Fat and oil	Soybean oil	5 (100.0)	80.0	20.0	0	0	0
	Peanut	5 (100.0)	0	20.0	20.0	60.0	0
	Lard oil	2 (40.0)	0	0	20.0	20.0	60.0

Table A-3 Frequency of most commonly consumed food groups among 9 subjects with Lawa

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Starches	Rice	9 (100.0)	9 (100.0)	0	0	0	0
	Pumpkin	8 (88.8)	0	0	44.4	44.4	11.1
	Waxy corn	8 (88.8)	0	0	22.2	66.7	11.1
	Taro bulb	7 (77.7)	0	11.1	22.2	44.4	22.2
	Mungbean noodle	7 (77.7)	0	0	33.3	44.4	22.2
Vegetables	Chinese cabbage	9 (100.0)	0	44.4	55.6	0	0
	Acacia pennata (Cha-om)	9 (100.0)	0	0	33.3	66.7	0
	Garden pea, leave	9 (100.0)	0	0	88.9	11.1	0
	Flower Chinese cabbage	8 (88.8)	0	44.4	44.4	0	11.1
	Garden pea	8 (88.8)	0	0	66.7	22.2	11.1
	Green yard long bean	8 (88.8)	0	0	55.6	33.3	11.1
	Radish	8 (88.8)	0	11.1	66.7	11.1	11.1
	White Chinese cabbage	8 (88.8)	0	0	33.3	44.4	22.2
	Oak fern (Pak-kood)	8 (88.8)	0	0	44.4	44.4	11.1
	Flower banana	8 (88.8)	0	0	11.1	77.8	11.1

Table A-3 Frequency of most commonly consumed food groups among 9 subjects with Lawa (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Fruits	Banana	9 (100.0)	22.2	22.2	44.4	0	11.1
	Orange	8 (88.8)	0	22.2	44.4	22.2	11.1
	Rambutants	7 (77.7)	0	0	33.3	44.4	22.2
	Apple	7 (77.7)	0	11.1	22.2	44.4	22.2
	Pomelo	7 (77.7)	0	0	22.2	55.6	22.2
	Jujube	7 (77.7)	0	0	22.2	55.6	22.2
	Watermelon	7 (77.7)	0	0	11.1	66.7	22.2
Meats	Pork meat	9 (100.0)	44.4	22.2	33.3	0	0
	Nile Tilapia fish	6 (66.6)	11.1	22.2	33.3	0	33.3
	Crab	6 (66.6)	0	0	0	66.7	0
	Beef	5 (55.5)	11.1	0	22.2	22.2	44.4
	Snakehead fish	5 (55.5)	0	0	33.3	22.2	44.4
Animal products	Chicken eggs	8 (88.9)	0	0	55.6	33.3	11.1
	Deep fried pork skin	7 (77.8)	0	0	22.2	55.6	22.2
	Deep fried buffalo skin	7 (77.8)	0	0	22.2	55.6	22.2

Table A-3 Frequency of most commonly consumed food groups among 9 subjects with Lawa (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Animal products	Steamed short bodied mackerel	6 (66.3)	0	0	33.3	33.3	33.3
	Pork ball	6 (66.3)	0	0	22.2	44.4	33.3
Fat and oil	Soybean oil	9 (100.0)	66.7	22.2	0	11.1	0
	Peanut	8 (88.9)	0	0	11.1	77.8	11.1
	Black sesame	4 (44.4)	0	0	22.2	22.2	55.6
	White sesame	2 (22.2)	0	0	0	22.2	77.8
	Lard	2 (22.2)	0	0	0	22.2	77.8

Table A-4 Frequency of most commonly consumed food groups among 13 subjects with Haw

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Starches	Rice	13 (100.0)	13 (100.0)	0	0	0	0
	Rice noodle, small size	11 (84.6)	0	15.4	7.7	61.5	15.4
	Rice noodle fermented	11 (84.6)	0	15.4	7.7	61.5	15.4
	Potato	11 (84.6)	0	7.7	0	76.9	15.4
	Mungbean noodle	10 (76.9)	0	0	15.4	61.5	23.1
	Taro bulb	10 (76.9)	0	0	15.4	61.5	23.1
Vegetables	Cucumber	13 (100.0)	0	15.4	61.5	23.1	0
	French bean	13 (100.0)	0	7.7	46.2	46.2	0
	Carrot	13 (100.0)	0	0	46.2	53.8	0
	Flower Chinese cabbage	12 (92.3)	15.4	61.5	15.4	0	7.7
	Chinese cabbage	12 (92.3)	23.1	46.2	15.4	7.7	7.7
	Cabbage	12 (92.3)	0	38.5	53.8	0	7.7
	White Chinese cabbage	12 (92.3)	0	38.5	53.8	0	7.7
	Kale	12 (92.3)	0	30.8	38.5	23.1	7.7
	Chinese bitter gourd	12 (92.3)	0	15.4	53.8	23.1	7.7

Table A-4 Frequency of most commonly consumed food groups among 13 subjects with Haw (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Fruits	Orange	13 (100.0)	46.2	7.7	15.4	0	30.8
	Guava	11 (84.6)	0	0	7.7	76.9	15.4
	Mangosteen	11 (84.6)	0	0	0	84.6	15.4
	Longkong	11 (84.6)	0	0	0	84.6	15.4
	Banana	10 (77.9)	7.7	23.1	15.4	30.8	23.1
Meats	Pork meat	12 (92.3)	76.9	7.7	7.7	0	7.7
	Chicken meat	12 (92.3)	23.1	15.4	38.5	15.4	7.7
	Nile Tilapia fish	12 (92.3)	0	0	38.5	53.8	7.7
	Beef	6 (46.2)	0	7.7	7.7	30.8	53.8
	Red tilapia	6 (46.2)	0	0	15.4	53.8	30.8
Animal products	Tofu	12 (92.3)	0	15.4	61.5	15.4	7.7
	Chicken egg	12 (92.3)	0	15.4	38.5	38.5	7.7
	Steamed short bodied mackerel	11 (84.6)	0	0	38.5	46.2	15.4
	Steamed pork sausage	8 (61.5)	0	0	0	61.5	38.5

Table A-4 Frequency of most commonly consumed food groups among 13 subjects with Haw (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Animal products	Salted duck egg	6 (46.2)	0	0	7.7	38.5	53.8
	Preserved duck egg	6 (46.2)	0	0	7.7	38.5	53.8
Fat and oil	Soybean oil	13 (100.0)	84.6	15.4	0	0	0
	Lard	7 (53.8)	7.7	15.4	7.7	23.1	46.2
	Peanut	6 (46.2)	0	0	7.7	38.5	53.8
	White sesame	6 (46.2)	0	0	7.7	38.5	53.8
	Cashew nut	6 (46.2)	0	0	0	46.2	53.8

Table A-5 Frequency of most commonly consumed food groups among 21 subjects with Lahu

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Starches	Rice	21 (100.0)	100.0	0	0	0	0
	Pumpkin	15 (71.4)	0	0	23.8	47.6	28.6
	Waxy corn	14 (66.7)	4.8	0	19.0	42.9	33.3
	Potato	14 (66.7)	0	4.8	9.5	52.4	33.3
	Rice noodle, big size	14 (66.7)	0	0	4.8	61.9	33.3
Vegetables	Flower Chinese cabbage	20 (95.2)	0	66.7	14.3	14.3	4.8
	Cucumber	20 (95.2)	0	9.5	81.0	4.8	4.8
	Chinese cabbage	19 (90.5)	0	19.0	66.7	4.8	9.5
	French bean	19 (90.5)	0	9.5	42.9	38.1	9.5
	Garden pea	19 (90.5)	0	0	38.1	52.4	9.5
Fruits	Guava	17 (80.9)	0	0	19.0	61.9	19.0
	Orange	16 (76.2)	4.8	38.1	33.3	0	23.8
	Banana	16 (76.2)	9.5	14.3	42.9	9.5	23.8
	Ripe papaya	16 (76.2)	0	0	38.1	38.1	23.8

Table A-5 Frequency of most commonly consumed food groups among 21 subjects with Lahu (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Meats	Pork meat	20 (95.2)	61.9	14.3	19.0	0	4.8
	Chicken meat	17 (81.0)	4.8	9.5	47.6	19.0	19.0
	Red snapper fish	15 (71.4)	0	0	47.6	23.8	28.6
	Barb fish	13 (61.9)	0	0	38.1	23.8	38.1
	Nile Tilapia fish	12 (57.1)	0	0	28.6	28.6	38.1
Animal products	Chicken egg	21 (100.0)	0	4.8	66.7	28.6	0
	Steamed short bodied mackerel	13 (61.9)	0	0	19.0	42.9	38.1
	Deep fried pork skin	11 (52.4)	0	4.8	9.5	38.1	47.6
	Pork ball	9 (42.8)	0	0	19.0	23.8	57.1
	Tofu	8 (38.1)	0	0	14.3	23.8	61.9
Fat and oil	Soybean oil	18 (85.7)	23.8	33.3	33.3	4.8	14.3
	Peanut	14 (66.7)	0	0	14.3	52.4	33.3
	Cashew nut	7 (33.3)	0	0	4.8	28.6	66.7
	White sesame	7 (33.3)	0	0	0	33.3	66.7
	Sunflower seeds	6 (28.6)	0	4.8	4.8	19.0	71.4

Table A-6 Frequency of most commonly consumed food groups among 30 subjects with Akha

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Starches	Rice	30 (100.0)	96.7	0	3.3	0	0
	Waxy corn	21 (70.0)	3.3	3.3	26.7	36.7	30.0
	Pumpkin	24 (80.0)	3.3	3.3	13.3	60.0	20.0
	Rice noodle, big size	20 (66.7)	0	0	10.0	56.7	33.3
	Rice noodle fermented	20 (66.7)	0	0	6.7	60.0	33.3
Vegetables	Flower Chinese cabbage	30 (100.0)	6.7	53.3	33.3	6.7	0
	Chinese cabbage	29 (96.7)	6.7	43.3	36.7	10.0	3.3
	Cucumber	28 (93.3)	3.3	36.7	43.3	10.0	6.7
	Green yard long bean	26 (86.7)	0	10.0	50.0	26.7	13.3
	Egg plant pounded	25 (83.3)	0	3.3	26.7	53.3	16.7
Fruits	Rambutants	21 (70.0)	3.3	0	10.0	56.7	30.0
	Orange	26 (86.7)	6.7	23.3	33.3	23.3	13.3
	Banana	26 (86.7)	0	40.0	30.0	16.7	13.3
	Ripe papaya	22 (73.3)	3.3	3.3	30.3	36.7	26.7
	Unripe mango	22 (73.3)	0	3.3	26.7	43.3	26.7

Table A-6 Frequency of most commonly consumed food groups among 30 subjects with Akha (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Meats	Pork meat	30 (100.0)	73.3	6.7	10.0	10.0	0
	Chicken meat	25 (83.3)	0	13.3	30.0	40.0	16.7
	Red snapper fish	19 (63.3)	0	0	33.3	30.0	36.7
	Barb fish	18 (60.0)	0	0	33.3	26.7	40.0
	Nile Tilapia fish	22 (73.3)	3.3	6.7	20.0	43.3	26.7
Animal products	Chicken egg	26 (86.7)	0	16.7	56.7	13.3	13.3
	Steamed short bodied mackerel	23 (76.7)	0	0	40.0	36.7	23.3
	Deep fried pork skin	27 (90.0)	0	6.7	56.7	26.7	10.0
	Deep fried buffalo skin	17 (56.7)	0	3.3	13.3	40.0	43.3
	Salted mackerel	15 (50.0)	0	0	16.7	33.3	50.0
Fat and oil	Soybean oil	26 (86.7)	30.0	20.0	36.7	0	13.3
	Palm oil	14 (46.7)	6.7	16.7	16.7	6.7	53.3
	Peanut	22 (73.3)	0	0	20.0	53.3	26.7
	White sesame	13 (43.3)	0	0	6.7	36.7	56.7
	Black sesame	12 (40.0)	0	0	40.0	0	60.0

Table A-7 Frequency of most commonly consumed local foods among 14 subjects with Tai Yai

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Curry and soup	Mungbean noodle soup	10 (71.4)	0	0	4 (28.6)	6 (42.9)	4 (28.6)
	Flower Chinese cabbage curry-with pork bone (Jor puk kad)	8 (57.1)	0	1 (7.7)	4 (30.8)	2 (15.4)	6 (46.2)
	Flower Chinese cabbage curry	7 (53.9)	0	2 (14.3)	5 (38.5)	0	6 (46.2)
	Sesbania curry (Kang kae)	7 (53.9)	0	0	1 (7.1)	6 (42.9)	6 (42.9)
	Chinese cabbage curry	13 (100.0)	15.4	69.2	15.4	1 (7.1)	9 (64.3)
Chilly paste	Tomato chilli paste	11 (78.6)	0	0	7 (50.0)	4 (28.6)	3 (21.4)
	Dried fermented soybean-chilli paste (Nam prik tooa-nao)	10 (71.4)	0	1 (7.1)	6 (42.9)	3 (21.4)	4 (28.6)
	Green chilli Dip, Northern style-(Nam prik noom)	9 (64.3)	1 (7.1)	2 (14.3)	4 (28.6)	2 (14.3)	5 (35.7)
	Olive chilli paste (Namprik ma-koak)	8 (57.1)	0	0	6 (42.9)	2 (14.3)	6 (42.9)
	Ground pork with tomatoes and-chilli paste, Northern style (Nam prik Ong)	6 (42.9)	0	1 (7.1)	0	5 (35.7)	8 (57.1)

Table A-7 Frequency of most commonly consumed local foods among 14 subjects with Tai Yai (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Stir-fried and	Fried seasoning pork (Moo-tod)	6 (42.9)	0	0	0	6 (42.9)	8 (57.1)
Fried	Fried seasoning Nile tilapia (Pla-nin tod)	6 (42.9)	0	0	1 (7.7)	5 (38.5)	7 (53.8)
	Saute Flower Chinese cabbage- and pork	4 (28.6)	0	1 (7.1)	3 (21.4)	0	10 (71.4)
	Saute common cabbage and pork	1 (7.1)	0	0	0	1 (7.1)	13 (92.9)
	Saute Chinese kale and pork	2 (14.2)	0	1 (7.1)	0	1 (7.1)	12 (85.7)
Other foods items	Khao Ram-Fhuen	9 (64.3)	0	0	3 (21.4)	6 (42.9)	5 (35.7)
	Num-Ngyo	8 (57.1)	0	0	1 (7.1)	7 (50.0)	6 (42.9)
	Pork salad (Laab moo)	7 (50.0)	0	0	0	7 (50.0)	7 (50.0)

Table A-8 Frequency of most commonly consumed local foods among 5 subjects with Tai Lue

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Curry and soup	Flower Chinese cabbage curry	4 (80.0)	0	40.0	20.0	20.0	20.0
	Chinese cabbage curry	4 (80.0)	0	60.0	0	20.0	20.0
	Mungbean noodle soup	3 (60.0)	0	0	40.0	20.0	40.0
	Flower Chinese cabbage curry-with pork bone (Jor puk kad)	3 (60.0)	0	0	20.0	40.0	40.0
Chilly paste	Ground pork with tomatoes and-chilli paste, Northern style	4 (80.0)	0	0	20.0	60.0	0
	Tomato chilli paste	3 (60.0)	0	0	60.0	40.0	0
	Dried fermented soybean chilli paste (Nam prik tooa-nao)	3 (60.0)	0	0	40.0	20.0	40.0
	Green chilli Dip, Northern style-(Nam prik noom)	3 (60.0)	0	0	40.0	20.0	40.0
	Peanut chilli paste-(Namprik tooa-lisong)	3 (60.0)	0	0	0	60.0	40.0
	Olive chilli paste (Namprik ma-koak)	3 (60.0)	0	0	40.0	20.0	40.0

Table A-8 Frequency of most commonly consumed local foods among 5 subjects with Tai Lue (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Stir-fried and Fried	Saute Flower Chinese cabbage- and pork	4 (80.0)	0	0	60.0	20.0	20.0
	Fried seasoning pork (Moo-tod)	1 (20.0)	0	0	20.0	0	80.0
	Fried seasoning Nile tilapia (Pla-nin tod)	1 (20.0)	0	0	0	20.0	80.0
	Saute common cabbage and pork	1 (20.0)	0	0	20.0	0	80.0
	Saute Chinese kale and pork	1 (20.0)	0	0	20.0	0	80.0
	Saute Chinese cabbage and pork	1 (20.0)	0	0	20.0	0	80.0
	Saute green yard long bean and- pork (Pad tua fuk yaw)	1 (20.0)	0	0	20.0	0	80.0
Other foods items	Khao Ram-Fhuen	4 (80.0)	0	20.0	0	60.0	20.0
	Num-Ngyo	4 (80.0)	0	0	20.0	60.0	20.0
	Pork salad (Laab moo)	2 (40.0)	0	0	0	40.0	60.0

Table A-9 Frequency of most commonly consumed local foods among 9 subjects with Lawa

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Curry and soup	Chinese cabbage curry	8 (88.8)	22.2	33.3	33.3	0	11.1
	Mungbean noodle soup	7 (77.8)	0	0	55.6	22.2	22.2
	Sesbania curry (Kang kae)	7 (77.8)	0	0	55.6	22.2	22.2
	Flower Chinese cabbage curry	6 (66.6)	22.2	22.2	22.2	0	33.3
	Flower Chinese cabbage curry-with pork bone (Jor puk kad)	3 (33.3)	11.1	22.2	66.7	0	0
Chilly paste	Tomato chilli paste	6 (66.6)	0	0	44.4	22.2	33.3
	Dried fermented soybean chilli paste (Nam prik tooa-nao)	6 (66.6)	0	0	33.3	33.3	33.3
	Green chilli Dip, Northern style-(Nam prik noom)	6 (66.6)	0	0	33.3	33.3	33.3
	Ground pork with tomatoes and-chilli paste, Northern style	5 (62.5)	0	0	12.5	50.0	37.5
	Peanut chilli paste	5 (62.5)	0	0	11.1	44.4	44.4

Table A-9 Frequency of most commonly consumed local foods among 9 subjects with Lawa (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Stir-fried and Fried	Fried seasoning pork (Moo-tod)	7 (77.8)	0	11.1	66.7	0	22.2
	Fried seasoning Nile tilapia (Pla-nin tod)	5 (55.6)	0	0	55.6	0	44.4
	Saute Flower Chinese cabbage- and pork	3 (33.3)	0	0	33.3	0	66.7
	Saute Chinese kale and pork	3 (33.3)	0	0	33.3	0	66.7
	Saute Chinese cabbage and pork	3 (33.3)	0	11.1	22.2	0	66.7
	Saute swamp cabbage and pork	3 (33.3)	0	12.5	25.0	0	62.5
Other foods items	Khao Ram-Fhuen	7 (77.8)	0	0	0	77.8	22.2
	Num-Ngyo	7 (77.8)	0	0	22.2	55.6	22.2
	Pork salad (Laab moo)	6 (66.6)	0	0	0	66.7	33.3
	Abb	5 (55.6)	0	0	0	55.6	44.4
	Sour mungbean noodle salad	5 (55.6)	0	0	0	55.6	44.4

Table A-10 Frequency of most commonly consumed local foods among 13 subjects with Haw

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Curry and soup	Chinese cabbage curry	11 (84.6)	15.4	69.2	15.4	0	0
	Mungbean noodle soup	9 (69.2)	0	30.8	30.8	7.7	30.8
	Flower Chinese cabbage curry	2 (15.4)	0	7.7	7.7	0	84.6
	White Chinese cabbage curry	2 (15.4)	0	15.4	0	0	84.6
Chilly paste	Tomato chilli paste	10 (76.9)	7.7	30.8	38.5	0	23.1
	Green chilli Dip, Northern style- (Nam prik noom)	7 (53.8)	0	0	7.7	7.7	84.6
	Dried fermented soybean chilli paste (Nam prik tooa-nao)	3 (23.1)	0	0	15.4	7.7	76.9
	Peanut chilli paste- (Namprik tooa-lisong)	2 (15.4)	0	0	15.4	0	84.6
	Ground pork with tomatoes and chilli paste, Northern style	1 (7.7)	0	0	0	7.7	92.3

Table A-10 Frequency of most commonly consumed local foods among 13 subjects with Haw (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Stir-fried and Fried	Fried seasoning pork (Moo-tod)	9 (69.2)	0	0	38.5	30.8	30.8
	Fried seasoning Nile tilapia (Pla-nin tod)	9 (81.8)	0	0	18.2	63.6	18.2
	Saute Flower Chinese cabbage- and pork	7 (53.8)	0	23.1	23.1	7.7	46.2
	Saute Chinese kale and pork	6 (46.2)	0	15.4	30.8	0	53.8
	Saute common cabbage and pork	4 (30.8)	0	15.4	15.4	0	69.2
Other foods items	Khao Ram-Fhuen	8 (61.5)	0	0	7.7	53.8	38.5
	Num-Ngyo	6 (46.2)	0	7.7	0	38.5	53.8
	Pork salad (Laab moo)	6 (46.2)	0	0	7.7	38.5	53.8
	Sour mungbean noodle salad	5 (38.5)	0	0	7.7	30.8	61.5

Table A-11 Frequency of most commonly consumed local foods among 21 subjects with Lahu

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Curry and soup	Flower Chinese cabbage curry	18 (85.7)	19.0	52.4	14.3	0	20.0
	Chinese cabbage curry	15 (71.4)	9.5	52.4	9.5	0	28.6
	Mungbean noodle soup	11 (52.4)	0	0	14.3	38.1	47.6
	White Chinese cabbage curry	11 (55.0)	0	20.0	20.0	15.0	45.0
	Potato curry	10 (47.6)	0	0	23.8	23.8	52.4
	Young leaves pumpkin curry	9 (42.9)	0	14.3	14.3	14.3	57.1
Chilly paste	Tomato chilli paste	19 (90.5)	4.8	33.3	47.6	4.8	9.5
	Dried chilli paste (Namprik hang)	9 (42.9)	0	9.5	33.3	0	57.1
	Dried fermented soybean chilli paste (Nam prik tooa-nao)	8 (38.0)	0	0	19.0	19.0	61.9
	Green chilli Dip, Northern style- (Nam prik noom)	8 (30.1)	0	19.0	14.3	4.8	61.9

Table A-11 Frequency of most commonly consumed local foods among 21 subjects with Lahu (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Stir-fried and	Fried seasoning pork (Moo-tod)	12 (57.1)	0	4.8	33.3	19.0	42.9
Fried	Saute common cabbage and pork	6 (28.6)	0	0	14.3	14.3	71.4
	Saute green yard long bean and-pork (Pad tua fuk yaw)	6 (28.6)	0	0	19.0	9.5	71.4
	Saute swamp cabbage and pork	5 (23.8)	0	0	9.5	14.3	76.2
	Fried seasoning Nile tilapia (Pla-nin tod)	4 (23.8)	0	0	10.0	10.0	80.0
Other foods items	Khao Ram-Fhuen	14 (66.7)	0	0	4.8	61.9	33.3
	Num-Ngyo	13 (61.9)	0	0	4.8	57.1	38.1
	Long egg plant pounded salad	10 (47.6)	0	0	9.5	38.1	52.4
	Abb	9 (42.9)	0	0	19.0	23.8	57.1
	Flower Chinese cabbage salad	9 (42.9)	0	14.3	23.8	4.8	57.1
	Pork salad (Laab moo)	6 (28.6)	0	0	0	28.6	71.4
	Sour mungbean noodle salad	7 (33.3)	0	0	9.5	23.8	66.7

Table A-12 Frequency of most commonly consumed local foods among 30 subjects with Akha

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Curry and soup	Flower Chinese cabbage curry	25 (83.3)	3.3	66.7	13.3	0	16.7
	Chinese cabbage curry	25 (83.3)	3.3	63.3	16.7	0	16.7
	Mungbean noodle soup	16 (53.3)	3.3	3.3	33.3	13.3	46.7
	Nile tilapia soup (Tum pla-nin)	13 (43.3)	0	0	6.7	36.7	56.7
	Flower Chinese cabbage curry-with pork bone (Jor puk kad)	12 (37.9)	0	6.9	13.8	17.2	62.1
	Potato curry	9 (30.0)	0	0	0	30.0	70.0
	Young leaves pumpkin curry	9 (30.0)	0	10.0	13.3	6.7	70.0
Chilly paste	Tomato chilli paste	29 (96.7)	3.3	30.0	50.0	13.3	3.3
	Dried fermented soybean chilli paste (Nam prik tooa-nao)	19 (63.3)	0	0	43.3	20.0	36.7
	Green chilli Dip, Northern style-(Nam prik noom)	19 (63.3)	0	16.7	36.7	10.0	36.7
	Dried chilli paste (Namprik hang)	8 (26.7)	0	16.7	10.0	0	73.3

Table A-12 Frequency of most commonly consumed local foods among 30 subjects with Akha (cont.)

Food Groups	List of Foods	Number (%)	Everyday 7 t/w (%)	Frequent 5-6 t/w (%)	Sometimes 1-4 t/w (%)	Seldom < 4 t/m (%)	Never - (%)
Stir-fried and	Fried seasoning pork (Moo-tod)	13 (43.3)	0	10.0	20.0	13.3	56.7
Fried	Saute common cabbage and pork	10 (34.5)	0	10.3	17.2	6.9	65.5
	Saute Chinese cabbage and pork	9 (30.0)	0	10.0	16.7	3.3	70.0
	Fried seasoning Nile tilapia (Pla-nin tod)	7 (26.9)	0	0	23.1	3.8	73.1
	Saute green yard long bean and-pork (Pad tua fuk yaw)	7 (23.3)	0	3.3	10.0	10.0	76.7
Other foods items	Pork salad (Laab moo)	22 (73.3)	0	0	26.7	46.7	26.7
	Num-Ngyo	19 (63.3)	0	0	3.3	60.0	36.7
	Abb	17 (56.7)	0	10.0	26.7	20.0	43.3
	Sour mungbean noodle salad	15 (50.0)	0	0	10.0	40.0	50.0
	Khao Ram-Fhuen	13 (43.4)	0	0	6.7	36.7	56.7
	Long egg plant pounded salad	12 (40.0)	0	0	26.7	13.3	60.0
	Flower Chinese cabbage salad	10 (33.3)	0	13.3	16.7	3.3	66.7

APPENDIX E

Table A-13 Nutritive values of most commonly consumed food composition per 100 g edible portion

Food Name (th)	Food Name (eng)	Energy (kcal)	CHO (g)	Sugar (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	Na (mg)	Fiber (g)	Ash (g)	Water (g)
ข้าวแป้ง	**Starch**													
ข้าวเจ้า, ขัดขาว, นึ่ง	Rice, polished, steamed	133.0	30.3	0	0.3	2.3	6.0	19.0	0.3	88.0	34.0	0.2	0.3	66.8
ฟักทอง	Pumpkin	61.6	13.1	2.6	0.3	1.5	9.7	25.9	0.8	334.8	15.1	2.6	0.9	92.2
ข้าวโพดข้าวเหนียว	Corn,Waxy	148.0	30.9	0	0.8	4.4	13.0	116.0	0.7	118.0	14.0	-	0.7	63.2
วุ้นเส้น, แช่น้ำ	Mungbean noodle, soaked	141.0	34.4	0	0.1	0.1	8.2	4.1	1.2	-	0	-	-	47.4
ขนมจีน	Rice noodles, fermented	106.0	24.3	0	0.3	1.4	14.0	10.0	-	10.0	47.0	0.3	0.2	73.8
ก๋วยเตี๋ยวเส้นเล็ก	Rice noodles, small size	145.2	32.5	0	0.4	2.8	7.9	14.5	1.3	-	75.2	0.1	0.1	30.2
ก๋วยเตี๋ยวเส้นใหญ่	Rice noodles, big size	121.6	25.3	0	1.3	2.2	5.3	18.2	1.5	65.4	76.8	0.1	0.1	47.1
มันฝรั่ง, ต้ม	Potato, boiled	72.0	16.3	0.7	0.1	1.9	7.0	44.0	0.8	-	3.3	-	-	81.0
มันเทศขาว, ต้ม	Sweet potato, boiled	149.0	35.8	10.9	0.4	0.6	72.0	51.0	0.7	284.0	18.0	4.2	1.3	62.2
ข้าวเหนียวขาว,	Rice, glutinous, steamed	229.0	52.0	0.1	0.3	4.6	5.0	12.0	0.3	24.0	12.0	0.3	0.1	42.9
ผัก	**Vegetables**													
ผักกวางตุ้ง, ดอก	Cabbage, chinese, flowers	20.8	1.8	0	0.4	2.6	25.6	24.0	0.3	-	-	-	-	72.9
ผักกวางตุ้ง	Cabbage, chinese	21.6	3.4	1.6	0.2	1.8	108.1	34.8	1.2	213.4	103.4	1.9	0.9	87.7
แตงกวา	Cucumber	23.0	4.6	2.1	0.1	0.8	20.0	28.0	0.4	166.0	5.0	1	0.5	93.9
ถั่วฝักยาว, ดิบ	Yard long bean, green	38.0	6.3	1.4	0.3	2.5	36.0	50.0	0.8	224.0	24.0	3.1	0.7	90.1

Table A-13 Nutritive values of most commonly consumed food composition per 100 g edible portion (cont.)

Food Name (th)	Food Name (eng)	Energy (kcal)	CHO (g)	Sugar (g)	Fat (g)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	Na (mg)	Fiber (g)	Ash (g)	Water (g)
ผัก	**Vegetables**													
ผักกาดขาว	Cabbage, chinese, white	16.0	2.1	0	0.1	1.7	73.0	30.0	0.5	284.0	46.0	1.9	0.8	95.3
ถั่วลันเตา, ฝักอ่อน	Garden peas, pods	47.0	8.5	5.1	0.1	3	43.0	56.0	0.9	128.0	2.0	3.3	0.7	87.7
ถั่วแขก	French bean	27.0	4.5	0	0.1	1.9	78.0	45.0	3.8	-	1.7	-	-	91.8
ผักบุ้งจีน	Swamp cabbage, chinese	23.0	2.4	0	0.3	2.7	51.0	31.0	3.3	263.0	118.0	3.1	-	92.3
ผักบุ้งไทย, ต้น	Swamp cabbage, white stem	26.0	3.9	0	0.3	1.9	29.0	44.0	2.0	399.0	78.0	3.3	1.3	92.7
ผักบุ้งไทย, ต้น	Swamp cabbage, red stem	27.0	4.6	0	0.2	1.8	26.0	35.0	1.3	367.0	23.0	3.8	1.4	92.0
ผลไม้	**Fruits**													
ส้มเขียวหวาน	Tangelo, Tangerine	45.0	9.9	8.3	0.2	1.0	29.0	21.0	0.4	162.0	33.0	1.5	0.4	88.4
กล้วยน้ำว้า, สุก	Banana, Nam-Wa variety	122.0	29.0	-	0.2	0.8	10.0	30.0	0.6	248.0	5.0	2.4	0.6	69.0
เงาะ	Rambutan	77.0	17.9	-	0.1	1.0	15.0	17.0	0.7	137.0	22.0	-	0.7	80.5
ฝรั่ง	Guava, common	52.0	12.1	6.3	0.1	0.7	10.0	17.0	0.05	164.0	15.0	3.7	0.05	86.5
มะม่วงแก้ว, ดิบ	Mango, kaew variety, unripe	81.0	19.1	-	0.2	0.6	13.0	9.0	0.6	126.0	3.0	3	0.6	79.3
มะม่วงแรด, ดิบ	Mango, rad variety, unripe	80.0	19.1	-	0.2	0.5	20.0	13.0	0.6	138.0	76.0	2.3	0.6	79.8
มะม่วงพิมเสนมัน	Mango, pimsaen variety	83.0	18.9	-	0.5	0.9	15.0	12.0	-	-	-	1.8	-	77.7
แอปเปิ้ล	Apple	61.0	14.7	11.0	0.1	0.2	12.0	11.0	0.5	122.0	64.0	0.6	0.5	84.7
มะขามหวาน	Tamarind, sweet	314.0	75.6	73.3	0	2.9	141.0	165.0	0.9	-	35.7	-	0.9	12.4
มะม่วงแก้ว, สุก	Mango, kaew variety, ripe	93.0	22.4	-	0.1	0.6	34.0	10.0	0.3	-	-	1.6	0.3	76.7
มะม่วงน้ำดอกไม้,	Mango, nam-dok-mai, ripe	80.0	18.8	-	0.2	0.9	6.0	16.0	0.3	144.0	3.0	1.2	0.3	79.6

Table A-13 Nutritive values of most commonly consumed food composition per 100 g edible portion (cont.)

Food Name (th)	Food Name (eng)	Energy (kcal)	CHO (g)	Sugar (g)	Fat (g)	Chol (mg)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	Na (mg)	Fiber (g)	Ash (g)	Water (g)
เนื้อสัตว์	**Meat**														
เนื้อหมูสันนอก	Pork, loin (Fat 7.7%)	153.0	0	0	7.7	40.0	21.0	3.0	224.0	0.9	353.0	101.0	-	1.2	71.2
เนื้อหมูสันใน	Pork, tenderloin	116.0	0	0	3.2	37.0	21.8	4.0	237.0	1	381.0	97.0	-	1.3	74.5
ไก่, เนื้อ	Chicken, meat	186.0	1.4	0	12.4	81.0	17.3	10.0	137.0	0.5	188.0	90.0	-	0.8	68.1
ปลานิล	Nile tilapia	87.0	0	0	1.1	58.0	17.4	51.0	170.0	0.9	316.0	87.0	-	1.1	78.5
ปลาดุกอุย	Gunthers walking catfish	209.0	1.3	0	14.7	139.0	16.0	20.0	168.0	0.8	288.0	65.0	-	1.1	65.1
ปลาดุกด้าน	Batrachian walking catfish	117.0	0.5	0	3.8	94.0	20.2	18.0	287.0	0.7	362.0	108.0	-	1.2	74.2
วัว, เนื้อ ติดมัน	Beef, meat medium fat	273.0	0	0	22.1	74.9	17.2	8.0	130.0	2.3	-	70.8	-	-	59.8
ปลาแดง / ปลา	Red snapper	86.0	0	0	1.2	57.0	18.9	45.0	70.0	0.7	234.0	73.0	-	-	79.1
ปลาช่อน	Striped snakehead fish	109.0	0	0	3.3	149.0	17.5	24.0	188.0	1	317.0	49.0	-	1.2	76.3
กุ้ง, น้ำจืด (ตัวเล็ก)	Shrimp, common	82.0	0.4	0	1.3	187.0	16.2	161.0	292.0	2.2	-	-	-	-	79.0
หอยขม, จุ๊บ	Snail, pond/river	74.0	4.9	0	0.7	188.0	12.1	-	114.0	8.7	-	-	-	3	79.3
ผลิตภัณฑ์เนื้อสัตว์	**Animal Products**														
ไข่ไก่, ทั้งฟอง	Hen egg, whole	155.0	1.6	0.9	10.8	427.0	12.8	12.8	0	38.0	230.0	3.1	3.1	0	111.0
หมู, หนัง, ทอด /	Pork skin, deep fried	619.0	0	0	46.0	100.8	51.2	51.2	0	19.0	55.0	2.0	2.0	0	-
ปลาทู, นึ่ง / ปลาทู	Short bodied mackerel, steamed	138.0	0.3	0	4.4	88.0	21.6	21.6	0	168.0	479.0	2.2	2.2	0	629.0
เต้าหู้ขาว, อ่อน	Soybean curd, white, soft	59.0	1.8	0.6	3.4	0	5.5	0	5.5	37.0	62.0	1.3	0	1.3	248.0
หมู, ลูกชิ้น, ลวก	Pork, ball, blanch	141.0	8.4	1	6.0	33.0	13.2	13.2	0	29.7	154.0	0.7	0.7	0	140.0
หมู, แหนม	Pork sausage, fermented	185.0	3.6	0	9.9	-	20.2	20.2	0	15.0	132.0	1.3	1.3	0	-
ไส้อั่ว, สุก	Pork sausage, Northern style	424.0	5.2	0	37.4	116.5	16.7	-	-	61.0	155.0	-	-	-	-
ไก่, ตีน / เล็บมือนาง	Chicken, feet, boiled	122.2	0.8	0	8.3	81.7	11.8	11.8	0	-	-	-	-	-	-
ปลาทู, เค็ม	Mackerel, salted	145.0	2.4	0	4.2	72.5	24.4	24.4	0	131.0	50.0	-	-	-	-

Table A-13 Nutritive values of most commonly consumed food composition per 100 g edible portion (cont.)

Food Name (th)	Food Name (eng)	Energy (kcal)	CHO (g)	Sugar (g)	Fat (g)	Chol (mg)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	Na (mg)	Fiber (g)	Ash (g)	Water (g)
นม	**Milk**														
นมสดยูเอชที, รสจืด	Milk, whole, UHT natural	67.0	4.9	4.4	3.8	7.0	3.3	3.3	0	113.0	90.0	0.1	0.1	0	123.0
นมเปรี้ยวพร้อมดื่ม, พาสเจอร์ไรส์ รสต่างๆ	Yoghurt, drinking, pasteurised, different flavours	84.0	16.0	15.2	1.6	0	1.5	1.5	0	53.0	45.0	0.1	0.1	0	-
นมเปรี้ยวยูเอชที, รสต่าง ๆ	Yoghurt, drinking, UHT, different flavours	84.0	16.6	13.5	1.3	1.0	1.4	1.4	0	59.0	43.0	0.2	0.2	0	-
นมผงขาดมันเนย, แคลเซียมสูง (แอนลีน)	Milk, powder, defatted, high calcium (Anlene)	355.0	48.0	-	0.9	36.52	38.6	38.6	0	1600	1300	2	2	0	1640
นมถั่วเหลือง *	Soybean milk	81.0	10.0	8.3	3.5	4.0	2.5	24.0	-	0.4	-	37.0	0.4	0.4	88.0
ขนมและของหวาน	**Dessert**														
ขนมปัง, ขาว, แผ่น	Bread, white, sliced	291.0	48.3	3.4	5.9	1.1	11.1	0	11.1	60.0	-	1.2	0	1.2	-
ข้าวหลาม (ไม่มัน)	Glutinous rice cooked in bamboo	249.1	55.9	11.3	1.1	0	4.3	0	4.3	6.9	25.8	0.5	0	0.5	20.0
ข้าวต้มมัด	Glutinous rice steamed With banana and coconut milk	197.6	44.5	7.2	1.01	0	2.9	0	2.9	6.5	43.1	1.2	0	1.2	77.3
น้ำมันและไขมัน	**Oil and fat**														
น้ำมันถั่วเหลือง	Soybean oil	817.0	0	0	90.8	0	0	0	0	-	-	-	-	-	-
ถั่วลิสง, ต้ม	Peanut, boiled	316.0	11.4	2.3	26.3	0	14.4	0	14.4	45.0	178.0	1.5	0	1.5	-

Table A-13 Nutritive values of most commonly consumed food composition per 100 g edible portion (cont.)

Food Name (th)	Food Name (eng)	Energy (kcal)	CHO (g)	Sugar (g)	Fat (g)	Chol (mg)	Prot (g)	Ca (mg)	P (mg)	Fe (mg)	K (mg)	Na (mg)	Fiber (g)	Ash (g)	Water (g)
น้ำมันและไขมัน	**Oil and fat**														
งา, ขี้ม้อน, ดิบ	Sesame seeds / Kie-mont	492.0	12.3	0	42.0	0	16.0	0	16.0	442.0	284.0	6.3	0	6.3	-
งา, ขาว, คั่ว	Sesame seeds, white, roasted	682.0	0	0	64.2	0	26.1	0	26.1	90.0	-	13.0	0	13.0	-
งา, ดำ, คั่ว	Sesame seeds, black, roasted	562.0	0	0	52.1	0	23.3	0	23.3	1452	-	22.0	0	22.0	-
น้ำมันปาล์มโอเลอิน	Palm oil	791.0	0	0	87.9	0	0	0	0	-	-	-	-	-	-
น้ำมันหมู	Lard, oil (Fat 100.0%)	902.0	0	0	100.0	89.0	0	0	0	-	-	0	0	0	-

Sources: Inmucal - Nutrients program WD.2 versions**,** Institute of Nutrition, Mahidol University

*Nutritional value of food item from the Nutritive Value of Thai Food 2005, Department of Nutrition Ministry of Public Health.

APPENDIX F

นิยามศัพท์

Definition of Terms

อาหารพื้นบ้าน อาหารที่ประชาชนในเขตหนึ่งๆ นิยมบริโภคเป็นประจำจนกระทั่งเกิดการติดใจในรสชาติของอาหารนั้นๆ แม้ว่าจะโยกย้ายถิ่นไปอยู่แหล่งอื่นยังคงประกอบอาหารนั้นอยู่เสมอ

แกง อาหารที่มีลักษณะเป็นน้ำอาจมีหรือไม่มีรสเผ็ด

ต้ม การนำอาหารที่ต้องการต้มใส่หม้อพร้อมกับน้ำ ตั้งไฟให้เดือดจนกว่าจะสุกใช้เวลา ตามชนิดนั้นๆ

น้ำพริก น้ำที่เกิดแต่รสพริกหรืออาหารชนิดหนึ่งที่ปรุงด้วยกะปิ กระเทียม มะนาว พริกขี้หนู เป็นต้น อาจใช้น้ำปลาหรือน้ำปลาร้าแทนกะปิ ใช้ของเปรี้ยวอื่นๆ แทน เช่น มะขาม มะดัน มะม่วง แทนมะนาว

ผัด การทำอาหารต่างๆ ให้สุกทั่วถึงกัน โดยใช้น้ำมันหรือน้ำกะทิเป็นสื่อความร้อน

ทอด การทำอาหารให้สุกโดยใช้น้ำมันเป็นสื่อความร้อนและอาหารที่สุกด้วยการทอดจะมีน้ำมันซึมซาบอยู่ในอาหารนั้นๆ ด้วย

ยำ กับข้าวหนึ่งอย่างที่ปรุงด้วยผักเป็นส่วนใหญ่ เคล้ากันหลายๆ อย่าง มีการนำอาหารที่สุกหรือสุก พร้อมจะกินได้ทุกชนิดมาคลุกเคล้าให้เข้ากับน้ำปรุงรส และเสริฟได้เลย โดยไม่ต้องตั้งไฟ ชื่อของยำจะเรียกตามเครื่องปรุงหลัก

ทัศนีย์ โรจน์ไพบูรย์. เทคโนโลยีอาหารและเครื่องดื่ม. นนทบุรี: มหาวิทยาลัยสุโขทัยธรรมาธิราช; 2539.

ข้าวแรมฟืน

ข้าวฟืน หรือ ข้าวแรมฟืน หรือ ข้าวแรมคืน คือ เป็นอาหารชนิดหนึ่งที่มีรสเปรี้ยว เผ็ด หวาน เป็นทั้งอาหารว่างและอาหารหลัก เป็นได้ทั้งอาหารคาวและหวาน แต่ทุกอย่างเป็นอาหารมังสะวิรัติและอาหารเจ ข้าวแรมฟืนเป็นอาหารที่นิยมรับประทานของชาวไทยใหญ่ โดยมีที่การนำเข้ามาจากแคว้นสิบสองปันนาประเทศจีน จากนั้นผ่านประเทศพม่าและเข้ามาทางภาคเหนือของประเทศไทยเป็นเวลานานหลายสิบปีแล้ว

กรรมวิธีในการทำข้าวแรมฟืน ซึ่งก็มีส่วนประกอบหลักอยู่ 2 อย่าง คือตัวแป้งข้าวแรมฟืนและเครื่องปรุง ซึ่งมีลักษณะคล้ายกับก๋วยเตี๋ยวของชาวจีน ตัวข้าวแรมฟืนที่นิยมรับประทานกันจะมีอยู่ 2 ชนิด คือข้าวแรมฟืนขาวและข้าวแรมฟืนถั่วลันเตา แต่ปัจจุบันได้มีข้าวแรมฟืนถั่วลิสง (ถั่วดิน) เพิ่มขึ้นมาอีกด้วย

- **ข้าวแรมฟืนขาว** - ทำมาจากข้าวเจ้า โดยโม่ข้าวเจ้าแข็งเพื่อทำแป้ง แล้วนำน้ำแป้งที่ตกตะกอนมาเคี่ยวกับปูนขาวจนสุก จากนั้นเทใส่ภาชนะทิ้งไว้ 1 คืน วันรุ่งขึ้นแป้งจะแข็งตัวตามรูปภาชนะที่บรรจุ
- **ข้าวแรมฟืนถั่วลันเตา** - ข้าวแรมฟืนถั่วลันเตาจะมีสีเหลือง โดยมีวิธีทำเริ่มจากการนำเมล็ดถั่วลันเตามาแช่น้ำจนเมล็ดขยายใหญ่แล้วจึงนำมาโม่ จากนั้นนำตะกอนส่วนหนึ่งมาเคี่ยวจนเดือดและให้สังเกตดูว่าตะกอนเริ่มเหนียวแล้ว จึงเทใส่ภาชนะแต่ไม่นิยมทำค้างคืนหรือแรมคืนเพราะหากทิ้งไว้นาน แป้งนี้จะเหลว ไม่จับตัวแข็งเหมือนข้าวแรมฟืนขาว เมื่อได้แป้งข้าวแรมฟืนแล้ว ก็นำมาหั่นเป็นชิ้นสี่เหลี่ยมผืนผ้าเล็ก ๆ เตรียมไว้

APPENDIX G

Flower Chinese cabbage

Chinese cabbage

Garden pea, leaves

French bean

Rak Shoo

Oak fern

Figure A-1: The most commonly consumed vegetables among 92 people with type 2 diabetes in Doi Tung Development Project area

Nile Tilapia fish (Pla-Nin)

Catfish (Pla-Duk)

Red snapper fish (Pla-Zhay)

Pond snail (Hoi Khom)

Steamed short bodied mackerel

Deep fried buffalo skin

Figure A-2: The most commonly consumed meats and animal products among 92 people with type 2 diabetes in Doi Tung Developmen Project area

Chinese cabbage curry

Sesbania curry (Kang Kae)

Flower Chinese cabbage curry

Flower Chinese cabbage curry with pork bone (Jor puk kad)

Potato curry

White Chinese cabbage curry

Figure A-3: Most frequently consumed curry among 92 study subjects

Tomato chilli paste

Dried soybean fermented chilli paste (Namprik Tooa-Nao)

Green chilli Dip, Northern style (Nam Prik Noom)

Ground pork with tomatoes and chilli paste, Northern style (Nam Prik Ong)

Peanut chilli paste (Nam Prik Tua-Lisong)

Olive chilli paste (Namprik ma-koak)

Figure A-4: Most frequently consumed chili paste among 92 study subjects

Pork salad (Laab moo)

Saute Chinese kale and pork

Fried seasoning pork (Moo-tod)

Flower Chinese cabbage salad

Khao-Ram Fhuen and seasoning

Tai Yai Num-Ngyo

Figure A-5: Most frequently consumed others local food items among 92 subjects

BIOGRAPHY

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